Part 1 General

1.1 ADMINISTRATIVE

.1 Submit to Contract Administrator submittals listed for review in accordance with the Specifications, or as requested by the Contract Administrator.

.2 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.

.1 Allow 10 Working Days for review of submittals by the Contract Administrator.

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

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

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

.6 Review submittals prior to submission to 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 Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

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

.8 Verify:

.1 Field measurements
.2 Field construction criteria
.3 Catalogue numbers and similar data
.4 Ensure affected adjacent Work is co-ordinated.

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

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

.11 Acceptance of Shop Drawings for a component or a subassembly does not constitute acceptance of the complete assembly of which it is a part.

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

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

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 The Contractor shall arrange for the preparation of clearly identified Shop Drawings as specified or as the Contract Administrator may reasonably request. Shop Drawings are to clearly indicate materials, weights, dimensions, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, clearly indicate that all such attachments and connections have been properly coordinated, regardless of the trade under which the adjacent articles or equipment will be supplied and installed. Shop Drawings are to indicate their relationship to design Drawings and Specifications. Notify the Contract Administrator in writing of any deviations in Shop Drawings from the requirements of the Contract Documents.

.3 Have Shop Drawings stamped, signed and dated by a Professional Engineer licensed to practice in the Province of Manitoba where required in the Specifications or by the Contract Administrator.

.4 The Contractor shall examine all Shop Drawings prior to submission to the Contract Administrator to ensure that all necessary requirements have been determined and verified and that each Shop Drawing has been checked and coordinated with the requirements of the Work and the Contract Documents.

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

.1 Submit one electronic PDF copy.

.6 Shop Drawing reviews by the Contract Administrator is solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in Shop Drawings rests with the Contractor and review by the Contract Administrator shall not imply such approval.

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

.1 When stamped "REVIEWED" or "NO EXCEPTIONS TAKEN", distribute additional copies as required for execution of the Work.

.2 When stamped "REVIEWED AS MODIFIED" or "MAKE NOTED CORRECTIONS", ensure that all copies for use are modified and distributed, same as specified for "REVIEWED".

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

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

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

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

.9 Any adjustments made on Shop Drawings by the Contract Administrator are not intended to change the Contract Price. If it is deemed that such adjustments affect the Contract Price, clearly state as such in writing prior to proceeding with fabrication and installation of Work.

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

.11 Only two (2) reviews of Shop Drawings will be made by the Contract Administrator at no cost. Each additional review will be charged to the Contractor at the Contract Administrator's scheduled rates. The Contract Administrator's charges for the additional Work will be deducted from the Contractor's Progress Certificates.

.12 Show the following information in lower right hand corner of shop drawings.

.1 Project Title.
.2 Tender number or other project number assigned by the Contract Administrator.
.3 Name of the depicted item in accordance with the Specifications and Drawings.
.4 Project series number and location where the item is used if applicable.
.5 Specification section number if applicable
.6 Proposed option if applicable.
.7 Name of Contractor.

.13 Accompany submissions with transmittal letter, containing:

.1 Date.
.2 Project title and number.
.3 Contractor's name and address.
.4 Identification and quantity of each shop drawing, product data and sample.
.5 Specification Section, Title, Number, and Clause
.6 Other pertinent data.
.7 Date and revision dates.
.8 Project title and Bid Opportunity number.
.9 Name of:
.1 Contractor
.2 Subcontractor
.3 Supplier
.4 Manufacturer
.5 Separate detailer when pertinent

.10 Identification of product of material.

.11 Relation to adjacent structure or materials.

.12 Field dimensions, clearly identified as such.

.13 Specification section name, number and clause number or drawing number and detail/section number.

.14 Applicable standards, such as CSA or CGSB numbers.

.15 Contractor's stamp, initialled or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

1.3 PROCEDURES

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

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

.3 Other Considerations

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

.2 Material and equipment delivered to the site of the works will not be paid for at least until pertinent shop drawings have been submitted and reviewed.

.3 Incomplete shop drawing information will be considered as stipulated deductions for the purposes of progress payment certificates.

.4 No delay or cost claims will be allowed that arise because of delays in submissions, re-submissions and review of shop drawings.

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

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator instructions, or law of Place of Work.

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

.4 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 may be engaged by the City for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the City. Costs of additional tests required due to defective Work shall be paid by the Contractor.

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

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

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Contract Administrator at no cost to the City. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

.1 The City, the Contract Administrator, and other authorities having jurisdiction shall have access to the work.

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 the Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements 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 Contract Documents, amount of which will be determined by Contract Administrator.

1.5 REPORTS

.1 Submit draft inspection and test reports to Contract Administrator, prior to inclusion with the O&M manuals, in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.3 DEWATERING

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

1.4 WATER SUPPLY

.1 Provide potable water as required for construction use.

1.5 TEMPORARY HEATING AND VENTILATION

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

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

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

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

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

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

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

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

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

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

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

1.6 TEMPORARY POWER AND LIGHT

.1 Provide temporary power and light, construction power, lighting, and other requirements during shutdowns. The Roland Flood Pumping Station is equipped with a 5kV service and 120/240V service. The 5kV service provides 600V power within the Station via the step-down transformers in the transformer vault. The 120/240V service connects to an existing 120/240V panelboard. It is anticipated that the 5kV service (and thus the 600V distribution) will be unavailable throughout the duration of the work for use as a source of temporary power. It is anticipated that the 120/240V service and panelboard could be demolished near the end of the project and therefore could be used as a source for temporary 120/240V power.

.2 If 600V power is required by the Contractor then the Contractor may coordinate with, and pay for, Manitoba Hydro to provide a temporary 600V service. Where a temporary 600V service is used, the Contractor is responsible for providing a service entrance rated fusible disconnect switch or circuit breaker, a utility metering enclosure, and the 600V distribution. All costs are to be paid for by the Contractor. As an alternative to a temporary 600V service the Contractor may provide a temporary 600V generator, and all fuel costs are paid for by the Contractor. Provision of 600V power is not a mandatory requirement.

.3 The existing 5kV and 120/240V power supplies may be utilized for temporary power provided that there are no operational and schedule impacts associated with the use of the power.

.4 The existing Station lighting and receptacles may be used for construction requirements. Correct and repair any damage to existing electrical distribution, lighting, and receptacles, caused by use under this Contract..

1.7 FIRE PROTECTION

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Indicate use of supplemental or other staging area.

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

.4 Remove from site all such work after use.

1.2 SCAFFOLDING

.1 Scaffolding in accordance with CAN/CSA-S269.2.

.2 Provide and maintain scaffolding and ladders.

1.3 HOISTING

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

.2 Hoists to be operated by qualified operator.

1.4 CONSTRUCTION PARKING

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

.2 Provide and maintain adequate access to project site.

1.5 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.

1.6 SANITARY FACILITIES

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

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

1.7 OFFICES

.1 Provide office heated to 20 degrees C, lighted, 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 The Contractor shall be responsible for installation, maintenance, removal, operating costs, and service installation costs for the field office as described herein.

1.8 LAYDOWN AND STORAGE

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

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

.1 Flammable liquids are stored or handled.

.2 Welding or flame cutting is performed.

1.9 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 working 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 will clean the Site and charge the Contractor.

1.10 WARNINGS AND TRAFFIC SIGNS

.1 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.

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

Part 2 Products

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

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

.3 Cost for such testing will be born by the City in event of conformance with Contract Documents or by the Contractor in event of non-conformance.

1.2 QUALITY

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

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection. Should disputes arise as to quality or fitness of products, decision rests strictly with the Contract Administrator based upon requirements of Contract Documents.

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

1.3 AVAILABILITY

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

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

1.4 METRIC PROJECT

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

.2 During construction, when specified metric elements are unattainable at the time they are required to meet the construction schedule, the Contractor shall notify the Contract Administrator in writing and suggest alternative substitutions. Costs due to these substitutions shall be borne by the Contractor.

1.5 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

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

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

1.6 TRANSPORTATION

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

1.7 MANUFACTURER'S INSTRUCTIONS

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

.2 Notify the Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that the Contract Administrator will establish the course of action.

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

1.8 REMEDIAL WORK

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

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

1.9 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

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

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

1.10 PROTECTION OF WORK IN PROGRESS

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 WORKMANSHIP

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

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

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

END OF SECTION

Part 1 General

1.1 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 Remove and replace defective and non-conforming Work.

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

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

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

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

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

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

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

.2 Remove waste materials from 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.

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

.5 Provide on-site containers for collection of waste materials and debris.

.6 Dispose of waste materials and debris off site.

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

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

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

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

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

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

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

.5 Pay costs of transportation.

1.2 OPERATING AND MAINTENANCE MANUALS

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

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

.3 One (1) advance copy of the manual shall be submitted prior to Total Performance of the Work for review and comments. After review, five (5) hard copies and one electronic (PDF) copy of the final manuals shall be submitted.

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

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

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

- .1 Overall Title sheet, labelled "Operation and Maintenance Instructions", and containing project name and date, facility's covered in the manual, City's Contract number, the name and address of the Contractor, and the issue date.
- .2 Overall list of contents, indicating the facilities upgraded by the project.
- .3 Title sheet for each section, labelled "Operation and Maintenance Instructions", the applicable facility, and containing project name and date.
- .4 List of contents for each section.
- .5 Include:
  - .1 Brochures/catalogue excerpts of all components of the Work.
  - .2 Documentation of all test results.
  - .3 Complete set of equipment and assembly drawings
  - .4 Installation, start-up, O&M Manuals
  - .5 Any specific requirements from the Specifications

.6 Clean Shop Drawings and cutsheets of all equipment and materials,

.1 Do not utilize the submittals as these may have markups on them and would therefore contain inaccurate information.

.7 Include sections for the record drawings of all installations. Drafted record drawings of size 432x279mm (11 x 17") will be inserted by the Contract Administrator, based on the record drawings marked up by the Contractor.

.8 Names, addresses, and telephone numbers of all major sub-contractors and suppliers.

.7 Modify and supplement the manual as required by the Contract Administrator.

.8 Format to be as follows:

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

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

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

1.3 AS-BUILT DRAWINGS

.1 After award of Contract, the Contract Administrator will provide a complete set of Drawings for the purpose of maintaining Project As-Built Drawings. Accurately record deviations from Contract Documents caused by Site conditions and changes ordered by the Contract Administrator. Update daily.

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

.3 On completion of each facility, submit As-Built Drawings to Contract Administrator for review.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 The City of Winnipeg (CW)

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

.2 Canadian Standards Association (CSA)

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

1.2 SUBMITTALS

.1 Shop Drawings

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

.2 Construction Method

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

Part 2 Products

2.1 MATERIALS

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

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

.3 Premoulded joint filler:

□

.1 Bituminous impregnated fibreboard: to ASTM D1751.

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

.5 Sealer: proprietary poly-siloxane resin blend.

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

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

2.2 MIXES

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

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

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

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

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

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

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

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

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

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

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

Part 3 Execution

3.1 GENERAL

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

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

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

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

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

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

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

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

3.2 FORMING

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

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

3.3 INSERTS

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

3.4 FINISHES

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

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

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

□

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

.1 Screed to plane surfaces and use floats.

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

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

3.5 CONTROL JOINTS

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

3.6 EXPANSION AND ISOLATION JOINTS

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

3.7 CURING

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

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

3.8 SEALING

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

3.9 SITE TOLERANCES

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

3.10 QUALITY CONTROL

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

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

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

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

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

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

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

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

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

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

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

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 City of Winnipeg (CW)

.1 CW 2160

.2 American Concrete Institute (ACI)

.1 SP-66, ACI Detailing Manual 2004.

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

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

.3 CSA International

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

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

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

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

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

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

.4 Reinforcing Steel Institute of Canada (RSIC)

.1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

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

.4 Shop Drawings:

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

.1 Indicate placing of reinforcement and:

.1 Bar bending details.

.2 Lists.

.3 Quantities of reinforcement.

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

1.3 QUALITY ASSURANCE

.1 Submit:

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

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

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

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

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

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

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

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

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

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

.6 Replace defective or damaged materials with new.

2.2 FABRICATION

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

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

2.3 SOURCE QUALITY CONTROL

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

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

Part 3 Execution

3.1 FIELD BENDING

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

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

.3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

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

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

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

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

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

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

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

3.3 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes

.2 CSA International

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

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

.3 CSA S16.1, Design of Steel Structures.

.4 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59, Welded Steel Construction (Metal Arc Welding).

.6 CSA S157, Strength Design in Aluminum

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

1.3 QUALIFICATION

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

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

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

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

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

2.2 MATERIALS

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

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

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

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

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

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

.2 Isolating Sleeves

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

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

.4 Hot Dipped Galvanized Steel Repair Material

.1 Galvalloy and Gal-Viz

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

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

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

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

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

2.3 FABRICATION

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

.2 Confirm measurements for all fabrications before fabricating.

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

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

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

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

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

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

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

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

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

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

.13 Pipe Bollards

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

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

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

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

2.4 FINISHES

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

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

.3 Zinc primer: zinc rich, ready mix.

2.5 ISOLATION COATING

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

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

.2 Concrete, mortar and masonry.

.3 Wood.

2.6 SHOP PAINTING

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

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

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

.4 Touch up surfaces after installation.

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

2.7 ANGLE LINTELS

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

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

2.8 PIPE RAILINGS

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

.2 Galvanize pipe railings after fabrication.

2.9 ACCESS LADDERS

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

.2 Galvanized after fabrication.

2.10 CHANNEL AND HSS ACCESSORIES

.1 Fabricate accessories from steel, sizes as indicated.

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

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

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

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate.

.2 Inform the Contract Administrator in writing of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Contract Administrator.

3.2 ERECTION

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

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

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

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

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

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

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

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

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

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

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

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

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

3.3 PIPE RAILINGS

.1 Install pipe railings as indicated.

3.4 ACCESS LADDERS

.1 Install access ladders in locations as indicated.

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

3.5 CHANNEL AND HSS ACCESSORIES

.1 Install steel channel frames to openings as indicated.

3.6 CLEANING

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

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

3.7 PROTECTION

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

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

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

.2 Canadian Gas Association (CGA).

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

.3 Canadian General Standards Board (CGSB)

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

.4 Underwriters Laboratories of Canada (ULC).

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

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

- .1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

.1 Product Data:

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

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

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

Part 2 Products

2.1 INSULATION

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

.2 Rigid board: mineral (rock slag) wool board to CAN/ULC-S702, thickness & locations as indicated on Drawings, butt edges. Acceptable material: Rockwool ComfortBoard-80, or approved equivalent in accordance with B7.

2.2 ACCESSORIES

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install insulation after building substrate materials are dry.

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

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

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

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

.6 Insulation installed into stud cavities shall be snug fit to provide sufficient support, with no gaps or sags, and fully fill cavity. Avoid over-compressing insulation.

.7 Ceiling installation shall be friction fit between rafters and/or draped across with no gaps or sags.

.8 In all cases, fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.9 In all cases, offset both vertical and horizontal joints in multiple layer applications.

3.3 EXAMINATION

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

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

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

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

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include:

.1 Product characteristics.

.2 Performance criteria.

.3 Limitations.

.2 Quality assurance submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

Part 2 Products

2.1 SHEET VAPOUR BARRIER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15 mm thick.

2.2 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: acoustical sealant compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

.3 Staples: minimum 6 mm leg.

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

Part 3 Execution

3.1 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior wall, ceiling, and floor assemblies to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.2 EXTERIOR SURFACE OPENINGS

.1 Cut sheet vapour retarder to form openings and ensure material is lapped and sealed to frame.

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.
.2 Lap sheet over sealant and press into sealant bead.
.3 Install staples through lapped sheets at sealant bead into wood substrate.
.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.
.2 Apply continuous bead of sealant over solid backing at joint.
.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
.4 Install staples through lapped sheets at sealant bead into wood substrate.
.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier.
.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.6 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International Inc.

.1 ASTM C726, Standard Specification for Mineral Fiber Roof Insulation Board.

.2 ASTM C728, Standard Specification for Perlite Thermal Insulation Board.

.3 ASTM C1177/C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

.4 ASTM C1396/C1396M, Standard Specification for Gypsum Board.

.5 ASTM D41, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

.6 ASTM D312, Standard Specification for Asphalt Used in Roofing.

.7 ASTM D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

.8 ASTM D2178, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

.9 ASTM D6162, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fibre Reinforcements.

.10 ASTM D616, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fibre Reinforcements.

.11 ASTM D6164, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

.12 ASTM D6222, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcement.

.13 ASTM D6223, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcement.

.14 ASTM D6509, Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcement.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 37-GP-9Ma, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.

.2 CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

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

.3 Canadian Roofing Contractors Association (CRCA)

.1 CRCA Roofing Specifications Manual.

.4 Canadian Standards Association (CSA International)

.1 CSA A123.21, Standard Test Method for the Dynamic Wind Uplift Resistance of Mechanically Attached Membrane-Roofing Systems

.2 CSA-A123.3, Asphalt Saturated Organic Roofing Felt.

.3 CSA-A123.4, Asphalt for Constructing Built-Up Roof Coverings and Waterproofing Systems.

.4 CSA A231.1, Precast Concrete Paving Slabs.

.5 CSA O121, Douglas Fir Plywood.

.6 CSA O151, Canadian Softwood Plywood.

.5 Factory Mutual (FM Global)

.1 FM Approvals - Roofing Products.

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

.1 Material Safety Data Sheets (MSDS).

.7 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S702.2, Standard for Mineral Fibre Thermal Insulation for Buildings.

.3 CAN/ULC-S704, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.4 CAN/ULC-S706, Standard for Wood Fibre Thermal Insulation for Buildings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide complete information on roofing membrane system proposed by contractor for review.

.3 Product Data:

.1 Provide a copy of most recent technical roofing components data sheets describing materials' physical properties and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide a cop of WHMIS MSDS and indicate VOC content for:

.1 Primers.

.2 Asphalt.

.3 Sealers.

.4 Filter fabric.

.4 Provide shop drawings:

.1 Indicate flashings, control joints, and tapered insulation details.

.2 Provide layout for tapered insulation.

.5 Manufacturer's Installation Instructions: indicate special precautions required for seaming the membrane.

.6 Reports: indicate procedures followed, ambient temperatures and wind velocity during application.

.1

1.3 QUALITY ASSURANCE

.1 Installer qualifications: company or person specializing in application of modified bituminous roofing systems with minimum 5 years documented experience.

.2 Sustainability Standards Certification:

.1 Recycled Content: provide listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their percentages of post-consumer and post-industrial content.

.2 .

1.4 FIRE PROTECTION

.1 Fire Extinguishers:

.1 Maintain minimum one Fire Extinguisher with hose and shut-off nozzle, size suitable for roof area size

.2 ULC labelled for A, B and C class protection.

.2 Maintain fire watch for 1 hour after each day's roofing operations cease.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle materials in accordance with [manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

.2 Storage and Handling Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of felt and membrane in upright position. Store membrane rolls with salvage edge up.

.4 Remove only in quantities required for same day use.

.5 Place plywood runways over completed Work to enable movement of material and other traffic.

.6 Store sealants at +5 degrees C minimum.

.7 Store insulation protected from daylight and weather and deleterious materials.

.3 Packaging Waste Management: remove for disposal and recycling all packaging and waste in accordance with Section 01 74 11 – Cleaning.

.1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.2 Fold up metal banding, flatten and place in designated area for recycling.

1.6 FIELD CONDITIONS

.1 Ambient Conditions

.1 Do not install roofing when temperature remains below -5 degrees C or as per manufacturers' installation instructions, whichever is warmer.

.2 Minimum temperature for solvent-based adhesive is -5 degrees C or as per manufacturers' installation instruction, whichever is warmer.

.2 Install roofing on dry deck, free of snow and ice, use only dry materials and apply only during weather that will not introduce moisture into roofing system.

Part 2 Products

2.1 PERFORMANCE CRITERIA

.1 Compatibility between components of roofing system is essential. Provide written declaration to the Contract Administrator stating that materials and components, as assembled in system, meet this requirement.

.2 Roofing System: to CSA A123.21 for wind uplift resistance.

2.2 DECK COVERING

.1 Gypsum board sheathing: to ASTM C1396/C1396M, thickness as indicated.

.2 Cementitious Board: thickness as indicated.

.3 Glass Mat, Gypsum Board: to ASTM C1177 thickness as indicated.

.4 Plywood:

.1 To CSA O121 or CSA O151, thickness as indicated.

.5 Sand: natural silica sand passing 1-18 mm sieve.

2.3 DECK PRIMER

.1 Asphalt primer: to CGSB 37-GP-9Ma or ASTM D41.

2.4 VAPOUR RETARDER

.1 As indicated on drawings.

.2 Self adhesive air/vapour barrier modified bitumen membrane vapour retarder waterproofing membrane strip, non-woven polyester reinforcement and elastomeric bitumen

2.5 MEMBRANE

.1 Base sheet: to CGSB 37-GP-56M, polyester fibres to ASTM D6164, glass fibres to ASTM D6163, or combination of polyester and glass fibres to ASTM D6162.

.1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer, Atactic Polypropylene (APP) thermoplastic polymer, prefabricated sheet, glass or polyester reinforcement, having nominal minimum weight of 180 g/m^2.

.2 Fully adhered.

.3 Class C - plain surfaced.

.4 Grade - heavy duty service.

.5 Base sheet membrane properties: to CGSB 37-GP-56M.

.6 ULC certification: Class B.

.2 Cap sheet membrane: to CGSB 37-GP-56M, polyester fibres to ASTM D6164, ASTM D6622, glass fibres to ASTM D6163, ASTM D6223, or combination of polyester and glass fibres to ASTM 6162, ASTM D6509.

.1 Styrene-Butadiene-Styrene (SBS) elastomeric polymer, Atactic Polypropylene (APP) thermoplastic polymer, prefabricated sheet, glass or polyester reinforcement, having nominal minimum weight of 180 g/m^2.

.2 Fully adhered.

.3 Class A-granule surfaced.

.1 Colour for granular surface: gray.

.4 Grade - heavy duty service.

.5 Bottom surface sanded or polyethylene.

.6 Cap sheet membrane properties: to CGSB 37-GP-56M

.7 ULC certification: Class B.

2.6 ADHESIVE

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

2.7 OVERLAY BOARD

.1 Overlay Board: 12.7 mm thick asphalt-based recovery board with non-woven glass facers as recommended by the membrane manufacturer or asphalt impregnated fiberboard.

.1 Install over insulation to provide torch safe surface.

2.8 BITUMEN

.1 Asphalt: to CAN/CSA A123.4 or ASTM D312, Type 1 or type 2.

2.9 MINERAL FIBRE INSULATION - Preferred

.1 To ASTM C726 or CAN/ULC-S701, Type 1, CAN/ULC-S702.2, thickness as indicated, square edges, unfaced. Tapered shape to provide 0.25:12 slope with minimum thickness of 12 mm at drains.

.2 Acceptable product: Rockwool Toprock DD or DD Plus, Tapered, or approved equal in accordance with B7.

2.10 POLYSTYRENE INSULATION

.1 Extruded polystyrene (XPS) insulation or expanded polystyrene (EPS) insulation to CAN/ULC-S701, thickness as indicated, shiplapped edges. Tapered shape to provide 0.25:12 slope with minimum thickness of 12 mm at drains.

2.11 EXPANDED POLYSTYRENE INSULATION (FIBREBOARD FACED)

.1 Polystyrene: to CAN/ULC-S701, thickness as indicated. Tapered shape to provide 0.25:12 slope with minimum thickness of 12 mm at drains.

.2 Insulating fibreboard facing: to CAN/ULC-S706, Type I, thickness 2 mm

2.12 POLYISOCYANURATE INSULATION

.1 To CAN/ULC-S704, type 1, class 1, thickness as indicated, square edges, unfaced. Tapered shape to provide 0.25:12 slope with minimum thickness of 12 mm at drains.

2.13 SEALERS

.1 Plastic cement: asphalt.

.2 Sealing compound: rubber asphalt type.

.3 Sealants: Caulking - see Section 07 92 00 - Joint Sealants.

2.14 CANT STRIPS

.1 Cut from or prefabricated from fibreboard, fibreglass, rigid mineral wool fibre material, to measure 140 mm on slope.

2.15 FASTENERS

.1 Covering to decking: Minimum #10 self tapping, Type A or AB, plated screws. Recommend FM Approved screw and plate assemblies.

.2 Insulation to deck: coated insulation fasteners and galvanized plates must meet FM Approval for wind uplift and corrosion resistance, as recommended by insulation manufacturer.

Part 3 Execution

3.1 QUALITY OF WORK

.1 Do examination, preparation and roofing Work in accordance with Roofing Manufacturer's Specification Manual, CRCA Roofing Specification Manual, and Provincial Roofing Association Manual, particularly for fire safety precautions, and to FM / ULC.

.2 Do priming in accordance with manufacturers written recommendations.

.3 The interface of the walls and roof assemblies will be fitted with durable rigid material plywood providing connection point for continuity of air barrier.

.4 Assembly, component and material connections will be made in consideration of appropriate design loads.

3.2 EXAMINATION OF ROOF DECKS

.1 Verification of Conditions:

.1 Inspect with Contract Administrator deck conditions including parapets, construction joints, roof drains, plumbing vents and ventilation outlets to determine readiness to proceed.

.2 Evaluation and Assessment:

.1 Prior to beginning of work ensure:

.1 Decks are firm, straight, smooth, dry, free of snow, ice or frost, and swept clean of dust and debris. Do not use calcium or salt for ice or snow removal.

.2 Curbs have been built.

.3 Roof drains have been installed at proper elevations relative to finished roof surface.

.4 Plywood and lumber nailer plates have been installed to deck, walls and parapets as indicated.

.3 Do not install roofing materials during rain or snowfall.

3.3 PROTECTION OF IN-PLACE CONDITIONS

.1 Cover walls, walks, adjacent roofs other and adjacent work where materials hoisted or used.

.2 Use warning signs and barriers. Maintain in good order until completion of Work.

.3 Clean off drips and smears of bituminous material immediately.

.4 Dispose of rainwater off roof and away from face of building until roof drains or hoppers functional.

.5 Protect roof from traffic and damage. Comply with precautions deemed necessary by the Contract Administrator.

.6 At end of each day's work or when stoppage occurs due to inclement weather, provide protection for completed Work and materials out of storage.

.7 Metal connectors and decking will be treated with rust proofing or galvanization.

3.4 DECK SHEATHING

.1 Mechanically fasten to deck Gypsum Board Sheathing, Glass Mat Gypsum Board, Cementitious Board underlay with screws to deck, spaced maximum 400mm on centre each way.

.2 Place with long axis of each sheet transverse to deck directions, with end joints staggered and fully supported on rafters.

3.5 PRIMING DECK

.1 Apply deck primer to roofing substrate at the rate recommended by manufacturer.

3.6 (EXPOSED) CONVENTIONAL MEMBRANE ROOFING (CMR) APPLICATION

.1 Insulation: fully adhered, adhesive application:

.1 Adhere insulation to [steel deck] [laminated vapour barrier] using solvent-based adhesive.

.2 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.3 Cut end pieces to suit.

.4 Apply adhesive in continuous ribbons at 300 mm on centre.

.5 Separate the membrane and insulation with a drainage layer or slipsheet.

.2 Insulation: fully adhered, bitumen application:

.1 Embed insulation in 1 to 1.5 kg/m^2 mopping of bitumen.

.2 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.3 Cut end pieces to suit.

.3 Insulation: mechanically fastened application:

.1 Mechanically fasten insulation using screws and pressure distribution plates.

.2 Fasten insulation as per manufacturer's written recommendations.

.3 Number and pattern of screws per board to meet Factory Mutual requirements.

.4 Place boards in parallel rows with ends staggered, and in firm contact with one another.

.5 Cut end boards to suit.

.4 Tapered insulation application:

.1 Mop insulation to deck board with hot asphalt at rate of 1 kg/m^2.

.2 Install tapered insulation as first insulation layer, in accordance with shop drawings. Stagger joints between layers 150 mm minimum.

.5 Overlay Board: adhesive application:

.1 Adhere overlay board to insulation with vulcanized adhesive at the rate of one litre per m^2.

.2 Place boards in parallel rows with end joints staggered. Cap joints approximately 25 mm.

.3 Cut ends to suit and apply adhesive in continuous ribbons at 300 mm on centre.

.6 Base sheet application:

.1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.

.2 Unroll and embed base sheet in uniform coating of asphalt applied at rate of 1.2 kg/m^2, at 230 degrees C.

.3 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.

.4 Lap sheets 75 mm minimum for side and 150 mm minimum for end laps.

.5 Application to be free of blisters, wrinkles and fishmouths.

.7 Cap sheet application:

.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.

.2 Unroll and embed cap sheet in uniform coating of asphalt applied at rate of 1.2 kg/m^2, EVT at point of contact.

.3 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.

.4 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm minimum from those in base sheet.

.5 Application to be free of blisters, fishmouths and wrinkles.

.6 Do membrane application in accordance with manufacturer's recommendations.

.8 Flashings:

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.

.2 Mop and or torch sheets onto substrate in 1 metre wide strips.

.3 Lap flashing base sheet to membrane base sheet minimum 150 mm and seal by mopping or torch welding.

.4 Lap flashing cap sheet to membrane cap sheet 250 mm minimum and torch weld.

.5 Provide 75 mm minimum side lap and seal.

.6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.

.7 Do work in accordance with manufacturer's recommendations and specifications

.9 Roof penetrations:

.1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with manufacturer's recommendations and details.

3.7 PROTECTED MEMBRANE ROOFING (PMR) APPLICATION

.1 Primer:

.1 Apply deck primer to deck boards at rate specified on label.

.2 Base sheet application:

.1 Starting at low point of roof, perpendicular to slope, unroll base sheet, align and reroll from both ends.

.2 Unroll and embed base sheet in uniform coating of asphalt applied at rate of 1.2 kg/m^2 or per manufacturer installation instructions, EVT at point of contact.

.3 Unroll and torch base sheet onto substrate taking care not to burn membrane or its reinforcement or substrate.

.4 Lap sheets 75 mm for side and 150 mm for end laps.

.5 Application to be free of blisters, wrinkles and fishmouths.

.3 Cap sheet application:

.1 Starting at low point on roof, perpendicular to slope, unroll cap sheet, align and reroll from both ends.

.2 Unroll and embed cap sheet in uniform coating of asphalt applied at rate of 1.2 kg/m^2 or per manufacturer installation instructions, EVT at point of contact.

.3 Unroll and torch cap sheet onto base sheet taking care not to burn membrane or its reinforcement.

.4 Lap sheets 75 mm minimum for side laps and 150 mm minimum for end laps. Offset joints in cap sheet 300 mm from those in base sheet.

.5 Application to be free of blisters, fishmouths and wrinkles.

.6 Do membrane application in accordance with manufacturer's recommendations.

.4 Flashings:

.1 Complete installation of flashing base sheet stripping prior to installing membrane cap sheet.

.2 Mop or torch sheets onto substrate in 1 metre wide strips.

.3 Lap flashing base sheet to membrane base sheet minimum 100 mm and seal by mopping or torch welding.

.4 Lap flashing cap sheet to membrane cap sheet 150 mm and torch weld.

.5 Provide 75 mm side lap and seal.

.6 Properly secure flashings to their support, without sags, blisters, fishmouths or wrinkles.

.7 Do Work in accordance with manufacturer's recommendations and specifications.

.5 Roof penetration:

.1 Install roof drain pans, vent stack covers and other roof penetration flashings and seal to membrane in accordance with the manufacturer's recommendations and details.

.6 Insulation application:

.1 Place insulation laid in parallel rows with ends staggered.

.2 Where insulation is in contact with cants, cut bevel edges on insulation to fit snug to cant slope.

.7 Filter fabric application when required:

.1 Apply fabric unbonded over installed insulation.

.2 Overlap edges 300 mm minimum.

.3 Cut fabric around roof drains, vents and other penetrations and extend under metal flashings.

3.8 CANTS

.1 Install cants over rigid insulation or insulation stops.

.2 Apply hot bitumen to receiving surface and embed cant firmly by hand.

.1 Fasten wood cants to wood insulation stops where present.

.3 Angle cut cants to fit tightly on back and bottom where roof to wall angle varies from 90 degrees.

3.9 FIELD QUALITY CONTROL

.1 Inspections:

.1 Notify Contract Administrator at least 24 hrs prior to membrane installation to permit inspection and observation.

3.10 CLEANING

.1 Remove bituminous markings from finished surfaces.

.2 In areas where finished surfaces are soiled caused by work of this section, consult manufacturer of surfaces for cleaning advice and complying with their documented instructions.

.3 Repair or replace defaced or disfigured finishes caused by work of this section.

.4 Waste Management: separate waste materials for disposal and recycling.

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

.2 Clearly label location of salvaged material's storage areas and provide barriers and security devices.

.3 Ensure emptied containers are sealed and stored safely.

.4 Unused coating material must be disposed of at official hazardous material collections site.

.5 Unused adhesive, sealant and asphalt materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.6 Dispose of unused adhesive, sealant and asphalt materials at official hazardous material collections site.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.1 ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing (incorporating Amendment No. 1).

.2 CAN/CGSB-19.13, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.4 CAN/CGSB-19.17, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24, Multi-component, Chemical Curing Sealing Compound.

.6 CAN/CGSB-19.21 Sealing and Bedding Compound, Acoustical

.3 General Services Administration (GSA) - Federal Specifications (FS)

.1 FS-SS-S-200, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

1.2 SUBMITTALS

.1 Submit product data.

.2 Manufacturer's product to describe.

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit manufacturer's instructions.

.1 Instructions to include installation instructions for each product used.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with the manufacturer’s written instructions.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

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1.4 ENVIRONMENTAL CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 5 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

.4 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.5 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Type 1 – Silicones One Part: to CAN/CGSB-19.13. Acceptable material: Dow Corning 795, GE Silpruf, Tremco Spectrum 2.

.2 Type 2 – Silicones One Part: to CAN/CGSB-19.22-M89 (Mildew resistant). Acceptable material: Dow Corning 786.

.3 Type 3 – Acrylic Latex One Part: to CGSB 19-GP-5M. Acceptable material: Tremco 100 Latex Caulk, GE Acrylasil Latex Caulk.

.4 Type 4 – Butyl: to CGSB 19-GP-14M. Acceptable material: Tremco Butyl Sealant

.5 Type 5 – Rubber/Synth Rubber: To CGSB 19.24. Acceptable material: Tremco Acoustical/Curtainwall Sealant, LePage PL Acousti-seal

2.2 ACCESSORIES

.1 Preformed Compressible and Non-Compressible back-up materials.

.1 High-Density Foam. Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa,

extruded polyolefin foam, 32 kg/m density, or neoprene foam backer, size as recommended by manufacturer.

.2 Bond Breaker Tape. Polyethylene bond breaker tape that will not bond to sealant.

.2 Joint cleaner: non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.3 Primer: as recommended by manufacturer.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building: Sealant Type 1.

.2 Miscellaneous flashing joints and metal cladding: Sealant Type 1.

.3 Perimeter of washroom fixtures (e.g., sinks, urinals, water closets, vanities, etc.): Sealant Type 2.

.4 Interior paintable joints: Sealant Type 3.

.5 Bedding aluminum doorsills: Sealant Type 4.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

Part 3 Execution

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

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.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

.1 Sealant.

.1 Apply sealant in accordance with manufacturer's written instructions.
.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
.3 Apply sealant in continuous beads.
.4 Apply sealant using gun with proper size nozzle.
.5 Use sufficient pressure to fill voids and joints solid.
.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
.7 Tool exposed surfaces before skinning begins to give slightly concave shape.
.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.
.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup.

.1 Clean adjacent surfaces immediately and leave Work neat and clean.
.2 Remove excess and droppings, using recommended cleaners as work progresses.
.3 Remove masking tape after initial set of sealant.

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END OF SECTION

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Part 1 General

1.1 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual.

.5 National Fire Code of Canada

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), c. 34 .

1.2 SCOPE OF WORK

.1 The scope of work includes, but is not limited to:

.1 Paint all new interior walls

.2 All interior piping shall be painted in accordance with this specification.

.3 Any new metal surfaces, not already factory finished, shall be painted in accordance with this specification. Touch up any equipment factory painted, including equipment supplied by the City.

.4 Existing structural steel shall be painted in accordance with this specification as indicated in the drawings

.5 All concrete repairs, patching and new concrete shall be painted in accordance with this specification.

.6 Paint all existing concrete walls and surfaces as shown in the Specifications and Drawings.

1.3 SUBMITTALS

.1 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Provide color samples to the Contract Administrator for approval before application.

.3 Submit product data for the use and application of paint thinner.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation and application instructions.

.6 Extra Materials:

.1 Submit one 4-litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.2 Deliver to the City of Winnipeg and store where directed.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly.

.7 Remove paint materials from storage only in quantities required for same day use.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.2 Ventilation: ventilate area of work by use of approved portable supply and exhaust fans.

.3 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.

.4 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

.5 Apply paint only when surface to be painted is dry, properly cured, and adequately prepared.

Part 2 Products

2.1 MATERIALS

.1 Only paint materials listed in the MPI Approved Products List (APL) are acceptable for use on the project, except where other products are specified.

.2 Paint materials for each coating formula to be products of a single manufacturer.

.3 Colour schedule will be determined by the Contract Administrator. Selection of colours will be from manufacturer's full range of colours.

.4 Paint Finishes: Except for Formula 1 (epoxy) use Master Painters Institute (MPI) finishing formulae as specified below:

.1 Formula 1: for wood to receive paint finish: MPI EXT 6.4B - Alkyd GR (semi-gloss) finish premium grade.

.2 Formula 2: for shop primed and unprimed ferrous metal surfaces (Alkyd):

.1 MPI EXT 5.1D Alkyd G5 (semi-gloss) finish premium grade.

.2 Touch-up shop primer (if used) with primer provided by the manufacturer.

.3 One coat marine alykd metal primer CGSB-1-GP-48M.

.4 Two coats semi-gloss enamel CAN/CGSB-1.57.

.5 Acceptable products: Pratt and Lambert, Benjamin Moore, Glidden, Cloverdale or Northern Paint.

.6 Provide color samples to the Contract Administrator for approval before application.

.7 Paint and primer shall be from the same manufacturer.

.3 Formula 3: for galvanized and zinc-coated metal: MPI EXT 5.3B - Alkyd G5 (semi-gloss) finish premium grade.

.4 Formula 4: for concrete, walls and ceilings apply: MPI EXT 3.1A - Latex G5 (semi-gloss) finish premium grade.

.1 One coat latex primer-sealer CAN/CGSB-1.119.

.2 Two coats semi-gloss enamel CAN/CGSB-1.57.

.3 Acceptable products: Pratt and Lambert, Benjamin Moore, Glidden, Cloverdale or Northern Paint.

.4 Paint and primer shall be from the same manufacturer.

.5 Formula 5: for concrete floors apply: MPI EXT 3.2D – Alkyd floor enamel #59 low gloss finish premium grade. Sprinkle with clean silica sand to provide slip-resistant surface acceptable to Contract Administrator.

2.2 EXTRA MATERIALS

.1 Submit one 4-litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.2 Deliver to City and store as directed.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to the Contract Administrator.

.2 Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.4 PREPARATION

.1 Protection:

.1 Cover or mask floors, walls, and equipment adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

.2 Protect items that are permanently attached such as Fire Labels on doors, frames, and name plates on equipment.

.2 Surface Preparation: Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.3 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.4 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

3.5 APPLICATION

.1 Apply paint in accordance with manufacturer's application instructions unless specified otherwise.

.2 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.3 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.4 Sand and dust between each coat to remove visible defects.

.5 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

.6 Do not paint over galvanized metal, aluminium, stainless steel, brass or bronze, rubber, plated surfaces, machined surfaces, hangers and nameplates.

.7 Ventilate area of work by use of approved portable supply and exhaust fans.

.8 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.

.9 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

.10 Apply paint only when surface to be painted is dry, properly cured, and adequately prepared.

.11 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.12 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.13 Sand and dust between each coat to remove visible defects.

.14 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.15 Paint both sides and edges of backboards for electrical equipment before installation. Leave equipment in original finish except for touch-up as required.

3.6 CLEANUP

.1 Clean and reinstall all hardware items that were removed before undertaken coating operations.

.2 Remove over-spray, paint splatter and spills from exposed surfaces that were not intended for painting. Remove smears and spatter immediately as operations progress, using appropriate methods as per manufacturer's instructions.

3.7 PUMPS

.1 Do not apply primer or paint to pumps.

3.8 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Do not paint exposed conduit, ductwork and hangers, unless otherwise indicated.

.2 Paint exposed piping. Colour and texture to match adjacent surfaces, except as noted otherwise.

.3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.4 Do not paint over nameplates, brass or bronze surfaces or machined surfaces.

.5 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashes on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of the Contract Administrator. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by the Contract Administrator.

3.10 STANDARDS OF ACCEPTANCE

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface when viewed using final lighting source.

.2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Piping, valves and pumping equipment: No visible defects from a distance of 1000 millimetres at 90 degrees to surface when viewed using final lighting source.

.4 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/NFPA 10-2010, Portable Fire Extinguishers.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S508-2002 (R2007), Rating and Fire Testing of Fire Extinguishers and Class "D" Extinguishing Media.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHER

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.

.2 Size: 4.5 kg.

2.2 EXTINGUISHER BRACKET

.1 Type recommended by extinguisher manufacturer.

2.3 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of CAN/ULC-S508.

.2 Supply and install an identification lamacoid adjacent to each fire extinguisher.

.3 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

Part 3 Execution

3.1 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets as indicated.

.2 Attach lamacoid with screws.

END OF SECTION

Part 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 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.

Part 2 Products

2.1 SUMP PUMP SUBMERSIBLE

.1 Capacity: 250 L/min (66 usgpm) @ 8 m head.

.2 Motor: 1 HP, hermetically sealed.

.3 Specific Requirements:

.1 P-F12

.1 Motor:

.1 Internal overload protection.

.2 120VAC, 1Ø

.2 Power Cable:

.1 Heavy duty rated, oil and water resistant.

.2 Epoxy seal on motor end

.3 Length: 3m (10').

.3 Control: integral vertical float.

.4 Solids handling capability: 25mm (1”)

.5 Discharge size: 38mm (1 ½ ") NPT.

.6 Temperature: 40°C continuous

.7 Impeller: Stainless or Polymer

.8 Casing: Cast iron volute type

.9 Mechanical Seal: Silicon Carbide vs. Silicon Carbide sealing faces. Stainless steel metal parts, BUNA-N elastomers.

.10 Shaft: stainless steel.

.11 Fasteners: stainless steel.

.12 Capable of running dry without damage to components.

.13 Bearings: Heavy duty ball bearing construction.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated on the drawings, and as per manufacturer instructions.

.2 Ensure pump and motor assembly do not support piping.

.3 Align vertical pit mounted pump assembly after mounting and securing cover plate.

.4 Locate double check valve and isolation valve within 1.5 m of pump room floor

3.3 START-UP

.1 General:

.1 Procedures:

.1 Check power supply.

.2 Start pumps, check impeller rotation.

.3 Check for safe and proper operation.

.4 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.5 Adjust alignment of piping and conduit to ensure full flexibility.

.6 Eliminate causes of cavitation, flashing, air entrainment.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for copper domestic water service used in the following:

.1 PVC piping for domestic water services and seal water piping inside building.

.2 PVC piping for sump pump inside drywell.

.2 Sustainable requirements for construction, verification and operation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 22 42 01 - Plumbing Specialties and Accessories

.3 Section 23 05 00 - Common Work Results - Mechanical

.4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.3 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).

.1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).

.3 ASTM F492, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.

.3 American Water Works Association (AWWA).

.1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International).

.1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS-SP-67, Butterfly Valves.
.2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction.

.1 NRCC 38728, National Plumbing Code of Canada (NPC).

.9 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.4 SUBMITTALS

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

Part 2 Products

2.1 PVC PIPING

.1 General:

.1 Piping, fittings, flanges, flange gaskets, primer, cement to be product of one manufacturer.
.2 Equipment manufacturers as listed or approved equal in accordance with B7.

.2 Piping: to CSA-B137 and ASTM D1784.

.1 Schedule 80.
.2 To be smooth and free from imperfections.

.3 Fittings:

.1 Pressure rating: same as for pipes.
.2 NPS 1/2 to 4: solvent welded type.
.3 NPS 6 and over: solvent welded type.
.4 Solvent Welded Fittings: to ASTM D2467, solvent welded type, from PVC, compatible with piping.
.5 Field fabricated fittings: not permitted.

.4 Provisions for Pipe Movement:

.1 Offsets: locations, shapes, dimensions to be as indicated.

.5 Flanged Joints:

.1 Flanges: PVC, Vanstone style, conforming dimensionally to ANSI/ASME B16.1, for 1,355 kPa: slip-on full faced, solvent welded to pipe.
.2 Gaskets: EPDM Gaskets for glycol service, 3 mm thick.

.3 Bolts and nuts: to ASTM A307, Grade B, ANSI B18.2.1, ANSI B18.2.2: stud bolts, carbon steel, semi-finished with heavy hex nuts, complete with washers.

.6 Valves:

.1 Ball valves:

.1 100 mm and under – PVC, PTFE ball seals with EPDM, socket ends, vented freeze protection. Chemline Type 21 or approved equal in accordance with B7.

.2 150 mm - Lug style, PVC butterfly valve and disc, EPDM seat and seals, 403 stainless steel shaft, plastic handle. Chemline Type 57LIS or approved equal in accordance with B7.

.3 200mm - Lug style, PVC butterfly valve and disc, EPDM seat and seals, 403 stainless steel shaft, gear operated actuator. Chemline Type 57LIS or approved equal in accordance with B7.

.4 Up to NPS 2: socket weld ends.

.5 NPS 2 1/2 and over: flanged ends.

.2 Spring (silent) check valves:

.1 50 mm and under - True union, full port, PVC ball check, EPDM seals, socket ends. Chemline BT or approved equal in accordance with B7.

.2 65 mm to 100 mm - Single union, full port, PVC ball check, EPDM seals, socket ends. Maximum working pressure 690 kPa at 50°C. Chemline BC or approved equal in accordance with B7.

.3 150 mm to 200 mm - Wafer style, PVC body, spacer and disc, 316 stainless steel, EPDM seals. Maximum working pressure 760 kPa for 150 mm and 600 kPa for 200 mm at 40°C. Chemline WP or approved equal in accordance with B7.

.4 Up to NPS 2: socket weld ends.

.5 NPS 2 1/2 and over: flanged ends.

.7 Strainers: PVC, Y-type, having full port full flow openings with hex cap and fluoroelastomer 0-ring cap seal.

.1 Screens: Type 316 stainless steel with 40 mesh stainless steel wire cloth.

.2 Pressure rating: 1035 kPa.

.3 For PVC piping systems under NPS 4, use Chemline Y-Strainer or approved equal in accordance with B7.

2.2 PIPING

.1 Domestic water piping systems within building.

.1 Above ground: copper tube, hard drawn, type K to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.3 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150 to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125 to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: roll grooved to CSA B242.

2.4 JOINTS

.1 Rubber gaskets, 1.6 mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5tin copper alloy.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.5 GATE VALVES

.1 NPS 2 and under, soldered:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc .

.2 NPS 2 and under, screwed:

.1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc

2.6 GLOBE VALVES

.1 NPS2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc.

2.7 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat

.2 NPS 2 and under, screwed:

.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat

.2

2.8 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and BunaN seat, steel lever handle

.2 NPS 2 and under, soldered:

.1 To ANSI/ASME B16.18, Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and BunaN seat, steel lever handle, with NPT to copper adaptors

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with NPC and local authority having jurisdiction.

.2 Install pipe work as shown on the drawings and as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.6 Buried tubing:

.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.

.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.2 VALVES

.1 Isolate equipment, fixtures and branches with gate or ball valves as shown on the drawings or as directed by the Contract Administrator.

3.3 PRESSURE TESTS

.1 Conform to requirements of Section[23 05 00 - Common Work Results - 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 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper to Provincial potable water guidelines. Let system flush for additional 2 h, then draw off another sample for testing.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.6 DISINFECTION

.1 Flush out, disinfect and rinse system as required to achieve conformance to Provincial potable water guidelines.

.2 Upon completion, provide laboratory test reports on water quality for Contract Administrator approval.

3.7 START-UP

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Monitor piping systems for freedom of movement, pipe expansion as designed.

.4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.3 Verify compliance with safety and health requirements.

.4 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.3 Reports:

.1 Include certificate of water flow and pressure tests conducted on incoming water

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM B 32, Standard Specification for Solder Metal.

.2 CSA Group (CSA)

.1 CAN/CSA-B125.3, Plumbing Fittings.

.3 American National Standards Institute/American Water Works Association (ANSI/AWWA):

.1 ANSI/AWWA C111/A21.11-[17], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

1.3 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for 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.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary to: ASTM B 306

.1 Fittings.

.1 Cast brass: to CAN/CSA-B125.3

.2 Wrought copper: to CAN/CSA-B125.3

.2 Solder: to ASTM B 32

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground: to CAN/CSA-B70

.1 Joints:

.1 Hub and spigot:

.1 Caulking lead: to CSA B67

.2 Mechanical joints:

.1 Neoprene or butyl rubber compression gaskets with stainless steel clamps, compounded for water and sewer service.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code.

3.3 TESTING

.1 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.

.2 Ensure weirs are correctly sized and installed correctly.

.3 Verify provisions for movement of roof system.

.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

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

Part 1 General

1.1 RELATED REQUIREMENTS

.1 07 92 00 - Joint Sealants

1.2 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D 2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D 2564, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

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

.1 Safety Data Sheets (SDS).

.3 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada [2015] (NPC).

1.3 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 MATERIAL

.1 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

2.2 PIPING AND FITTINGS

.1 For piping to:

.1 CAN/CSA B1800

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D 2564

.2 Solvent weld for ABS: to ASTM D 2235

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code

3.3 TESTING

.1 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.
.2 Open, cover with linseed oil and re-seal.
.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Storm water drainage:

.1 Verify domes are secure.
.2 Ensure weirs are correctly sized and installed correctly.
.3 Verify provisions for movement of roof system.

.4 Ensure fixtures are properly anchored, connected to system and effectively vented.

.5 Affix applicable label (storm, sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 1 General

1.1 REFERENCES

.1 American Water Works Association (AWWA).

.1 AWWA C511-07, Reduced-Pressure Principle Backflow Prevention Assembly.

.2 Canadian Standards Association (CSA International).

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.

.2 Indicate dimensions, construction details and materials for specified items.

.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.4 Instructions: submit manufacturer's installation instructions.

.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

Part 2 Products

2.1 WATER METERS

.1 Positive Displacement type to ANSI/AWWA C700

.2 Capacity: as per piping size.

2.2 REDUCED-PRESSURE BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, reduced pressure principle type.

.2 Valve body: bronze.

.3 End connections: threaded, NPT.

.4 Maximum working pressure: 1207 kPA (2413 kPa test).

.5 Temperature range: 0 to 60°C.

.6 Shutoff valve: full port, resilient seated, bronze ball valve with bronze ball valve test cock.

.7 Accessories: drain line air gap fitting.

.8 Acceptable material: Watts or approved equal in accordance with B7.

2.3 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

2.4 STRAINERS

.1 860 kPa, Y type with 20 mesh, monel, stainless steel removable screen.

.2 NPS2 and under, bronze body, screwed ends, with brass cap.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Install in accordance with the National Plumbing Code of Canada and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 WATER METERS

.1 Install water metre provided by local water authority.

.2 Install water metre as indicated.

3.4 BACK FLOW PREVENTORS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain or as indicated.

3.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.6 STRAINERS

.1 Install with sufficient room to remove basket.

3.7 START-UP

.1 Timing: start-up only after:

.1 Pressure tests have been completed.

.2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.

.2 Provide continuous supervision during start-up.

3.8 TESTING AND ADJUSTING

.1 Backflow preventers:

- .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.

.2 Strainers:

- .1 Clean out repeatedly until clear.
- .2 Verify accessibility of cleanout plug and basket.
- .3 Verify that cleanout plug does not leak.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Shop drawings to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Points of operation on performance curves.

.3 Manufacturer to certify current model production.

.4 Certification of compliance to applicable codes.

.4 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Operation and maintenance manual approved by, and final copies deposited with, Contract Administrator before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Operation instruction for systems and component.

.4 Description of actions to be taken in event of equipment failure.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 3 copies of draft Operation and Maintenance Manual to Contract Administrator for approval. Submission of individual data will not be accepted unless directed by Contract Administrator.

.2 Make changes as required and re-submit as directed by Contract Administrator.

.7 As-built drawings:

.1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS

BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.2 Submit to Contract Administrator for approval and make corrections as directed.

.3 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.8 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 MAINTENANCE

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Not Applicable.

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Do painting in accordance with Section 09 91 23 - Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems. Vacuum interior of ductwork, fan, and filter.

3.3 DEMONSTRATION

.1 Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of duct work, actuators, and controllers, including the installation and location of identification systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

1.3 SUBMITTALS

.1 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.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Contract Administrator.

2.4 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.5 CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

2.6 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.7 LANGUAGE

.1 Identification in English.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 23 - Painting has been completed.

3.3 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.4 LOCATION OF IDENTIFICATION ON DUCTWORK SYSTEMS

.1 On both sides of visual obstruction or where run is difficult to follow.

.2 At point immediately upstream of major manually operated or automatically controlled dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.3 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.5 CONTROLLERS

.1 Controllers: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams and equipment schedule mounted in frame behind non-glare glass where directed by Contract Administrator. Provide one copy (reduced in size if required) in each operating and maintenance manual.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Testing, Adjusting, and Balancing (TAB) is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Contract Administrator within 90 days of award of contract.

.2 Provide documentation confirming qualifications.

.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 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 and confirm in writing to Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Contract Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contract Administrator for verification of TAB reports.

1.9 START OF TAB

.1 Notify Contract Administrator 3 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of doors and other construction affecting TAB,

.2 Application of weather-stripping, sealing, and caulking.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Volume control dampers installed and open.

.6 Access doors, installed, closed.

.7 Outlets installed, volume control dampers open.

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 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.2 Calibrate within 3 months of TAB. Provide certificate of calibration to Contract Administrator.

1.13 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 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 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 Contract Administrator.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Contract Administrator.

.4 Pay costs to repeat TAB as required to satisfaction of Contract Administrator.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Contract Administrator, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Contract Administrator.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of TAB standards of AABC and SMACNA.

.2 Do TAB of following systems, equipment, components, controls:

.1 Fans.

.2 Dampers.

.3 Qualifications: personnel performing TAB current member in good standing of AABC.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC.

.5 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.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, fan, other equipment causing changes in conditions.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Definitions:

.1 For purposes of this section:

.1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.

.2 "EXPOSED" - means "not concealed" as previously defined.

.3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:

.1 CRD: Code Round Ductwork,

.2 CRF: Code Rectangular Finish.

.2 Reference Standards:

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.1 ANSI/ASHRAE/IESNA 90.1-13, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 ASTM International Inc.

.1 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.3 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practices Guide (2013).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:

.1 Maximum flame spread rating: 25.

.2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Exhaust and conditioned air supply ductwork insulation shall be Fiberglas type RFFRK, 25 mm (1") thickness duct insulation. Use flexible duct insulation for sizes 300 x 300 (12" x 12") and smaller, and all round ducts. Ducts with any dimensions 350 mm (14") or larger shall be insulated with rigid insulation.

.2 Outdoor air inlet, relief air ductwork, and return air ductwork shall be insulated with 50 mm (2") thick Neoprene coated fibreglass duct liner unless otherwise shown on drawings.

.3 Mixed air ductwork up to the air handling unit shall be insulated with 50 mm (2") thick neoprene coated fibreglass duct liner unless otherwise shown on drawings.

2.3 JACKETS

.1 Canvas:

.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

2.4 ACCESSORIES

.1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick-setting

.3 Canvas adhesive: washable.

.4 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

Part 3 Execution

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

.2 Ensure surfaces are clean, dry, free from foreign material.

.3 Apply so the finished application has the full specified thickness or insulation. Flexible duct insulation applied too tightly will be removed and reapplied properly.

.4 Impale rigid and board style insulation on No. 9 insulation pins at 300 mm (12”) on centre and secured with 50 mm (2”) diameter speed washers.

.5 All exposed fibreglass ductwork insulation to be finished with 6 ounce canvas and two coats of adhesive to form a fire retardant jacket.

3.2 SEALING

.1 Seal all exterior foil type vapour jacket duct insulation with 100 mm (4") wide RFFRK self adhesive tape applied over all retaining pins, longitudinal and butt joints, and along other breaks in the vapour barrier to provide a continuous vapour seal.

3.3 CLEANING

.1 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 SUMMARY

.1 Section Includes:

.1 Materials and installation procedures for control of air flow rates.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 DAMPERS

.1 Operating type dampers are specified in Section 23 33 15.

2.2 DAMPER OPERATORS

.1 Product requirements for damper operators are specified in Section 40 92 00.

2.3 ELECTRIC DUCT HEATERS CONTROL

.1 Product requirements for electric duct heater controls are specified in Section 40 92 00.

2.4 UNIT HEATER UH CONTROLS

.1 Product requirements for unit heater controls are specified in Section 40 92 00.

Part 3 Execution

3.1 IDENTIFICATION

.1 Provide in accordance with Section 23 05 54 - Mechanical Identification.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of low-pressure metallic ductwork, joints, and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.2 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A368-15, Standard Specification for Stainless Steel Wire Strand

.3 CSA International

.1 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition 2005.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Pressure Range (Pa)	SMACNA Seal Class
500 to 750	B
250 to 500	C
125 to 250	C

.2 Seal classification:

.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

.2 Class B: longitudinal seams, transverse joints and connections made airtight with tape.

.3 Class C: transverse joints and connections made air tight with tape. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 GALVANIZED STEEL DUCTWORK

.1 Lock forming quality: to .2 ASTM A653/A653M 15.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 FITTINGS

.1 Fabrication: to SMACNA.

.2 Mitred elbows, rectangular:

.1 600 mm or less:

.1 double thickness turning vanes.

.2 55 mm wide rails spaced on 50 mm centers.

.2 Greater than 600 mm:

.1 double thickness turning vanes.

.2 115 mm wide rails spaced on 115 mm centers

.3 Branches:

.1 Provide volume control damper in branch duct near connection to main duct.

.4 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.5 Offsets:

.1 Short radiused elbows as indicated.

2.5 DUCT SEALANTS

.1 Water-based, vinyl acetate duct sealant designed for sealing joints in low and high pressure systems.

.2 Formulated for indoor and outdoor use, remains flexible, non-flammable.

.3 Acceptable materials: Duro Dyne DDS181 or approved equal in accordance with B7.

2.6 DUCT AND PLENUM ACCESS DOORS

.1 Insulated access doors with latches and hinges.

.2 Frames secured to ductwork using sheet metal screws at 150 mm (6") on center.

.3 Where hinged access doors are inconvenient, removable doors with 4 cam locks are acceptable.

.4 All access doors shall have 25 mm (1") internal glass fiber insulation.

2.7 FLEXIBLE DUCT CONNECTIONS

.1 Neoprene coated fiberglass 150 mm (6") wide with 75 mm (3") galvanized metal for the connections.

2.8 HANGERS

.1 Support all horizontal ductwork with non-perforated, galvanized steel, or rods and angle iron passing under ducts according to the following schedule:

Longest Dimension of Duct	Round Hangers	Trapeze Strap Hangers	Shelf Angles	Maximum Spacing
Up to 450 mm (18")	6 mm (1/4") Rod	25 mm (1") x 18 Ga.	25x25x3 mm (1"x1"x1/8")	3000 mm (10'-0")
475 thru 750 mm (19"-30")	6 mm (1/4") Rod	25 mm (1") x 16 Ga.	25x25x3 mm (1"x1"x1/8")	3000 mm (10'-0")
775 thru 1050 mm (31"-42")	6 mm (1/4") Rod	25 mm (1") x 16 Ga.	38x33x3 mm (1 1/2" x 1 1/2" x 1/8")	3000 mm (10'-0")
1175 thru 1500 mm (43"-60")	10 mm (3/8") Rod	38 mm (1 1/2") x 16 Ga.	38x38x3 mm (1 1/2" x 1 1/2" x 1/8")	3000 mm (10'-0")
1525 thru 2100 mm (61"-84")	10 mm (3/8") Rod	38 mm (1 1/2") x 16 Ga.	50x50x3 mm (2"x2"x1/8")	2400 mm (8'-0")
2125 thru 2400 mm (85"-96")	12 mm (1/2") Rod	38 mm (1 1/2") x 16 Ga.	50x50x5 mm (2"x2"x3/16")	2400 mm (8'-0")
Over 2425 mm (97")	12 mm (1/2") Rod	38 mm (1 1/2") x 16 Ga.	50x50x6 mm (2"x2"x1/4")	2400 mm (8'-0")

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.3 Support risers in accordance with SMACNA.

3.2 FLEXIBLE DUCT CONNECTIONS

.1 Provide flexible connections wherever ductwork and plenums are connected to fans or fan equipment

3.3 DUCTWORK

.1 Sheet metal ductwork installed in accordance with the recommendations of the SMACNA Low Velocity Ductwork Standards. Double thickness turning vanes installed in all 90° square turn elbows having no change in dimension through turn.

.2 Where duct elbows are round, use a radius dimension of 1 1/2 times the width of duct (in the plane of the turn) to the centerline of the duct.

.3 No turning vanes installed in duct elbows that are branch duct connections to plenums or directly behind return air grilles.

.4 Variation of duct sizes will be permitted only after obtaining written permission of the Contract Administrator.

.5 Rectangular ductwork exceeding 450 mm (18") in any dimension stiffened by breaking the sheets diagonally. Cross breaking may be omitted for insulated ductwork, provided ducts are 2 gauges heavier than scheduled.

.6 Rectangular ducts constructed by breaking the corners and grooving the longitudinal seams using Pittsburg seam or other approved airtight seam.

.7 All laps in sheet metal in the direction of air flow. All edges and slips hammered down to leave a smooth interior duct.

3.4 HANGERS

.1 Angle hangers and Unistrut: complete with locking nuts and washers.

.2 Hanger spacing: in accordance with SMACNA.

3.5 DUCT JOINT SEALING

.1 Clean all ductwork prior to application of sealer to ensure that it is dry and free of grease, etc. Seal to consist of a 6 mm (1/4") bead of the material along all joints, which when dry to be minimum 3 mm (1/8") thick at joints and seams and to extend a minimum of 13 mm (1/2") on each side of the joint.

.2 Apply in strict accordance with the sealant manufacturer's recommendations. Samples to be submitted to the Contract Administrator on request.

3.6 ACCESS PANELS AND DOORS

.1 Provide airtight duct access doors at all automatic dampers, coils, filters, and fire dampers to facilitate inspections and servicing. Minimum size of access to be 25% of damper area or 200 x 200 mm (8” x 8”), whichever is larger. Doors in ducts smaller than 200 x 200 mm (8” x 8”) to be duct size.

3.7 SUPPORTS AND HANGERS

.1 Supports to secure ducts and equipment, prevent sway, sag and duct vibrations, provide for expansion and contraction, and to have a neat appearance.

.2 Supports to be designed for strength and rigidity in a manner which does not stress the

building construction.

.3 Take care not to weaken concrete or penetrate waterproofing.

.4 Vertical ducts to be supported at each floor unless otherwise required by expansion conditions or otherwise directed. Ducts to be supported by means of angle iron collars bearing on each floor slab.

.5 If possible, hangers and supports for covered ducts shall not injure or pierce insulation. If there is no alternative, the insulation covering to be repaired to Contract Administrator's satisfaction.

Provide sheet metal shields to protect insulation at areas of contact with hangers and supports.

END OF SECTION

1.1 REFERENCES

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

.1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

.3 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m^2 with 75 mm (3") galvanized metal for connections.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks.

.5 Where hinged access doors are inconvenient, removable doors with 4 cam locks are acceptable.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 INSTALLATION

.1 Flexible Connections:

- .1 Install in following locations:
  - .1 Inlets and outlets to supply air units and fans.
- .2 Length of connection: 100 mm.
- .3 Minimum distance between metal parts when system in operation: 75 mm.
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
  - .1 Ducting on sides of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

- .1 Size:
  - .1 200 x 200 mm for viewing; where space is available.
- .2 Locations:
  - .1 Control dampers.
  - .2 Devices requiring maintenance.
  - .3 Required by code.
  - .4 Heating coils.
  - .5 Elsewhere as indicated.

.3 Instrument Test Ports:

- .1 General:
  - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .2 Locate to permit easy manipulation of instruments.
- .3 Install insulation port extensions as required.
- .4 Locations:
  - .1 For traverse readings:
    - .1 Ducted inlets to roof and wall exhausters.
    - .2 Inlets and outlets of other fan systems.
    - .3 Main and sub-main ducts.
    - .4 And as indicated.
  - .2 For temperature readings:
    - .1 At outside air intakes.
    - .2 In mixed air applications in locations as approved by Contract Administrator.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

3.3 CLEANING

.1 Perform cleaning operations as specified in Section 01 74 11 - Cleaning and in accordance with manufacturer's recommendations.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Balancing dampers for dry well supply and exhaust air system.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 BALANCE DAMPERS

.1 Material: 304 stainless steel, factory manufactured.

.2 Opposed blade: 1.6 mm thick 304 stainless steel, symmetrical about pivot point.

.3 Maximum blade height: 100 mm.

.4 Bearings: stainless steel sleeve pressed into cast housing bolted to the damper frame.

.5 Linkage: located in jamb out of airstream and constructed of minimum 3.5 mm stainless steel double clevis arms with 4.8 x 19 stainless steel tie bars pivoting on 9.5 mm diameter stainless steel pivot pins with lock type retainers.

.6 Blade Seals: TPE, mechanically attached to blade.

.7 Channel frame: 16 ga. hat channel, 304 stainless steel.

.8 Acceptable Materials: Ruskin, Greenheck or approved equal in accordance with B7.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Dampers: vibration free.

.4 Ensure damper operators are observable and accessible.

.5 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.6 Corrections and adjustments as directed by Contract Administrator.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Operating dampers for mechanical forced air ventilation systems.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate the following:

.1 Performance data.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 OUTDOOR AIR AND EXHAUST DAMPERS AND DAMPER OPERATORS

.1 Multi-blade type, opposed or parallel as indicated on schedule.

.2 Frame:

.1 Extruded aluminum (6063-T5) not be less than 0.080” (2.03 mm) in thickness.

.2 101.6 mm deep x 25.4 mm, with duct mounting flanges on both sides of frame.

.3 50.8 mm mounting flange on the rear of the damper.

.4 Assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.3 Blades:

.1 Maximum 162.6 mm deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 1.52mm.

.2 Internally insulated with expanded polyurethane foam; thermally broken.

.3 Insulating factor of R-2.29 and a temperature index of 55 (tested to AAMA 1502.7 Test Method).

.4 Blade seals:

.1 Extruded silicone, secured in an integral slot within the aluminum blade extrusions.

.2 Mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals are not acceptable.

.5 Frame seals:

.1 Extruded silicone, secured in an integral slot within the aluminum frame extrusions and shall be mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.6 Bearings:

.1 Dual bearing system composed of a Celcon inner bearing (fixed around a 11.1 mm aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame.

.2 Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

.7 Hexagonal control shaft:

.1 Size: 11.1 mm.

.2 Adjustable length; integral part of the blade axle. A field-applied control shaft shall not be acceptable.

.3 All parts zinc-plated steel.

.8 Linkage hardware:

.1 Aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation.

.2 Complete with cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing metal will not be approved.

.9 Performance:

.1 Designed for operation in temperatures ranging from -40°C to 100°C.

.2 AMCA rated for Leakage Class 1A at 0.25 kPa static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.10 Dampers shall be custom made to required size, with blade stops not exceeding 31.7 mm in height.

.11 Acceptable materials: Tamco 9000SC or approved equal in accordance with B7.

.12 Operators:

.1 Refer to Section 40 92 00.

2.2 MIXED AIR DAMPER AND DAMPER OPERATORS

.1 Multi-blade, opposed or parallel as indicated on schedule.

.2 Frame:

.1 Extruded aluminum (6063-T5) not be less than 0.080" (2.03 mm) in thickness.

.2 101.6 mm deep x 25.4 mm, with duct mounting flanges on both sides of frame.

.3 50.8 mm mounting flange on the rear of the damper.

.4 Assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.3 Blades:

.1 Maximum 162.6 mm deep extruded aluminum (6063-T5) air-foil profiles with a minimum wall thickness of 1.52 mm.

.4 Blade seals:

.1 Extruded EPDM, secured in an integral slot within the aluminum blade extrusions; mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals are not acceptable.

.5 Frame seals:

.1 Extruded silicone, secured in an integral slot within the aluminum frame extrusions; mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.6 Bearings:

.1 Dual bearing system composed of a Celcon inner bearing (fixed around a 11.1 mm aluminum hexagon blade pivot pin), rotating within a polycarbonate outer bearing inserted in the frame.

.2 Single axle bearing, rotating in an extruded or punched hole shall not be acceptable.

.7 Hexagonal control shaft:

.1 Size: 11.1 mm.

.2 Adjustable length; integral part of the blade axle. A field-applied control shaft shall not be acceptable.

.3 All parts zinc-plated steel.

.8 Linkage hardware:

.1 Aluminum and corrosion-resistant zinc-plated steel, installed in the frame side, out of the airstream, and accessible after installation.

.2 Complete with cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing metal will not be approved.

.9 Performance:

.1 Designed for operation in temperatures ranging from -40°C to 100°C.

.2 AMCA rated for Leakage Class 1A at 0.25 kPa static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.10 Dampers shall be custom made to required size, with blade stops not exceeding 31.7 mm in height.

.11 Acceptable materials: Tamco 1000 or approved equal in accordance with B7.

.12 Operators:

.1 Refer to Section 40 92 00 - Automation - Primary Control Devices.

2.3 BACK DRAFT DAMPERS

.1 Frame:

.1 Extruded aluminum (6063-T5) not be less than 0.060" (1.52 mm) in thickness.

.2 63.5 mm deep.

.3 Assembled using zinc-plated steel mounting fasteners. Welded frames shall not be acceptable.

.2 Blades:

.1 Maximum 127 mm deep extruded aluminum (6063-T5) profiles with a minimum wall thickness of 1.52 mm.

.3 Blade seals:

.1 Extruded silicone, secured in an integral slot within the aluminum blade extrusions; mechanically fastened to prevent shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals are not acceptable.

.4 Frame seals:

.1 Extruded silicone, secured in an integral slot within the aluminum frame extrusions; mechanically fastened to prevent shrinkage and movement over the life of the damper. Metallic compression type jamb seals will not be approved.

.5 Bearings:

.1 Maintenance-free bearings system composed of a 12.7 mm aluminum pivot point rotating in a Celcon bearing.

.6 Linkage hardware:

.1 Hard alloy aluminum (6005-T6) crank arms fastened to aluminum pivot rods and secured within a channel running along top of blades.

.2 Large diameter, 8.73 mm, hard alloy aluminum (6065-T6C) linkage rod connect the crank arms by means of a zinc-plated steel trunnion.

.3 Complete with cup-point trunnion screws to prevent linkage slippage. Linkage that consists of metal rubbing metal will not be approved.

.7 Performance:

.1 Designed for operation in temperatures ranging from -40°C to 100°C.

.2 AMCA rated for Leakage Class 1A at 0.25 kPa static pressure differential. Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.8 Provide weights to maintain backpressure of 25 Pa (adj.) as per Section 40 92 00 of the specifications.

.9 Dampers to be custom made to required size.

.10 Acceptable materials: Tamco 7000WT or approved equal in accordance with B7

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Fans, motors, accessories and hardware for commercial use.

1.2 REFERENCES

.1 Air Conditioning and Mechanical Contractors (AMCA)

.1 AMCA Publication 99-2003, Standards Handbook.

.2 AMCA 300-2008, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301-2006, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210-2007, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.3 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 static pressure, kW, 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 AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal.

1.4 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

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

.3 Provide:

.1 Fan performance curves showing point of operation, kW and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.1 Spare parts to include:

.1 One set of filters to be installed after TAB.

.2 One set of spare filters.

.3 One set of fan belts if required.

.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.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

Part 2 Products

2.1 FANS GENERAL

.1 Motors:

.1 Sizes as indicated.

.2 Factory primed before assembly in colour standard to manufacturer.

.3 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.4 Vibration isolation: hanging spring isolators

.5 Flexible connections: to Section 23 33 00 - Air Duct Accessories.

2.2 CENTRIFUGAL FANS

.1 General

.1 Base fan performance at standard conditions.

.2 Performance capabilities as per schedule.

.3 Permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number on cabinet.

.4 Fan wheels:

.1 Non-overloading, backward inclined centrifugal wheel.

.2 Constructed of aluminum.

.3 Statically and dynamically balanced in accordance to AMCA Standard 204-05.

.4 Wheel cone and fan inlet matched and have precise running tolerances for maximum performance and operating efficiency.

.5 Single thickness blades securely riveted or welded to a heavy gauge back plate and wheel cone.

.5 Motor

.1 Motor enclosure: Open type and Explosion resistant, as specified on Mechanical Drawing Schedule.

.2 Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the scheduled voltage and phase.

.6 Local On/Off switch

.2 Inline Centrifugal

.1 Housing/Cabinet Construction

.1 Square design constructed of heavy gauge galvanized steel, includes square duct mounting collars.

.2 Housing and bearing supports constructed of heavy gauge bolted and welded steel to prevent vibration and rigidly support shaft and bearing assembly.

.3 Housing supports constructed of structural steel with formed flanges.

.4 Drive frame supporting the motor constructed of welded steel.

.5 Access panels: Two sided, located perpendicular to motor mounting panel, permit easy access to all internal components.

.6 Insulation: 25 mm fibreglass liner.

.2 Acceptable materials: Greenheck SQ or approved equal in accordance with B7.

2.3 AIR CONDITIONER

.1 General

.1 Furnish and install a self-contained, vertical, exterior wall mount, through-the-wall air conditioner.

.2 Unit shall be factory assembled, pre-charged, pre-wired, tested and ready to operate. Unit performance shall be certified in accordance with the Air Conditioning Heating and Refrigeration Institute (AHRI) Standard 390-2003 for Single Package Vertical Units. Unit efficiency shall be specified by EER.

.3 Capacities shall be as indicated on drawings.

.2 Construction features

.1 Cabinet

.1 Construction shall be a single, enclosed, weatherproof casing constructed of 20-gauge galvanized steel, stainless steel, or aluminum. Unit base is constructed of 16-gauge galvanized steel for painted and aluminum cabinets, stainless steel for stainless cabinets. Each exterior casing panel to be bonderized and finished with baked-on exterior polyester enamel paint prior to assembly. The baked-on cured paint finish shall pass the industry rub test with a minimum of 72 rubs MEK (Methyl Ethyl Ketone) or standard rub test of a minimum of 100 rubs using Toluene. Cooling section shall be fully insulated with 1-inch fiberglass to prevent sweating and to muffle sounds. Openings shall be provided for power connections. Access openings appropriate for outside structure to all fan motors and compressor for making repairs and for removing internal components without removing unit from its permanent installation. Fresh air intake and outdoor coil shall be protected from intrusions by a sturdy metal grating with less than 1/4 inch openings.

.2 Insulation shall be foil faced for ease of cleaning.

.3 Full-length side mounting brackets shall be an integral part of the cabinet. Bottom mounting bracket shall be provided.

.4 The unit shall use a high efficiency scroll compressor. The compressor shall be covered by a 5-year parts warranty. The refrigeration circuit shall be equipped with factory installed high and low pressure controls and liquid line filter dryer. The refrigeration control shall be a factory installed capillary tube. Compressor shall be mounted on rubber grommets. Unit shall be provided with R-410A (HFC) non-ozone depleting refrigerant.

.5 The condenser fan, motor and shroud shall be of slide out configuration for easy access.

.6 The indoor blower motor shall be twin wheels with forward curve blades. Motor shall be high efficiency PSC type.

.7 Electrical components are easily accessible for routine inspection and maintenance through front service panels. Circuit breaker is standard on

all 208/230-volt models. Circuit breaker/toggle disconnect access is through lockable access panel.

.3 Economizer

.1 The Economizer is internally mounted and allows outside air to be used for free-cooling when temperature and humidity conditions are favorable. The amount of exhaust air varies in response to the system controls and settings defined by the user. It includes a built-in exhaust air damper. The economizer is designed to provide free-cooling when outside conditions are cool and dry enough to satisfy cooling requirements without operating the compressor, providing lower operating costs while extending the life of the compressor.

.2 Standard Features:

.1 Fully modulating

.2 Hi-torque 44 lb-in. actuator

.3 Simple single blade design

.4 Positive shut-off with non-stick gaskets

.3 Filter

.1 2" Pleated – MERV 8

.4 Power supply: 575V, 3 phase, 60 Hz.

.5 Acceptable materials: Bard W150APQ0ZEP c/w RG-10W; or approved equal in accordance with B7.

.6

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

.1 Install fans as indicated, complete with spring isolators, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Air Duct Accessories.

.2 Bearings and extension tubes to be easily accessible.

.3 Access doors and access panels to be easily accessible.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 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.

1.2 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

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

1.4 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Grilles and diffusers of same generic type.

2.2 SUPPLY GRILLES

.1 Furnish and install supply registers of the sizes and mounting types indicated on the plans and outlet schedule. Registers shall be single deflection type with one set of fully adjustable deflection blades spaced 3/4 in. [19mm] on center. The blades shall run parallel to the (long/short) dimension of the registers, as indicated in the outlet schedule. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The damper shall be coated steel. The grille shall be finished in (B15 Aluminum Powder Coat).

.2 Acceptable materials: Price 520/D/F/L/A or approved equal in accordance with B7.

2.3 RETURN GRILLES

.1 Furnish and install exhaust registers of the sizes and mounting types indicated on the plans and outlet schedule. Grilles shall be 0 degree deflection fixed louver type with blades spaced 3/4 in. [19mm] on center. The blades shall run parallel to the (long / short) dimension of the register. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the diffuser face.

.2 Acceptable materials: Price 520/Z/D/A/L or approved equal in accordance with B7

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.18- M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.

.3 Underwriters' Laboratories of Canada

.1 ULC -S111- 07, "Fire Tests for Air Filter Units".

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

1.5 EXTRA MATERIALS

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Contract Administrator, supply 1 complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50 degrees C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

2.2 ACCESSORIES

.1 Holding frames: permanent channel section construction of extruded aluminum, 1.6 mm thick, except where specified otherwise.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side.

.5 Acceptable material: AAF SurePleat Side Access Filter Housing, or approved equal in accordance with B7.

2.3 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18.

.2 Holding frame: galvanized steel, or slide in channel for side access.

.3 Performance:

.1 MERV 8 to ASHRAE 52.2.

.4 Fire Rated: to ULC -S111.

.5 Nominal thickness: 100 mm.

.6 Acceptable material: PerfectPleat 4” HC M8, or approved equal in accordance with B7.

2.4 FILTER GAUGES - DIAL TYPE

.1 Diaphragm actuated, direct reading.

.2 Range: 0 to 2 times initial pressure.

.3 Acceptable material: Dwyer Magnehelic, or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer’s recommendations and with adequate space for access, maintenance and replacement.

3.2 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.3 FILTER GAUGES

.1 Install type as indicated across each filter bank in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and application of electric duct heaters.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.46-M1998(R2001), Electric Air-Heaters.

1.3 SUBMITTALS

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

.2 Submit product data and include:

.1 Element support details.
.2 Heater: total kW rating, voltage, phase.
.3 Number of stages.
.4 Rating of stage: rating, voltage, phase.
.5 Heater element watt/density and maximum sheath temperature.
.6 Maximum discharge temperature.
.7 Physical size.
.8 Unit support.
.9 Performance limitations.
.10 Clearance from combustible materials.
.11 Internal components wiring diagrams.
.12 Minimum operating airflow.
.13 Pressure drop operating airflow.

Part 2 Products

2.1 DUCT HEATERS

.1 Duct heaters: Insert type.

.2 Elements:

.1 Open coil and Tubular as per schedules on M0003

.3 Staging:

.1 Staged heaters: balanced line current at each stage.
.2 Each stage: uniform face distribution.

.4 Controls:

.1 Remote control via remote 0-10V signal, which proportionally controls the heat output, 0 – 100%.

.2 Controls mounted in a CSA Type enclosure and to include:

.1 Integral disconnect switch.

.2 Magnetic contactors.

.3 Control transformers.

.4 Universal heater controller.

.3 Where controls are mounted in heater, exercise care in mounting contactors to minimize switching noise transmission through ductwork.

.4 High temperature cut-out and air proving switch.

.5 Electrical:

.1 Size as indicated.

.2 575V, 3Ø.

.6 Main isolation disconnect switch.

.7 Acceptable materials: Caloritech, E.H. Price, Thermolec or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Make power and control connections to CSA C22.2 No.46.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - for Electrical.

.2 Perform tests in presence of Contract Administrator.

.1 Provide test report and include copy with Operations and Maintenance Manuals.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

.2 Submit product data sheets for unit heaters. Include:

.1 Product characteristics.

.2 Performance criteria.

.3 Mounting methods.

.4 Physical size.

.5 kW rating, voltage, phase.

.6 Cabinet material thicknesses.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 UNIT HEATER UH-F65 and UH-F66

.1 Capacity: as per schedule.

.2 General:

.1 Cabinet: 18 and 20 gauge steel, epoxy/polyester powder coated.

.2 Horizontal mount with factory supplied mounting brackets.

.3 Fan Motor:

.1 Mounted in cold compartment.

.2 Thermally protected.

.3 Totally enclosed and factory-lubricated ball bearings.

.4 Elements:

.1 Tubular stainless steel.

.5 Control:

.1 Heater supplied with relay to allow 24 VAC control.

.2 Factory supplied, wall mounted thermostat.

.3 Part # T822D2642 or approved equal in accordance with B7.

.6 Approvals:

.1 All components and entire unit CSA or ULC approved and must bear the label.

□

.7 Acceptable materials: Stelpro ASHU, or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Suspend unit heaters from wall as indicated.

.2 Install thermostats in location indicated.

.3 Make power and control connections.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - 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.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 26. This section supplements the requirements of Division 01.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1-2021 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 Where services of a manufacturer’s factory service engineer is required, arrange and pay for services to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with 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 Section 01 61 00 - Common Product Requirements.

.2 Equipment and material shall 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. For enclosures to be installed within hazardous locations, Stainless Steel (316) NEMA 4X enclosures shall be used.

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 equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.9 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic lamacoid nameplates, white background, 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.

1.10 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders, branch circuit and control wiring.

.1 Wire tags to be heat shrink type with black letters on a white background.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.11 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.12 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and the Contract Administrator.

.2 Lamacoid 3 mm thick plastic engraving sheet, red face, white core, mechanically attached with self tapping screws, 20mm text.

1.13 WALL MOUNTED DRAWINGS

.1 Provide drawings in plexiglass holder adjacent to the main electrical distribution.

.1 Plexiglass holder to be designed for the purpose and allow for easy replacement of the drawing.

.2 Size: 432mm x 279mm minimum size.

.2 Drawings:

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.1 1-0118F-E0005 - Single Line Diagram

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 centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 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: 2000 to bottom.
.6 Emergency stop switches: 1500 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 CSA / ULC approved assembly for the installation conditions.

1.17 CUTTING AND PATCHING

.1 Provide all cutting a patching required.

.2 Return exposed surfaces to an as-found condition.

.3 Exercise care where cutting holes existing concrete elements so as not to damage existing reinforcing.

.1 Locate existing reinforcing utilizing a reinforcing bar locator and mark out on the surface of the concrete.
.2 For all holes larger than 50 mm passing through reinforced concrete, mark the location of the desired hole and all adjacent rebar. Obtain approval from the Contract Administrator prior to cutting.
.3 Firestop and seal all penetrations, regardless of whether the penetration requires a fire rating.

□

1.18 ANCHOR INSTALLATION

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

1.19 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial 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.

1.20 TESTING

.1 All test instruments utilized are to have been calibrated within one year of the date utilized.

.2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

1.21 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 each 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.

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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 Should Shop Drawing information be insufficient or the Contract Administrator does not approve of the Shop Drawings, the Contractor shall arrange to resubmit Shop Drawings at no additional change to contract price.

.6 Manufacture of Products shall conform to revised Shop Drawings.

1.22 AS-BUILT 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 As-Built 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. As-Built Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.

.3 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

.4 CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

1.2 PRODUCT DATA

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

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 Tin-Plated 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, ~~RWU90~~ or TECK90.

.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: Tin-Plated Copper.
.2 Circuit conductors: Tin-Plated Copper, size as indicated.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

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.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: polyvinyl chloride material.

.7 Fastenings:

.1 One (1) hole malleable iron / steel straps to secure surface cables 50 mm in diameter and smaller.

.2 Two (2) hole steel straps for cables larger than 50 mm in diameter.

.3 Channel type supports for two or more cables.

.4 Threaded rods: 6 mm diameter to support suspended channels.

.8 Cable Fittings:

.1 Minimum requirement: 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 explosion-proof 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 ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

□

.2 Conductors, copper, size as indicated on the Drawings.

.3 Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 600V.

.4 Shielding as indicated on the drawings.

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 TECK CABLE 0 -1000 V

.1 Where surface mounted, provide clamps spaced a maximum of 1 m apart, unless otherwise indicated.

.2 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 (1) minute. Investigate resistances less than fifty (50) megaohms, or deviations between parallel conductors. Conductors with insulation resistance values, at one (1) minute, less than twenty-five (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:

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.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 on all field cables at both ends of the cable.

3.8 TESTING

.1 Test all power conductors 10 AWG and larger in accordance with Section 26 08 05.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE).

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International).

Part 2 Products

2.1 EQUIPMENT

.1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.2 Insulated grounding conductors: green, type RW90.

.3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install connectors in accordance with manufacturer's instructions.

.2 Protect exposed grounding conductors from mechanical injury.

.3 Use mechanical connectors for grounding connections to equipment provided with lugs.

.4 Use Burndy compression connectors, or approved equal in accordance with B7, for all grounding splices and terminations, unless otherwise indicated.

.5 Soldered joints not permitted.

3.2 EQUIPMENT GROUNDING AND BONDING

.1 Install grounding connections to transformers.

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.2 Install bonding connections to all electrical equipment.

.3 Include a separate green bonding wire in all power conduits including branch circuit wiring sized according to the largest power conductor in the conduit:

.1 8 AWG green ground wire for up to 4 AWG power conductors.

.2 6 AWG green ground wire for greater than 4 AWG and up to 2/0 AWG power conductors.

.4 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

END OF SECTION

□

Part 1 General

1.1 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, 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 (4).

.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 As per Section 26 05 34.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

□

.1 One (1) hole aluminum straps to secure surface conduits and cables 50 mm in diameter and smaller.

.2 Two (2) hole aluminum straps for conduits and cables larger than 50 mm in diameter.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support two (2) or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two (2) 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

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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 Submit shop drawings for enclosures in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Type and size as indicated on the drawings, or sized as per code requirements.

.2 Utilize Stainless Steel (316) construction for NEMA 4X junction and pull boxes.

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 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install Size 3 identification labels indicating system voltage and phase, or loop number for control wiring.

.3 Install a permanent label or lamacoid on the cover of all junction boxes indicating the circuit(s) contained within.

.1 Example: F72-2 (Panel F72, circuit 2)

□

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.1, Canadian Electrical Code, Part 1, 23rd Edition.

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 Flood Station Material Requirements:

.1	Main Floor (Motor Room):	Metal
.2	Wet Well:	PVC
.3	Dry Well:	PVC

.7 Comminutor Chamber Material Requirements:

.1	Main Floor (Motor Room):	Stainless Steel
.2	Lower Level:	Stainless Steel

2.2 SURFACE MOUNTED OUTLET BOXES, METAL

.1 General Requirements:

.1 Acceptable materials:

.1 Cast Aluminum for Flood Station Main Floor (Motor Room) and Dry Well.

.2 Stainless Steel for Comminutor Chamber Main Floor (Motor Room) and Lower Level

.3 Cast ferrous alloy with corrosion resistant epoxy coating.

.2 Finish

.1 Epoxy Enamel

.3 Mounting lugs as required.

.4 Wet location covers for all locations unless otherwise approved by the Contract Administrator.

.5 To CSA 22.2

.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 FS or FD cast aluminum boxes with factory threaded hubs and mounting feet for surface wiring of receptacles.
.2 Single gang unless specified otherwise.
.3 Manufacturer / Model:
.1 Crouse Hinds FS/FD series
.2 Or approved equal in accordance with B7.

2.3 SURFACE MOUNTED OUTLET BOXES, PVC

.1 General Requirements:

.1 To CSA C22.2 No. 18.
.2 Acceptable materials:
.1 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 equal in accordance with B7.
.2 Device Boxes:
.1 IPEX FS/FD series
.2 Or approved equal 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 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 diameter and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Provide boxes sized as required per Canadian Electrical Code.

.2 Support boxes independently of connecting conduits.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.4 Vacuum clean interior of outlet boxes before installation of wiring devices.

.5 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 CSA C22.2 No. 45, Rigid Metal Conduit.

.3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.

.4 CSA C22.2 No. 211.2, Rigid PVC (Un-plasticized) Conduit.

.5 CAN/CSA C22.2 No. 227.3, Flexible Non-metallic Tubing.

.2 Submittals

.1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures for the following:

.1 Metal conduit fittings.

.2 Fittings for hazardous locations.

Part 2 Products

2.1 GENERAL

.1 Flood Station Material Requirements:

.1	Main Floor (Motor Room):	PVC
.2	Wet Well:	~~PVC~~ Stainless Steel
.3	Dry Well:	PVC

.2 Comminutor Chamber Material Requirements:

.1	Main Floor (Motor Room):	Stainless Steel
.2	Lower Level:	Stainless Steel

2.2 RIGID PVC CONDUIT

.1 Meets CSA C22.2 No. 211.2.

.2 Minimum conduit diameter size: 19 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

2.3 FLEXIBLE METAL CONDUIT

.1 To CSA C22.2 No. 56, liquid-tight flexible metal.

.2 Minimum conduit diameter size: 19 mm, unless specifically indicated on the Drawings or approved by the Contract Administrator.

2.4 CONDUIT FASTENINGS

.1 One (1) hole straps to secure surface conduits 50 mm in diameter and smaller.

.2 Two (2) hole straps for conduits larger than 50 mm in diameter.

.3 Strap material to match conduit material.

.4 Beam clamps to secure conduits to exposed steel work.

.5 Channel type supports for two (2) or more conduits or as shown in the Drawings.

.6 Threaded rods, 6 mm diameter. to support suspended channels.

2.5 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.

2.6 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified.

.2 Coating: same as conduit.

.3 All fittings to be liquid and dust tight.

.4 Enclosure Connections:

.1 Connections in dry locations (bottom or side)

.1 Locknuts inside and outside enclosures.

.2 Insulated bushings Thomas & Betts Series 222 or approved equal in accordance with B7.

.2 Connections in wet locations and tops of enclosures in dry locations

.1 Liquid-tight threaded hubs

.2 Insulated bushings Thomas & Betts Series 222 or approved equal in accordance with B7.

.3 Utilize insulated grounding bushings at all non-metallic enclosure entries for metallic conduit, or as required for bonding in accordance with Code and good practice.

.5 Elbows:

.1 Utilize factory elbows for 27mm diameter and larger conduits.

.6 Threaded Hubs for Metal Conduit:

.1 Liquid and dust tight with insulated throat.

.2 Approved products:

.1 Thomas & Betts "Bullet Hub" 370AL Series or approved equal in accordance with B7.

.7 Fittings for Metal Conduit:

.1 Cast metal.

.2 Gasketted covers.

.3 Approved products:

.1 Crouse-Hinds Canada Ltd. "Condulet" series.

.8 Explosion proof conduit sealing fittings:

.1 CSA Certified suitable for Hazardous Locations – Class I, Zone 1, Group IIA.

.2 Material: Cast aluminum.

.9 Sealing Compound. As recommended by manufacturer.

2.7 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 Route conduits on existing or new pipe rack or suspended channels where possible. Conduits routing shall be installed to run parallel or perpendicular to building lines. Do not route conduit in angular directions with respect to building lines.

.3 Avoid routes that would interfere with any potential maintenance activities such as but not limited to:

.1 Roof Hatches.

.2 Floor Hatches.

.3 Mechanical Dampers.

.4 Building/Equipment Door Openings.

.5 Man Hole Covers.

.4 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 - GENERAL

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.3 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.4 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.

.5 Ensure electrical continuity in all metallic conduit systems.

.6 All conduit shown exposed in finished areas is to be free of unnecessary labels and trademarks.

.7 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.

.8 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.

.9 Install fish cord in empty conduits.

.10 Dry conduits out before installing wire.

.11 Install ground bonding wire in all conduits. Size ground wire as per CEC Table 17.

.12 Underground Conduits:

.1 Slope conduits away from the building to provide drainage.

.13 Surface Conduits:

.1 Run parallel or perpendicular to building lines. Do not run conduit in angular directions from building lines.

.2 Group conduits wherever possible on suspended or surface channels.

.3 Provide a minimum spacing of 100% of the largest conduit diameter between adjacent conduits.

.4 Do not pass conduits through structural members, except as indicated.

.5 Do not locate conduits less than 152 mm parallel to steam or hot water lines with a minimum of 25 mm at crossovers.

.6 Install spacers as required to provide spacing between the conduits and the supporting surface, with a minimum spacing 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.

.14 Colour Coding:

.1 Apply plastic tape or paint colour coded bands to conduits at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.

.2 Bands: 38 mm wide prime colour and 19 mm wide auxiliary colours

.3 Band colours as per the following table.

System	Prime Band	Aux. Band
Medium Voltage (> 750 V)	Orange	
347 / 600 V	Yellow	
120 / 208 / 240 V Power	Black	
UPS 120 / 208 / 240 V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring (< 50 V)	Blue	Orange
Intrinsically Safe	Blue	White

3.3 PVC CONDUIT

.1 Concrete Penetrations:

.1 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

.2 Maximum spacing between supports for rigid PVC conduit:

.1	27mm diameter conduit:	0.75 m
.2	35mm diameter conduit:	0.75 m
.3	41mm diameter conduit:	1.2 m
.4	53mm diameter conduit:	1.5 m
.5	63mm diameter conduit:	1.5 m
.6	78mm diameter conduit:	1.5 m
.7	91mm diameter conduit and larger:	2.0 m

3.4 METAL CONDUIT

.1 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.2 Mechanically bend conduits over 19 mm in diameter.

.3 Concrete Penetrations:

.1 Sleeves for Aluminum Conduit.

.2 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.

.3 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

.4 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 50 mm above finished floor level or housekeeping pad level.

.4 Maximum spacing between supports for rigid metallic conduit:

.1	16mm diameter conduit:	1.0 m
.2	21mm diameter conduit:	1.5 m

.3	27mm diameter conduit	1.5 m
.4	35mm diameter conduit	2.0 m
.5	41mm diameter conduit and larger	2.5 m

3.5 LIQUID-TIGHT FLEXIBLE CONDUIT

.1 Use as raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water.

.2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus four (4) times the conduit diameter.

.3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

3.6 INSTALLATIONS IN CATEGORY 1 LOCATIONS

.1 Arrange to provide drainage at frequent intervals to suitable locations.

.2 Equip with approved fittings to permit the moisture to drain out of the system.

.3 Install the conduit with a minimum of 12 mm space from the supporting surface.

.4 Install every joint to be water-tight.

.5 Where conduit leaves a warm room and enters a cooler atmosphere, seal the conduit and arrange the conduit in a manner to avoid condensation accumulation at the seal.

3.7 INSTALLATIONS IN CATEGORY 2 LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.8 INSTALLATIONS IN CATEGORY 2 WET LOCATIONS

.1 Comply with all requirements of Category 1 locations.

3.9 INSTALLATIONS IN HAZARDOUS ZONE 1 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.

3.10 INSTALLATIONS IN HAZARDOUS ZONE 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 NETA Acceptance Testing Specifications, 2017 (ATS-2021)

1.2 TESTING REPORT

.1 Prepare an overall inspection and test report that details all investigations and tests.

.2 The Contractor shall furnish paper copies in the hard-copy O&M Manuals and electronic copies on a USB memory stick (soft-copy) O&M Manual.

.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 USB memory stick.

.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.

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.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 Flood Pump P-F01 Motor (existing),

.2 Flood Pump P-F02 Motor (existing),

.3 Flood Pump P-F03 Motor (existing),

.4 Flood Pump P-F04 Motor (existing)

3.2 INSPECTION, TESTING AND MAINTENANCE PROCEDURES

.1 General

.1 All tests are based on NETA (InterNational Electrical Testing Association) standard ATS-2021. Where manufacturer's specifications, tolerances, and/or published data are not available, refer to the appropriate tables in ATS-2021.

.2 Torque all accessible bolted electrical connections. Additional requirements apply as specified.

.3 Utilize the existing drawings for reference while performing the specified electrical inspection work. Where the existing installation deviates from that shown on the drawings, mark-up the drawings with red pen as required to reflect the installation. Include the marked-up drawings in the report.

.4 The scope of required drawing checks is limited to the equipment and components that are part of the electrical inspection work.

.5 Any repairs made that affect the accuracy of the drawings shall be marked up on the drawings.

.6 Drafting of drawings is not required.

.7 All inspection values, readings, corrections, and assessments shall be clearly recorded for inclusion within the 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 utilizing the following:

.1 To correct to 20°C, utilize Table 260805-1.

.2 To correct to 40°C, utilize Table 260805-2.

Table 260805-1

Insulation Resistance Correction Factors (20 °C)

Measured Temperature (°C)	Oil Immersed Insulation	Solid Insulation
-10	0.125	0.25
-5	0.18	0.32
0	0.25	0.40
5	0.36	0.50
10	0.50	0.63
15	0.75	0.81
16	0.80	0.85
17	0.85	0.89
18	0.90	0.92
19	0.95	0.96
20	1.00	1.00
21	1.08	1.05
22	1.16	1.10
23	1.24	1.15
24	1.32	1.20
25	1.40	1.25
30	1.98	1.58
35	2.80	2.00
40	3.95	2.50
45	5.60	3.15
50	7.85	3.98
55	11.20	5.00
60	15.85	6.30

□

Table 260805-2

Insulation Resistance Correction Factors (40 °C)

Measured Temperature (°C)	Oil Immersed Insulation	Solid Insulation
-10	0.03	0.10
-5	0.04	0.13
0	0.06	0.16
5	0.09	0.20
10	0.13	0.25
15	0.18	0.31
16	0.19	0.33
17	0.21	0.34
18	0.22	0.36
19	0.24	0.38
20	0.25	0.40
21	0.27	0.42
22	0.29	0.44
23	0.31	0.46
24	0.33	0.48
25	0.35	0.50
30	0.50	0.63
35	0.71	0.79
40	1.00	1.00
45	1.41	1.26
50	2.00	1.59
55	2.83	2.00
60	4.00	2.52

.3 Perform winding resistance temperature correction calculations utilizing the following:

.1 $$R_C = R_M \frac{T_C + T_K}{T_M + T_K}$$

.2 Where, RC = Resistance at corrected temperature.

□

RM = Resistance at measured temperature.
TC = Temperature to correct to in °C.
TM = Measured temperature in °C.
TK = Temperature Resistance Constant
(234.5 °C for copper, 226.0 °C for aluminum)

3.3 MOTORS, INDUCTION, AC, 600 V

.1 Inspection and testing shall consist 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 Inspect air baffles, filter media, cooling fans, slip rings, brushes, and brush rigging. Air baffles and filter media should be clean. Cooling fans should operate. Slip ring wear and brushes should be within manufacturer's tolerances for continued use. Brush rigging should be intact.

.5 Clean the unit.

.6 Inspect bolted electrical connections for high resistance using a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

.7 Verify the application of appropriate lubrication and lubrication systems.

.8 Verify the absence of unusual mechanical or electrical noise or signs of overheating.

.9 Perform a rotation test to insure correct shaft direction.

.10 Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43. Test voltage shall be in accordance with manufacturer's published data or 500 Vdc.

.1 Where possible, test each winding separately. Ground all windings not under test.

.2 Ensure all cables and accessories are disconnected during the test.

.3 For motors <= 150kW (200 HP), the test duration is to be one (1) minute. Calculate the dielectric absorption ratio.

.4 For motors > 150kW (200 HP), the test duration is to be ten (10) minutes. Calculate the dielectric absorption ratio and polarization index.

.5 Correct test results to 40 °C.

.6 Investigate readings below 100 megaohms. Investigate dielectric absorption ratios less than 1.4 and polarization index ratios less than 2.0 for Class B insulation and Class F insulation.

.11 Where it is not possible to perform an insulation resistance test separately on each winding, perform a winding resistance test on each winding using a low-resistance ohmmeter.

.12 Measure running voltage and current and evaluate relative to load conditions and nameplate full-load amperes. Utilize a true RMS meter.

.13 Perform insulation-resistance test on insulated bearings in accordance with manufacturer's published data, if applicable.

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.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.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).

.2 CSA C9, Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA).

1.3 PRODUCT DATA

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

.2 At a minimum, product data shall include:

.1 Nameplate details.

.2 Outline dimensions.

.3 Anchoring method and dimensioned foundation template.

.4 Cable entry and exit locations.

.5 Wiring details.

.6 Enclosure finish and type.

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No.47.

.2 Requirements:

.1 Type: ANN.

.2 Single phase, kVA as indicated on the Drawings, 600V input, 120 / 240V output, 60 Hz.

.3 Voltage taps: ±5% taps with 2.5% interval taps full capacity above normal (FCAN) and 2.5% interval taps full capacity below normal (FCBN).

.4 Windings: Copper.

.5 Insulation: Class H, 220ºC.

.6 Temperature Rise: 115ºC at continuous full load.

.7 Basic Impulse Level (BIL): 10 kV.

.8 Hipot: 4 kV.

.9 Average sound level: To meet the local municipal & building codes and meet at minimum the following criteria:
45 dB max. up to 45 kVA.
50 dB max. up to 150 kVA.

.10 Impedance at 170°C: standard.

.11 Enclosure: as indicated in Schedule 26 12 17-1 (below).

.12 Mounting: as indicated on the drawings.

.13 Nameplate to include actual transformer impedance (%Z).

.14 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 as indicated on the Drawings. Provide brackets and bolts for wall mounted transformers. Ensure all transformers have good ventilation.

.2 Ensure adequate clearance around transformers for ventilation.

.3 Install transformers in level upright position.

.4 Install non-combustible insulating board, extending 300 mm 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 shown on nameplate.

.8 Mount transformers to reduce direct and transmitted noise. Mount core and coils of transformers.

.9 Make connections to transformers in flexible conduit, entering the enclosure below the coils.

.10 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 forms to be provided by the Contract Administrator. Complete test forms 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 (1) 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.

Schedule 26 12 17-1: Transformers

Identifier	Location	Size	Voltage	Enclosure Type
XFMR-F73	Motor Room	15 kVA	600:120/240V, 1Ø	NEMA 3R

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Service equipment and installation.

1.2 RELATED SECTIONS

.1 Section 01 74 11 - Cleaning

.2 Section 26 05 28 - Grounding - Secondary.

.3 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.4 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 SUBMITTALS

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

.2 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

.3 Submit shop drawings and indicate:

- .1 Outline dimensions.
- .2 Configuration of identified compartments.
- .3 Anchoring method and dimensioned foundation template.
- .4 Cable entry and exit locations.
- .5 Dimensioned position and size of busbars and details of provision for future extension.
- .6 Schematic and wiring diagrams.
- .7 Enclosure finish.

.4 Closeout Submittals: provide as-built drawings and supplemental information as specified in Section 01 78 00 - Closeout Submittals.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials where possible.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 600V CUSTOMER SERVICE TERMINATION ENCLOSURE (CSTE-F70)

.1 Requirements:

- .1 Rating: 600V, 600A, 3 phase, 4 wire.
- .2 Short Circuit Current Rating: 25 kA minimum
- .3 Service Entrance Rated.
- .4 Main Breaker:
  - .1 In accordance with 26 28 21 – Moulded Case Circuit Breakers, Clause 2.2.
- .5 Meter socket: 7-jaw with insulated neutral.
- .6 Provision for utility metering PTs (potential transformers).
  - .1 Metering PTs to be supplied and installed by Manitoba Hydro.
- .7 Provision for utility metering CTs (current transformers).
  - .1 Metering CTs to be supplied and installed by Manitoba Hydro.
- .8 Compartments and sections:
  - .1 Breaker Section
  - .2 Metering Section
- .9 All compartments and sections to be barriered from adjoining sections.
- .10 Copper bus.
- .11 Insulated neutral.
- .12 Provision for factory-installed neutral-ground link.
- .13 Enclosure Rating: NEMA Type 3R.
- .14 Mounting: Wall mount.
- .15 Cable Entry: Bottom.
- .16 Doors: Stays to hold compartment doors in 110 degrees open position.

.2 Manufacturer:

- .1 JRS MFG.,
- .2 Strong Electric,
- .3 Or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Install service equipment. Provide sand bedding installed in accordance with manufacturer's instructions. Install conduit sleeves, conduits, cable sleeves embedded in concrete pad and buried for CSTE load and line side cabling.

.2 Coordinate with Manitoba Hydro and/or the City to obtain the utility metering CTs and PTs. Install the CTs and PTs into the Customer Service Termination Enclosure, CSTE-F70.

.3 Manitoba Hydro to supply and install meter, test switch, and meter socket into the metering compartment.

.4 Manitoba Hydro to supply and install secondary wiring between CTs/PTs in CSTE-F70 and the meter socket in metering compartment.

.5 Coordinate with Manitoba Hydro to advise them when to complete their scope of work.

.6 Install conduits, power conductors, and ground cabling.

.7 Install CSTE-F70.

.8 Connect to incoming service.

.9 Connect to outgoing load circuits.

.10 Make secondary grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

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 SHOP DRAWINGS

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

.2 At a minimum, product data shall include:

.1 Nameplate details.
.2 Outline dimensions.
.3 Anchoring method.
.4 Cable entry and exit locations.
.5 Wiring details.
.6 Panel schedule indicating:
.1 All breaker locations.
.2 Main breaker and all branch breaker model numbers.
.3 All breaker sizes.
.4 Number of breaker poles associated with each breaker.
.7 Enclosure finish and type.

1.4 O&M Manual

.1 Include product data in operation and maintenance manuals.

Part 2 Products

2.1 PANELBOARDS, 240 V OR LESS

.1 Panelboards: to CSA C22.2 No.29 and product of one (1) manufacturer.

.1 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 Bus and breakers rated for 14 kA (symmetrical) interrupting capacity at 240 V, or as indicated on the Drawings.

.3 Each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Provide separate main breaker dead front cover plate that shall only be capable of being removed if branch breakers dead front cover plate is removed.

.6 Main Breaker:

.1 Main Breaker to be top mounted and separated from branch breakers.

.2 Backfed or branch mounted main breakers are not acceptable.

.7 Two (2) keys for each panelboard and key panelboards alike.

.8 Tin Plated Copper bus with neutral of same ampere rating as mains.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

.11 Enclosure Size: 508mm (20") wide

.12 Acceptable manufacturers and models:

.1 Schneider Electric Square D.

.2 Or approved equal in accordance with B7.

2.2 BREAKERS

.1 Connection: bolt-on.

.2 Type and rating as indicated on the drawings.

.1 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.2 GFCI breakers as indicated on the Drawings (for wet location along with below-grade receptacles, excluding sump pumps).

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for each panelboard Size 7 engraved as follows:

.1 Line 1 is to be the panel identifier as indicated on the Drawings, for example "PNL-F73".

.2 Line 2 is to be the voltage, for example "120/240V, 1Ø".

.3 Line 3 is to be the rating, for example "100A, 4W".

.3 Complete circuit directory with typewritten legend.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on a common backboard.

.3 Mount panelboards to height of two (2) metres to top of cover, as required by Code, or as indicated on the Drawings.

.4 Connect loads to circuits.

3.2 TESTING

.1 Test in accordance with Section 26 05 01.

.2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

.4 Submit shop drawings and indicate:

- .1 Outline dimensions.
- .2 Configuration of identified compartments.
- .3 Locations of all flush mounted equipment on each compartment including: pilot lights, pushbuttons, emergency stop buttons, selector switches, ammeters, hour meters, disconnect handles and compartment vents.
- .4 Floor anchoring method and dimensioned foundation template.
- .5 Cable entry and exit locations.
- .6 Dimensioned position and size of busbars.
- .7 Schematic and wiring diagrams.
- .8 Layout of all customer starter assemblies.
- .9 Lamacoid identifications, colours and locations.

.5 Closeout Submittals: provide as-built drawings and supplemental information for motor control centre as specified in Section 01 78 00 - Closeout Submittals.

- .1 Include data for each type and style of starter.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

.1 MCC-F71: 600 VAC, 60 Hz, Wye connected, 3-Phase, 4-Wire.

.2 MCC-F72: 600 VAC, 60 Hz, Wye connected, 3-Phase, 3-Wire.

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor NEMA Type 1A (gasketed) enclosure, front mounting.

.4 Suitability for Service Entrance: Yes (MCC-F71 only).

.5 Wiring class: Class 1, Type B-D or B-T as shown on the Drawings.

.6 Compartment Nameplates:

.1 White background with black letters, with compartment "JB-F74 Temporary Generator Connection" utilizing a red background and white text.

.2 Identification as indicated on the Drawings.

.7 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

.8 SCCR: 18 kA minimum.

.9 Acceptable manufacturer:

.1 Schneider Electric Model 6.

.2 This product was standardized by the City via RFP 756-2013. No alternates or substitutes will be accepted.

.10 Purchase or Quotation:

.1 All requests for purchase or quotation shall reference RFP 756-2013 to receive discount pricing that the City has negotiated with the Vendor.

.2 Contact: Schneider Electric Canada, 21 Omands Creek Blvd, Winnipeg, MB, R2R 2V2.

.3 The Bidder's bid price shall reflect the discounted equipment price. The City of Winnipeg and/or Contract Administrator will review the purchase price for standardized equipment to ensure the applicable discount factor has been applied.

2.3 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Dimensions: 2324 mm (91.5") high, 381 mm (15") deep and 508 mm (20") wide, except as noted on the Drawings.

.3 Assembled sections into a group having a common power bus and forming an enclosure to which additional sections may be readily added.

.4 Design for all power and control connections to be made from the front. All bus and feeder bolted connections shall be accessible from the front.

.5 Sections with horizontal wiring spaces top and bottom and with 102 mm full height vertical wiring spaces with cable tie supports. Insulate wireways from horizontal and vertical bus.

.6 Each vertical section divided into compartment units, minimum 152 mm high, as indicated.

.7 Each unit to have complete top and bottom steel plate for isolation between units.

.8 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.9 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.

.10 Stab opening protection: Removable protective caps.

.11 Isolation barriers:

.1 Provide barriers between units and wireways.

.2 Provide bolted on finger safe barriers/guards for all incoming power cabling to each compartment along with each compartment breaker/fuse line side lugs. Barriers/guards shall fully cover all incoming power cabling feeding each compartment along with all breakers/fuses line side energized metal to prevent accidental contact.

.12 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.13 Incoming cables to enter at top only.

.14 Provision for outgoing cables to exit via top only.

.15 Removable lifting means.

.16 Provision for future extension of both ends of motor control centres including busbars without need for further drilling, cutting or preparation in field.

.17 Divide assembly for shipment to site, complete with hardware and instructions for re-assembly.

.18 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.

.19 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.

.20 Master nameplate lamacoid: text as follows:

.1 Line 1 is to be MCC identifier as indicated on the Drawings, for example “MCC-F71”.

.2 Line 2 is to be the voltage, for example “600V, 3-Phase”.

.3 Line 3 is to be the rating, for example “600A, 3-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, tin-plated copper busbars in separate compartment bare self-cooled, extending entire width and height of motor control centres, supported on insulators and rated:

.1 Main horizontal busbars: As indicated on the Drawings.

.2 Branch vertical busbars: 300 A or 600 A as required.

.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 42 kA 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.

.6 Location: Top.

2.6 GROUND BUS

.1 Copper ground bus extending entire width of motor control centres.

.1 Size: 6 x 25 mm (1/4" x 1")

.2 Plating: Tin.

.3 Location: Bottom.

.2 Vertical ground bus, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

.1 Material: tin-plated copper.

2.7 TRANSIENT VOLTAGE SURGE SUPPRESSOR

.1 Supply and install a Transient Voltage Surge Suppressor (TVSS) where shown on the Drawings.

.2 Requirements:

.1 TVSS units and all components shall be designed, manufactured, and tested in accordance with the latest applicable CSA / ULC 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 TVSS 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 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.

.7 ANSI/UL 1449 5th Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 5th Edition VPR for the device shall not exceed the following:

.1 L-N, L-G, N-G:

.1 120/208 V: 700 V

.2 347/600 V: 1500 V

.2 L-L:

.1 120/208 V: 1200 V

.2 347/600 V: 3000 V

.3 TVSS Design:

.1 Maintenance Free Design – The TVSS shall be maintenance free and shall not require any user intervention throughout its life. TVSSs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. TVSSs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. TVSSs 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 TVSS 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 TVSS 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.

.4 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.

.5 Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

.1	600V Equipment – Service Entrance:	240 kA.
.2	600V Equipment – Not Service Entrance:	120 kA.

.6 Installation Requirements:

.1 The TVSS 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 TVSS.

.3 Utilize a breaker, appropriately rated as directed by the TVSS manufacturer, to connect the TVSS to the MCC. The TVSS shall be located directly adjacent to the circuit breaker.

.4 The TVSS 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 TVSS shall be CSA/cUL listed.

2.8 POWER METER

.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 fixed ratios shall not be acceptable.

.7 Maximum burden of 0.0625 VA at 10 Amps.

.8 The meter shall have an accuracy of +/- 0.25% or better for volts and amps, and 1.5% for power and energy functions.

.9 The meter shall provide true RMS measurements of voltage, phase to neutral and phase-to-phase; current, per phase and neutral.

.10 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 15^{th}.

.11 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.

2.9 VOLTAGE MONITORING RELAY

.1 Requirements,

.1 Suitable for direct connection to MCC bus having nominal operating voltage of 600 V line-to-line.

.2 Adjustable nominal input voltage via potentiometer from 500 V to 600 V.

.3 Undervoltage trip point:

.1 Adjustable from 88% to 92% of nominal voltage.

.4 Voltage unbalance:

.1 Adjustable from 2% to 10%.

.5 Phase loss detection:

.1 Triggered upon ≥ 15% unbalance.

.2 Response time ≤ 200 msec.

.6 Trip delay:

.1 Adjustable from 1 to 30 seconds.

.7 Automatic reset (restart) delay:

.1 Adjustable from 0.6 to 64 seconds.

.2 Adjustable random restart delay from 3 to 15 seconds.

.8 Faults stored in non-volatile memory.

.1 Storage of the last 10 faults.

.9 Status and faults displayed on LED readout.

.10 Remote reset input.

.11 CSA approved.

.2 Relay output:

.1 Equipped with, at minimum, one Form-C electromechanical dry contact output for monitoring.

.1 Relay contact to be normally open, held-closed during normal operation, and open upon an alarm condition.

.2 Actuate relay on any of the following:

.1 Phase A-B, B-C, or C-A voltage less than 550 V.

.2 Voltage unbalance greater than 10%.

.3 Rated at 10A resistive @ 250 VAC, 6A inductive (0.4 PF) @ 250 VAC.

.4 Mechanical life of $1x10^7$ operations.

.3 Acceptable products:

.1 Littlefuse DLMHBRAAA.

.2 Or approved equal in accordance with B7.

2.10 MOTOR STARTERS AND DEVICES

.1 Equip the MCCs with combination starters as specified and shown on the drawings.

.2 Refer to Section 26 29 10 – Motor Starters to 600 V.

2.11 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A 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.

.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 padlock 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 Compartment control devices mounted on front door with locations as indicated on the Drawings including: pushbuttons, emergency stop buttons, selector switches, pilot indicating lights, ammeters, hour meters, disconnect handles and compartment vents.

.7 Devices and components by one manufacturer to facilitate maintenance unless otherwise specified or indicated on the Drawings.

.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 pushbuttons of heavy-duty oil tight construction.

2.12 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.

2.13 EQUIPMENT IDENTIFICATION

.1 Identify Motor Control Centre with nameplates as follows:

.2 Nameplates:

.1 Lamacoid 3 mm thick plastic lamacoid nameplates, white background, black lettering, mechanically attached with self tapping screws. Generator compartment "JB-F74 Temporary Generator Connection" will utilize red background and white text.

NAMEPLATE SIZES

Motor Control Centre main nameplate	70 x 280 mm	3 lines	40 mm high letters
Individual Compartment nameplates	30 x 90 mm	3 lines	5 mm high letters
Compartment Device namplates	30 x 25 mm	2 lines	3 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.

2.14 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

.4 Paint motor control centres with exterior light gray and interiors white.

2.15 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.

2.16 SPARE PARTS

.1 One (1) set of fuses of each type and size.

Part 3 Execution

3.1 INSTALLATION

.1 Provide housekeeping pads below the MCC lineups as per the Drawings.

.2 Set and secure motor control centres 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 settings are applied.

.5 Coordinate concrete pad with bevelled edges as shown on the Drawings, sized to suit each MCCs, install and level channel sills and mount each MCCs.

3.2 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.

3.3 FIELD QUALITY CONTROL

.1 Ensure moving and working parts are lubricated where required.

.2 Operate starters in sequence to prove satisfactory performance of each Motor Control Centre during 8 hour period.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No.42-99(R2009), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.144.1-06(R2020), Ground Fault Circuit Interrupters.

.3 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.4 CSA-C22.2 No.55-M1986(R2012), Special Use Switches.

.5 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

Part 2 Products

2.1 SWITCHES – TWO POSITION, SINGLE POLE

.1 15 A, 120 V, single pole switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually operated heavy duty ac switches with following features:

.1 Heavy duty mounting strap.

.2 Terminal holes approved for No. 10 AWG wire.

.3 Colour: White.

.4 Silver alloy contacts.

.5 One piece lexan toggle, lever, and cam.

.6 Suitable for back and side wiring.

.7 Green hex head grounding terminal.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable manufacturer:

.1 Hubbell or approved equal in accordance with B7.

2.2 SWITCHES – TWO POSITION, DOUBLE POLE

.1 15 A, 120 V, double pole switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually operated heavy duty ac switches with following features:

- .1 Heavy duty mounting strap.
- .2 Terminal holes approved for No. 10 AWG wire.
- .3 Colour: White
- .4 Silver alloy contacts.
- .5 One piece lexan toggle, lever, and cam.
- .6 Suitable for back and side wiring.
- .7 Suitable for Hazardous locations as indicated on the Drawings.

.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 manufacturer:

- .1 Hubbell or approved equal in accordance with B7.

2.3 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, heavy duty specification grade to: CSA-C22.2 No.42 with following features:

- .1 Heavy duty nylon face with steel reinforcing plate in centre.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Colour: White
- .4 Power indicating light.
- .5 Break-off links for use as split receptacles.
- .6 Receptacle contacts to utilize spring steel clips to reduce contact fatigue.
- .7 Green hex head grounding terminal.
- .8 Suitable for Hazardous locations as indicated on the Drawings.

.2 Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, heavy duty specification grade to: CSA-C22.2 No.42 with following features:

- .1 Heavy duty nylon face with steel reinforcing plate in centre.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Colour: White
- .4 Power indicating light.
- .5 Break-off links for use as split receptacles.
- .6 Receptacle contacts to utilize spring steel clips to reduce contact fatigue.
- .7 Green hex head grounding terminal.
- .8 Suitable for Hazardous locations as indicated on the Drawings.

.3 Receptacles of one manufacturer throughout project.

.4 Acceptable manufacturer:

.1 Hubbell 8200 or approved equal in accordance with B7.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, 1 mm thick cover plates wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Mount 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 duplex receptacles vertically.

.3 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.4 Install a permanent label or lamacoid for all wiring devices indicating the circuit(s) contained within.

.1 Example: 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 operating on 600 V, 3-phase systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, thirteenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

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

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and Circuit breakers to CSA C22.2 No. 5

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.4 Circuit breakers to have minimum 18 kA symmetrical rms interrupting capacity rating at 600 V, or higher as indicated.

.5 Thermal magnetic moulded case circuit breakers to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.6 Include:

.1 On-off locking device.

.2 Neutral and Ground bus bars, fully rated.

2.2 CSTE-F70.MCB-CSTE (CSTE MAIN BREAKER)

.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:	0.20 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	0.5 – 16 sec (Adjustable)
.7	Short Time PU:	1.5 – 10 * LTPU (Adjustable)
.8	Short Time Delay:	0.0 to 0.4 sec (Adjustable)
.9	Instantaneous:	1.5 – 11 * Sensor Rating (Adjustable)
.10	Poles:	3
.11	Model:	Schneider Electric PowerPact L series with Micrologic 5.3 A (Ammeter) series trip unit, or approved equal in accordance with B7.

2.3 MCC-F71.MCB (MCC-F71 MAIN BREAKER)

.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:	0.20 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	0.5 – 16 sec (Adjustable)
.7	Short Time PU:	1.5 – 10 * LTPU (Adjustable)
.8	Short Time Delay:	0.0 to 0.4 sec (Adjustable)
.9	Instantaneous:	1.5 – 11 * Sensor Rating (Adjustable)
.10	Poles:	3
.11	Model:	Schneider Electric PowerPact L series with Micrologic 5.3 A (Ammeter) series trip unit, or approved equal in accordance with B7.

.12 Provide a control transformer and 24VDC power supply for powering the breaker trip unit. The facility utilizes flood pumps that only run at infrequent intervals and hence the facility will normally have minimal loading.

2.4 MCC-F71.CB-JB-F74 (MCC-F71 GENERATOR 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:	0.125 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	0.5 – 16 sec (Adjustable)
.7	Short Time PU:	1.5 – 10 * LTPU (Adjustable)
.8	Short Time Delay:	0.0 to 0.4 sec (Adjustable)
.9	Instantaneous:	1.5 – 12 * Sensor Rating (Adjustable)
.10	Poles:	3
.11	Model:	Schneider Electric PowerPact L series with Micrologic 5.3 A (Ammeter) series trip unit, or approved equal in accordance with B7.

2.5 MCC-F71.CB-F72 (MCC-F72 FEEDER BREAKER)

.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:	0.20 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	Fixed
.7	Short Time PU:	1.5 – 10 * LTPU (Adjustable)
.8	Short Time Delay:	Fixed
.9	Instantaneous:	1.5 – 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.

2.6 MCC-F72.CB-F01, MCC-F72.CB-F04 (P-F01 & P-F04 PUMP STARTER BREAKERS)

.1 Requirements:

.1	Frame Size:	250 A
.2	Sensor Rating:	250 A
.3	Interrupting Rating:	25 kA @ 600 VAC
.4	Trip Unit Type:	Electronic LI, Factory Sealed
.5	Long Time PU:	0.28 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	0.5 – 24 sec (Adjustable)
.7	Instantaneous:	1.5 – 12 * Sensor Rating (Adjustable)
.8	Poles:	3
.9	Model:	Schneider Electric PowerPact J series with Micrologic 3.2 series trip unit, or approved equal in accordance with B7.

2.7 MCC-F72.CB-F02 (P-F02 PUMP STARTER BREAKER)

.1 Requirements:

.1	Frame Size:	250 A
.2	Sensor Rating:	200 A
.3	Interrupting Rating:	25 kA @ 600 VAC
.4	Trip Unit Type:	Electronic LI, Factory Sealed
.5	Long Time PU:	0.28 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	0.5 – 24 sec (Adjustable)
.7	Instantaneous:	1.5 – 12 * Sensor Rating (Adjustable)
.8	Poles:	3

.9	Model:	Schneider Electric PowerPact L series with Micrologic 3.2 series trip unit, or approved equal in accordance with B7.

2.8 MCC-F72.CB-F03 (P-F03 PUMP STARTER BREAKER)

.1 Requirements:

.1	Frame Size:	150 A
.2	Sensor Rating:	90 A
.3	Interrupting Rating:	25 kA @ 600 VAC
.4	Trip Unit Type:	Electronic LI, Factory Sealed
.5	Long Time PU:	0.33 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	0.5 – 16 sec (Adjustable)
.7	Instantaneous:	1.5 – 15 * Sensor Rating (Adjustable)
.8	Poles:	3
.9	Model:	Schneider Electric PowerPact L series with Micrologic 3.2 series trip unit, or approved equal in accordance with B7.

2.9 THERMAL MAGNETIC BREAKERS >= 100A

.1 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 J series or approved equal in accordance with B7.

2.10 THERMAL MAGNETIC BREAKERS < 100A

.1 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.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 On circuit breakers with adjustable protection settings, set the protection settings as per the specifications and/or drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for disconnect switches operating on 600 V, 3-phase systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2021, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECTS GENERAL

.1 Rating: 600V, ampere rating as indicated on drawings, three-poles.

.2 Suitable for termination of copper wires.

.3 Disconnect switches shall be of the non-fused type where equipment is fed from a moulded case circuit breaker – unless fusing is required by the equipment vendor.

.4 All indoor and outdoor disconnect switches shall be minimum heavy-duty NEMA 4 enclosures. All disconnects marked as explosion proof shall be in NEMA 7/9 enclosures and rated for the hazardous area as indicated on the drawings.

.5 Provision for padlocking in the “ON” and "OFF" switch position by three padlocks.

.6 Mechanically interlocked door to prevent opening when handle in 'ON' position.

.7 Quick-make, quick-break action.

.8 ON-OFF switch position indication on switch enclosure cover.

.9 Materials shall be NEMA rated – not IEC rated.

.10 Include grounding bar for bond conductors.

.11 Shall be complete with insulated solid neutral lug assembly – where a neutral conductor is required.

□

.12 Minimum 10 kAIC rated equipment or greater as indicated on the drawings.

2.2 Approved Manufacturers

.1 Acceptable manufacturers of starters: Cutler Hammer, Square D, Schneider Electric, Siemens.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches as indicated and in accordance with the manufacturer's recommendations.

.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.

3.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Nameplate for each disconnect switch Size 8 engraved in accordance with Section 26 05 00 - Common Work Results – Electrical. Indicate disconnect equipment number, voltage, phase and MCC source feed.

END OF SECTION

□

Part 1 General

1.1 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.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Head load calculations.

.1 Provide heat load calculations, detailing the total head load within the starter and the required fan C.F.M. (cubic feet per minute) air-flow required to maintain a maximum temperature of 45°C within the enclosure. Utilize a maximum ambient air temperature of 30°C in the calculations.

.4 Shop Drawings:

.1 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide shop drawings for each starter, indicating:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout and components or internal units and front panels.

.4 Enclosure types.

.5 Wiring diagrams.

.6 Interconnection diagrams, as applicable.

.7 When air-cooled systems are provided, the following shall also be shown:

.1 Air inlet and outlet passages.

.2 Cooling fans.

.3 Filters.

1.3 CLOSEOUT SUBMITTALS

.1 Submit As-Built Drawings for each type and style of motor starter in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 GENERAL

.1 Starters: to NEMA ICS 2-2000.

.2 Equipment Identification:

.1 Colour: White background, black letters.

.2 Text Size: 8mm high letters.

.3 Text as shown on the Drawings.

.3 Control Wiring:

.1 Tin Plated Copper, 16 AWG, TEW unless otherwise indicated.

.4 Wire Identification:

.1 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram. Markings are to be computer generated.

.5 Device Identification:

.1 Door-mounted indicating lights, push buttons, emergency stop buttons, selector switches, ammeters, hour meters as indicated on the drawings. Identification to be lamacoids with white background and black text. Lamacoid locations and text as shown on the Drawings.

.2 On the door interior, install identification labels adjacent to each pilot device containing the identifier of the pilot device (e.g. HS-F010-3). The identification is to be provided by a lamacoid or permanent machine-made stick-on label.

.3 Internal components such as contactors and relays must be identified by a lamacoid or permanent machine-made stick-on-label. Relays composed of a base and removable relay are to be identified on the base or enclosure back-panel rather than on the removable relay component.

.6 Finishes:

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.

.1 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.2 SOFT STARTERS

.1 Design requirements:

.1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed 18 kA.

.2 Ventilation system designed for ambient temperature range of 5°C to 35°C. Enclosure temperature not to exceed 45°C.

.2 Soft Starter Modules:

.1 Continuous rating: as indicated on the Drawings.

.2 Rated operation voltage: 600 VAC, 60 Hz.

.3 Control circuit voltage: 120 VAC, 60 Hz.

.4 Operating temperature range, without de-rating: -15°C to +40°C.

.5 Logic inputs: Qty 4, 24 VDC.

.6 Logic outputs: Qty 2, 24 VDC (open collector), programmable.

.7 Relay outputs: Qty 3, Form-A (Normally Open).

.8 Analog outputs: Qty 1, 0-20 mA / 4-20 mA, programmable.

.9 Vibration resistance:

.1 1.5 mm peak from 2 to 13 Hz.

.2 1 gn from 13 to 200 Hz.

.10 Shock resistance: 16 g, 11 ms.

.11 Acceptable products:

.1 Schneider Electric ATS480 Series.

.2 No alternates will be accepted.

.3 Isolation Contactors:

.1 NEMA rated, size as indicated on the Drawings.

.2 120 VAC, 60 Hz coil.

.4 Bypass Contactors:

.1 NEMA rated, size as indicated on the Drawings.

.2 120 VAC, 60 Hz coil.

.5 Control Transformers:

.1 Single phase, dry-type, with 600V primary and 120V secondary, complete with primary and secondary fusing, installed in enclosure with soft starter, as indicated.

.2 Calculate required size of the control transformer. The size shown on the drawings is the minimum size. Provide size as required for appropriate operation of the starter, plus 20% spare capacity.

.6 Interval Timing Relays:

.1 Interval timing relay automatically switches state when energized and switches back to steady state after timing period lapses.

.2 Relay contact shall switch back to steady state while coil remains energized indefinitely.

.3 120 VAC, 60 Hz coil.

.4 Din rail mountable.

.5 Pins: 8.

.6 Power supply start.

.7 Time delay setting:

.1 Adjustable: 0.1 - 60 seconds.

.2 Rotary analog.

.8 Relay Outputs:

.1 Form-B contacts: Quantity 2.

.2 Rated for 120 VAC, 60 Hz.

.9 Modes:

.1 E (Interval).

.10 Acceptable products:

.1 Omron H3CR-A8 complete with Omron PF085A.

.7 Current Transducers:

.1 Power Supply: 120 VAC, 60 Hz.

.2 Input: 0 - 5A, 60 Hz.

.3 Output: 4 - 20 mA.

.8 Current Meters:

.1 Type: Analog

.2 Input: 0 - 5 A, 60 Hz.

.3 Display Range: 0 - 250 A.

.9 Cooling:

.1 Provide cooling system as required to maintain an acceptable enclosure.

.2 Intake fan located at bottom of enclosure.

.3 Exhaust vent located at top of enclosure.

.10 Door-mounted soft starter Human Interface Module (HIM).

.11 Pilot Devices:

.1 Push buttons and selector switches: Heavy-duty, oil tight, NEMA rated, 30 mm, labelled as indicated on the Drawings.

.2 Indicating lights: Heavy-duty, oil tight, NEMA rated, 30 mm, LED bulb, type and color as indicated on the Drawings.

.3 Start push buttons to utilize a green cap, and stop pushbuttons to utilize a red cap.

.4 Pilot devices are to be labelled with text along with label locations as indicated on the Drawings.

.12 Documentation:

.1 Provide door pocket with complete set of drawings for each starter.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 CSA/ULC listed, NEMA size as shown on the drawings.

.1 Smallest size of starter: NEMA size 1, unless otherwise indicated

.2 IEC rated starters are not acceptable.

.2 Short Circuit Current Rating (SCCR):

.1 The Short Circuit Current Rating (SSCR) of the assembly must equal or exceed 18 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.

Part 3 Execution

3.1 GENERAL

.1 Perform detailed review of drawings and make necessary corrections to ensure proper operation, and to ensure the design meets Code requirements. Notify the Contract Administrator of any proposed design modifications.

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 soft starter module 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 None.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE).

.1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.

.1 ASTM F1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International).

.5 ICES-005-07, Radio Frequency Lighting Devices.

.6 Underwriters' Laboratories of Canada (ULC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 LAMPS

.1 Lamps to be LED, as indicated on the drawings, medium bi-pin, rapid-start, 4000 K, 60,000 hour lamp life, 8000 initial lumens, CRI 85; or as otherwise indicated.

2.2 BALLASTS

.1 Ballast: CBM and CSA certified, energy efficient type, IC electronic.

.1 Rating: 120 VAC, 60 Hz for use with LED, 38 Watt lamps.
.2 Totally encased and designed for 40°C ambient temperature.
.3 Power factor: minimum 95% with 95% of rated lamp lumens.
.4 Current crest factor: 1.7 maximum.
.5 Harmonics: 10 % maximum THD.
.6 Operating frequency of electronic ballast: 20 kHz minimum.

.7 Total circuit power: 38 Watts.

.8 Ballast factor: greater than 0.90.

.9 Sound rated: Class A.

.10 Mounting: integral with luminaire.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in Luminaire Schedule on the Drawings.

2.5 LUMINAIRES

.1 As indicated in Luminaire Schedule on the Drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated on the Drawings.

.2 Provide adequate support to suit ceiling system.

.3 Install a permanent label or lamacoid for all luminaires indicating the circuit(s) contained within.

.1 Example: F73-2 (Panel F73, circuit 2)

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install rigid aluminum conduit for luminaires as indicated on the Drawings.

3.3 LUMINAIRE SUPPORTS

.1 Support luminaires from ceiling in accordance with local inspection requirements.

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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment for Emergency Lighting.

1.3 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 VAC.

.3 Output voltage: 12 VDC.

.4 Operating time: as shown in Emergency Lighting Battery Schedule on the Drawings.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for ‘Fault”.

.10 Lamp heads: integral on unit and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 4 W.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: white.

.13 Auxiliary equipment:

.1 Test switch.

.2 Battery disconnect device.

2.2 WIRING OF REMOTE HEADS

.1 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0 - 1000 V), sized 10 AWG, or larger as required..

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.1 The Contract Administrator will review the direction of the heads and may instruct the contractor to modify the direction. Redirect heads as requested by the Contract Administrator at no additional charge.

.3 Demonstrate emergency lighting operation and coverage to Contract Administrator.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.214-2008, Communications Cables (Bi-national standard, with UL 444).

.2 CSA T530-1999, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A).

1.2 PRODUCT DATA

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

Part 2 Products

2.1 TELEPHONES

.1 Existing telephones may be reutilized.

2.2 JACKS

.1 Requirements:

.1 Keystone RJ-11

.2 Utilize 110 style punch-down termination.

.2 Acceptable manufacturer:

.1 Levitron

.2 Or approved equal in accordance with B7.

2.3 CABLE

.1 Indoor wire: CAT-5e.

Part 3 Execution

3.1 DEMOLITION

.1 Demolish the existing telephone cabling back to NID. Obtain approval from the Contract Administrator prior to disconnecting telephone cabling.

.2 Minimize telephone service outages to planned shutdowns.

3.2 INSTALLATION

.1 Provide a complete system of conduits, boxes, and jacks for the telephone service to the building. Provide entrance conduit as required by the Telephone Utility.

.2 Utilize existing wall mounted telephone sets as indicated on the Drawings.

.3 Make all connections and test system.

.4 Ensure the City of Winnipeg McPhillips Control Centre can connect to the Polson system.

.5 Make connections to grounding as required.

.6 Prior to installation of service entrance, coordinate with the Telephone Utility to confirm all construction and installation details.

3.3 INSTALLATION OF CONDUCTORS

.1 Use appropriate tool for connecting conductors to terminals.

.2 Terminate all conductors on punch-down blocks, regardless of whether they are utilized.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 09 91 23 Painting

1.2 REFERENCE STANDARDS

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA C111/A21.11-12, Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 ANSI/AWWA C151/A21.51-17, Standard for Ductile-Iron Pipe, Centrifugally Cast.

.3 ANSI/AWWA C207-18, Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch Through 144 Inch (100 mm Through 3,600 mm).

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit shop drawings showing proposed method of installation for sewage force main in undercrossing.

.4 Certification to be marked on pipe.

.5 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Iron pipe:

.1 Carbon Steel Pipe: to ANSI/AWWA C151/A21.51.

.2 Rubber gaskets: to ANSI/AWWA C111/A21.11, full faced rubberized cloth type, 3mm thickness, compounded for water and sewer service.

Part 3 Execution

3.1 EXAMINATION

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

.1 Inform Consultant of unacceptable conditions immediately upon discovery.

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

3.2 PREPARATION

.1 Pipes and fittings to be clean and dry.

.2 Prior to installation, obtain Consultant's approval of pipes and fittings.

3.3 INSTALLATION

.1 Join pipes in accordance with ANSI/AWWA C600, for ductile iron pipe, and as per manufacturer's recommendations.

.2 Avoid damage to machined ends of pipes in handling and moving pipe.

.3 Maintain grade and alignment of pipes.

.4 Align pipes carefully before jointing.

.5 Joint deflection permitted within limits in accordance with pipe manufacturer's written recommendations.

.6 Support pipe firmly over entire length, except for clearance necessary at couplings.

.1 Do not use blocks to support pipe.

.7 Keep pipe and pipe joints free from foreign material.

.8 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Remove disturbed gaskets clean, lubricate and replace before jointing is attempted.

.9 Support pipes using hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.10 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.

3.4 PAINTING

.1 As per Section 09 91 23 Painting.

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.

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 40. This section supplements requirements of Division 01.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1-2021, 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 a complete working system, tested and ready for operation.

.2 These Specifications and the Drawings along with other Division Section Specifications 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.

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.3 Notify the 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 Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.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 Lamacoid 3 mm thick, plastic lamacoid nameplates, white background, 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.

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.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification is to be English.

1.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders, branch circuit, control and automation wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

1.10 TESTING

.1 All test instruments utilized are to have been calibrated within one year of the date utilized.

.2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

1.11 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 01.

.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 Should Shop Drawing information be insufficient or the Contract Administrator does not approve of the Shop Drawings, the Contractor shall arrange to resubmit Shop Drawings at no additional change to contract price.

.6 Manufacture of Products shall conform to revised Shop Drawings.

1.12 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.

1.13 O&M MANUAL

.1 Operations and Maintenance Manuals

.1 Refer to Section 01 78 00 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 Provide a manual that contains, at minimum, all pertinent information, drawings and documents associated with the PLC program and associated integration, including:

.1 Printout of the entire PLC program.

.2 Repair instructions for common issues.

.3 Printout of any related design documents, such as interface lists, etc.

.4 A USB memory stick containing the latest PLC program including configuration software.

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 01 33 00 - Submittal Procedures.

.2 Submit the following for review at least fifteen (15) Working Days prior to FAT.

.1 Detailed test procedures 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 purpose of testing is to ensure all control logic, status and alarm signals defined in the Functional Requirements Specification (FRS) within the PLC are conveyed to the City's SCADA HMI system via the cellular communication link. This shall be performed in conjunction with the Contract Administrator and/or City of Winnipeg personnel witnessing in person.

.2 The location of the FAT shall be in a Contractor supplied facility, within Winnipeg, Manitoba, Canada.

.3 Correct deficiencies at no additional cost and re-test until satisfactory performance is obtained.

.4 Acceptance of tests during the FAT shall 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 DEMONSTRATION SYSTEM

.1 Setup the complete automation system in the Contractor's facility, in a timely manner to allow for the complete and expeditious testing of the system and associated programming.

3.2 PROCEDURES

.1 All tests shall be documented.

.2 Produce test forms to allow for recording the results of the simulations and tests.

.3 All points to the SCADA system shall be tested with the assistance of City personnel.

.4 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 Testing of all discrete physical inputs with the use of wire jumpers.

.1 Confirm that the City's SCADA system is able to see the state transition.

.2 Confirm that the light on the front of the control panel illuminates (where a light is provided).

.3 Confirm that the light on the PLC input card illuminates.

.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.

.2 Confirm that the light on the PLC output card illuminates.

.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 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 the control logic as described in the FRS.

.2 Demonstration tests need not include:

.1 Connection of instruments to the control panel.

.2 Configuration of instruments.

.5 The Contract Administrator may request additional minor tests at the FAT. No additional payment shall be made for additional minor tests.

.6 The Contract Administrator shall review the system and test results. Incorporate comments and feedback from the Contract Administrator into the system design.

3.3 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 at no additional cost.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Submit commissioning plans and procedures, in writing, at least twenty (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 Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.3 COMMISSIONING FORMS

.1 The Contract Administrator shall provide a base set of standard commissioning forms. Additional forms shall be required, and must be prepared by the Contractor. The Contractor will be required to fully complete all test forms and submit to the Contract Administrator.

.2 Supplement the provided forms as required to make a complete commissioning report package. Utilize the Specifications, Drawings, and the Functional Requirements Specification 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 of Winnipeg personnel.

.2 Inform, and obtain approval from the Contract Administrator in writing at least fourteen (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 at no additional cost and re-test until satisfactory performance is obtained.

.4 Acceptance of tests shall 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 shall be considered as satisfactorily completed when the objectives of commissioning have been achieved and reviewed by the Contract Administrator.

Part 2 Products

2.1 NOT USED.

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 (1) qualified technician to test and commission the control system.

.2 Test each I/O point from the instrument to the City's SCADA HMI.

.1 Tests to be performed in conjunction with the City of Winnipeg personnel to verify alarm and status signals on the City's SCADA HMI.

.2 Test both states of discrete points.

.3 Test, at minimum, two values for analog points.

.3 Test each piece of equipment individually for complete functionality.

.4 Completely test the E-Stop functionality of each piece of equipment, as provided.

.5 Where software logic is provided in the PLC, all modifications to the software program to bypass interlocks or sensors shall be recorded and documented clearly in a separate document, and in the PLC software.

.1 Any software bypasses that remain, prior to leaving site, must be authorized by the Contract Administrator or designated representative.

.6 All deficiencies must be corrected by the Contractor at no additional cost.

.7 Commission each system using procedures prescribed by the Contract Administrator.

.8 Optimize operation and performance of systems by fine-tuning control loops and PID values.

3.3 SYSTEM SOFTWARE

.1 Load PLC system with appropriate program and/or configuration as per the included Functional Requirements Specification, fully tested and approved as part of the software FAT.

.1 Any changes made to the software after the FAT shall be submitted for review and approval of the Contract Administrator.

.2 Any issues identified on site shall 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 and/or the City of Winnipeg personnel 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-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.2 SUBMITTALS

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

.2 At a minimum, product data shall include:

.1 Nameplate details.
.2 Voltage and current ratings
.3 Mounting methods and outline dimensions.
.4 Enclosure types and ratings.
.5 Wiring diagrams.
.6 Device instrument numbers.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of the 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 – PUSH-PULL/TWIST TO RELEASE

.1 Supply and install enclosed two-position maintained emergency stop operator stations for the flood pumps P-F01, P-F02, P-F03 and P-F04 as indicated on the Drawings.

.2 Requirements:

.1	Ingress Protection:	NEMA 4X.
.2	Contact Life:	1,000,000 cycles.
.3	Mechanical Life:	250,000 cycles.
.4	Contact Rating:	10 A.
.5	Contact Configuration:	As indicated on the Drawings.
.6	Illumination:	Not required unless otherwise indicated.

.7 Acceptable for hazardous Class I, Zone 2 location.

.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 manufacturer's recommended methods, procedures and instructions.

.2 Readily accessible to allow for unhindered operation and servicing.

.3 Wall installation:

.1 Located as indicated on the Drawings.

.2 Securely mounted.

3.2 IDENTIFICATION

.1 Identify field devices with lamacoids. Install in a conspicuous location.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Process instrumentation.

1.2 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.

1.3 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.1 Provide shop drawings for each instrument, indicating:

.1 Nameplate details.

.2 Voltage and current ratings

.3 Mounting methods and outline dimensions.

.4 Enclosure types and ratings.

.5 Wiring diagrams.

.6 Device instrument numbers.

.2 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.

.3 Operating conditions: 0 to +5°C with 5 - 95% RH (non-condensing) unless otherwise specified.

.4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 LEVEL FLOAT SWITCHES (LSHH-F101, LSH-F501, LSH-S529)

.1 Requirements:

.1 Suspended mechanical float switch
.2 Fluid: Wastewater.
.3 Temperature Range: 0°C to +50°C.
.4 Output: Form C dry contact.
.5 Protection: IP68.
.6 Approvals: CSA or cUL.

.2 Acceptable products:

.1 Flygt ENM-10,
.2 Or approved equal in accordance with B7.

2.3 ULTRASONIC LEVEL TRANSMITTER, SENSOR (LIC-F100, LE-F100)

.1 Service:

.1 Fluid: Wastewater.

.2 Transmitter Requirements:

.1 Ambient Temperature: -20°C to +50°C.
.2 Power Supply: 24 VDC.
.3 Measuring points: 1.
.4 Enclosure: Panel mount, NEMA 3.
.5 Relay Outputs: Qty three (3) dry-contacts (2 SPST for control, 1 SPDT for alarm).
.6 Analog Output: Qty one (1) 4-20 mA.
.7 Accuracy: 0.25% of maximum range or 6 mm, whichever is greater.
.8 Resolution: 0.1% of program range or 2 mm, whichever is greater.

.3 Transducer Requirements:

.1 Ambient Temperature: -20°C to +65°C.
.2 Degree of Protection: IP65/IP68.
.3 Range: 0.3 to 8 m.
.4 Beam Angle: 10°.
.5 Frequency: 44 kHz.

.4 Cable Requirements:

.1 Type: 1 PR, 18 AWG, Shielded Twisted Pair.
.2 Electrical Characteristics: 62.3 pF/m @ 1 kHz between conductors, 108.3 pF/m @ 1 kHz between conductor and shield.
.3 Length: 30 metres.

.5 Acceptable Products:

.1 Siemens MultiRanger 100 transmitter, 7ML5033-1CB00-1A.

.2 Siemens Echomax XPS-15 transducer, 7ML1118-3EA30.

.3 Siemens Programmer, 7ML5830-2AH.

.4 The supply of ultrasonic level transmitters for the City of Winnipeg has been standardized under RFP 449-2014. No alternates or substitutes will be accepted.

.6 Purchase or Quotation:

.1 All requests for purchase or quotation shall reference RFP 449-2014 to receive discount pricing that the City has negotiated with the Vendor.

.2 Contact: Trans-West Company, 126 Bannister Road, Winnipeg, MB, R2R 0S3.

.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.

2.4 HVAC DUCT TEMPERATURE SENSORS (TE-F631)

.1 Requirements:

.1	Sensor:	1097 ohms @ 25°C.
.2	Insertion:	150 mm duct mount with wiring box.
.3	Operating Range:	-40°C to +121°C.

.2 Acceptable products:

.1 Honeywell C7031B2005/U,

.2 Or approved equal in accordance with B7.

2.5 ROOM TEMPERATURE SENSOR WITH INTEGRAL TRANSMITTER (TT-F691, TT-F692)

.1 Requirements:

.1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.2	Mounting:	Wall
.3	Protection:	NEMA 4 or IP67
.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 TH400

2.6 FAN FILTER DIFFERENTIAL PRESSURE SWITCH (PDSH-F611)

.1 Requirements:

.1	Type:	Electro-mechanical.
.2	Dry Contact:	SPDT, rated for at least 0.2 Amps at 24 VDC.

.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.

2.7 SEAL WATER 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: ¼" 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.

2.8 SEAL WATER FLOW SWITCHES, FSL-F011 / FSL-F021 / FSL-F031 / FSL-F041

.1 Requirements:

.1 Application: Flood pump seal water flow (potable water).
.2 Supply voltage: 24 VDC.
.3 Output: Qty 1, SPDT dry contact.
.4 Operating Temperature: -10°C to 40°C minimum.
.5 Sensor: Local.
.6 Mounting: Pipe.
.7 Enclosure Rating: NEMA Type 4X.
.8 Accessories:
  .1 Pipe mounting adapter.
  .2 Socket M12 connector cable, 60 meter length.
.9 Approvals: CSA or equivalent

.2 Acceptable Products:

.1 IFM Efector SI5010,

.2 Or approved equal in accordance with B7.

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 manufacturer’s recommended methods, procedures and instructions.

.3 Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Electrical:

.1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Provide complete conduit/cable system to link instrumentation and the control panel(s).

.3 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.4 Maximum conduit fill not to exceed 40%.

.5 Design drawings do not show conduit layout.

3.2 TEMPERATURE SWITCHES, SENSORS AND TRANSMITTERS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Mount in readily accessible location 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 Field adjust setpoint on temperature switches as per the drawings.

.5 Make adjustments as directed by the Contract Administrator at no additional cost.

3.3 PRESSURE SWITCHES

.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 at no additional cost.

3.4 SEAL WATER FLOW SWITCHES

.1 Follow manufacturer's installation instructions. Install instrument onto piping at a location with manufacturer specified number of upstream and downstream pipe diameters to ensure laminar flow. Provide all required fittings, wells, connectors, and fasteners.

.2 Field adjust setpoint to appropriate value to detect flow/no-flow condition.

.3 Make adjustments as directed by the Contract Administrator at no additional cost.

3.5 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 along with the Contract Administrator and/or the City of Winnipeg personnel shall be present to supervise the commissioning, initial operation, and functional testing of the equipment. Provide a minimum of ten (10) working days prior to performing instrument commissioning.

3.6 IDENTIFICATION

.1 Identify field devices with lamacoids. Install in a conspicuous location.

3.7 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 SUMMARY

.1 Section Includes:

.1 Process Control Devices including damper actuators.

1.2 REFERENCES

.1 Association (NEMA).

.1 NEMA 250-2021, 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.

1.3 SUBMITTALS

.1 Submit product data and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

.3 At a minimum, product data shall include:

.1 Nameplate details.
.2 Voltage and current ratings.
.3 Mounting methods and outline dimensions.
.4 Enclosure types and ratings
.5 Wiring details.
.6 Device instrument numbers.

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°C to +32°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-F600)

.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) 18 V, 3.5 mA for monitoring dry contact

.5 Mounting: Wall.

.6 Enclosure: NEMA Type 1, minimum.

.7 Acceptable products:

.1 Honeywell T775U2006,

.2 Or approved equal in accordance with B7.

2.3 ELECTRONIC DAMPER ACTUATORS, MODULATING (FV-F601, FV-F602, FV-F603)

.1 Requirements:

.1 Direct mount proportional type.

.2 Spring return type for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Damper actuator to drive damper from full open to full closed in less than 150 seconds.

.4 Spring return to drive damper from full open to full closed in less than 25 seconds at normal room temperature.

.5 Torque: As indicated on the Drawings

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Field configurable.

.8 Shaft Diameter: 8.0 mm to 16.0 mm (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: 24 VAC

.13 Operating range: 0 - 10 VDC

.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 SOLENOID VALVES – 120 VAC, XV-F011 / XV-F021 / XV-F031 / XV-F041

.1 Requirements:

.1	Application:	Flood pump seal water control
.2	Coil voltage:	120 VAC, 60 Hz
.3	Function:	2 way, normally closed
.4	Body Material:	Brass
.5	Media:	Potable water at 60 PSI pressure
.6	Pipe/port size:	Approximately 19 mm - field confirm existing piping diameter.
.7	Approvals:	CSA or equivalent

.2 Acceptable Manufacturers:

.1 ASCO,

.2 Or approved equal in accordance with B7.

2.5 ELECTRIC DUCT HEATER HCE-F63 CONTROL

.1 Modulating 0-10 VDC signal from Temperature Controller TIC-F600.

2.6 UNIT HEATER CONTROLLER (UH-F65, UH-F66)

.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 wiring in conduit or utilizing ACIC cabling.

.1 Provide complete conduit /cable system to link control devices with the controlling equipment.

.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. Lamacoid text shall be as indicated on the Drawings. 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.

.2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

3.4 UNIT HEATER CONTROL

.1 Mount thermostat in the location shown on the drawings.

3.5 MOTOR ROOM VENTILATION CONTROL

.1 Automatic control of outdoor air, mixed air, and exhaust air dampers based on occupied/unoccupied status.

.1 Occupied:

.1	Duct heater HCE-F63 setpoint:	21°C (adjustable).
.2	Damper FV-F601:	OPEN.
.3	Damper FV-F602:	CLOSED.
.4	Supply Fan SF-F62:	ON.
.5	Damper FV-F603:	OPEN.

.2 Unoccupied:

.1	Duct heater HCE-F63 setpoint:	15°C (adjustable).
.2	Damper FV-F601:	25% OPEN.
.3	Damper FV-F602:	75% OPEN
.4	Supply Fan SF-F63:	ON.
.5	Damper FV-F603:	25% OPEN.

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 C22.2 No.205-M1983(R2004), Signal Equipment.

.2 International Electrotechnical Commission (IEC).

.1 IEC 61131, Programmable Controllers.

1.2 DEFINITIONS

.1 PLC - Programmable Logic Controller.

.2 RTU - Remote Terminal Unit.

1.3 PLC SYSTEM DESCRIPTION

.1 For the purpose of this specification, the terms RTU and PLC will be deemed to be synonymous.

.2 The PLC consists of a controller and an I/O expansion module, mounted in control panel CP-F81.

.3 The City utilizes a remote SCADA system that interfaces with the flood pumping station control system PLC via cellular and PSTN (telephone) links using the DNP3 protocol.

.4 The Contractor's responsibility on the SCADA system is limited to:

.1 Provision of an interface in the PLC for the SCADA system.

.2 Testing of all status and alarm signals between the PLC and the City's SCADA system via the cellular network during the Factory Acceptance Test. This work will be performed in conjunction with the Contract Administrator and/or the City of Winnipeg personnel witnessing in person.

1.4 SYSTEM ARCHITECTURE

.1 Single PLC.

.1 Local I/O expansion modules.

.2 No remote I/O.

.3 Connected to the following:

.1 MDM01 – Cellular modem (supplied by the City).

.2 MDM02 – PSTN (telephone) modem.

1.5 SOFTWARE OWNERSHIP

.1 The City of Winnipeg 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 of Winnipeg facilities.

.2 The City of Winnipeg may turn the software over to a 3rd party, for use at any City of Winnipeg owned facility.

.3 Provide source code for all custom software and function blocks, or any other software logic utilized in the application.

.1 Source code for base function blocks provided by the PLC manufacturer are not required.

1.6 DESIGN REQUIREMENTS

.1 Design and implement a complete operating PLC system.

.2 The design is to be based upon the supplied Functional Requirements Specification.

.1 Utilize a tag naming convention that extends, and does not conflict with the tag scheme utilized in the Functional Requirements Specification.

.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 the Province of Manitoba.

.5 Do not assume that the Contractor's internal standards or standard programming methodology will be acceptable for this project. No additional payment shall be made for assumptions made regarding standard methods utilized by the Contractor.

.6 The Contract Administrator shall review the overall design. Make changes as requested by the Contract Administrator at no additional cost.

1.7 SUBMITTALS

.1 All submittals to be in accordance with Section 01 33 00 – Submittal Procedures.

.2 Stage 1:

.1 Submit product datasheets

.3 Stage 2:

.1 Submit a PLC design criteria prior to initiating programming which includes:

.1 The general PLC program structure.

.2 Function block programming languages are to be utilized. Permission must be given by the Contract Administrator using any language other than function block.

.3 A sample section of code.

.4 SCADA interface map.

.5 Variable naming methodology.

.4 Stage 3:

.1 Submit a 25% complete submittal, including:

.1 Software logic printout.

.2 The primary purpose of this submittal is to ensure that the methodology being utilized is as per requirements prior to the bulk portion of the work being completed. At this point, copies of code for similar pieces of equipment should not be completed.

.5 Stage 4:

.1 Submit a 99% complete submittal a minimum of twenty (20) Working days prior to the FAT, including:

.1 Complete software logic printout.

.2 SCADA interface map.

1.8 O&M MANUALS

.1 Include the following in the O&M Manuals:

.1 Product datasheets.

.2 Hardware and software user manuals.

.3 Letter stating that the PLC application has been reviewed and approved. The letter is to be signed and sealed by a Professional Engineer licensed to practice in Manitoba.

.4 SCADA interface map.

.5 PLC database listing and logic printout.

.6 USB memory stick containing the PLC application program.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLER

.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 automation 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 a 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 Processors:

.1 Qty 1, 32-bit ARM7 microcontroller, 32 MHz clock.

.2 Qty 2, Microcontroller co-processors, 20 MHz clock.

.3 Acceptable Products:

.1 Schneider Electric Modicon BME P58 3020,

.2 No alternates or substitutes will be accepted.

.7 Memory:

.1 Flash ROM: 16 MB.

.2 CMOS RAM: 4 MB.

.3 EEPROM: 4 kB.

.8 Integrated Ethernet Port:

.1 Quantity: 1.

.2 Speed: 10/100 Mbps.

.3 Connection: RJ45 connector.

.4 Supported protocols:

.1 Modbus/TCP.

.2 Modbus RTU in UDP.

.3 Modbus ASCII in UDP.

.4 DNP in TCP.

.5 DNP in UDP.

.6 FTP.

.5 Acceptable Products:

.1 Schneider Electric Modicon BMX NOR 0200H,

.2 No alternates or substitutes will be accepted.

.9 Serial Ports:

.1 Type:

.1 Qty 1, RS-485, Half duplex.

.2 Qty 1, RS-232 or RS-485 (jumper configurable), Full or Half duplex.

.3 Qty 1, RS-232, Full or Half duplex.

.2 Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 11500.

.3 Parity: None, Even or Odd.
.4 Word Length: 7 or 8 bits.
.5 Stop Bits: 1 Bit.
.6 Supported protocols:
.1 TeleBUS (compatible with Modbus RTU and Modbus ASCII).
.2 DF1.
.3 DNP.
.7 Acceptable Products:
.1 Schneider Electric Modicon BMX NOR 0200H,
.2 No alternates or substitutes will be accepted.

.10 USB Ports:

.1 Qty 1, USB Peripheral:
.1 Connector: Type B connector,
.2 Standard: USB 1.1,
.3 Speed: 12 Mbps (full speed).
.2 Qty 1, USB Host:
.1 Connector: Type A,
.2 Standard: USB 1.1, USB 2.0,
.3 Speed: 12 Mbps (full speed), and 1.5 Mbps (low speed),
.4 Rating: 5 V, 100 mA.

.11 Visual Indicators:

.1 Power Mode LED,
.2 Run LED,
.3 Status LED,
.4 Forced I/O LED,
.5 Digital Inputs/Outputs: LED
.6 Network communication activity

.12 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 overvoltages.
.3 Acceptable Products:
.1 Schneider Electric Modicon BME CPS 3020,
.2 No alternates or substitutes will be accepted.

.13 On-board Inputs and Outputs:

.1 Discrete Inputs (DI):
- .1 Channels: 32
- .2 Voltage: 12/24 VDC.
- .3 Current sinking: Required.
- .4 Indicating LEDs: Channel status (ON / OFF) for each channel.
- .5 Meet IEEE C37.90.1 surge withstand capability.
- .6 Acceptable Products:
  - .1 Schneider Electric Modicon BMX DDI 3202K,
  - .2 No alternates or substitutes will be accepted.

.2 Discrete Outputs (DO), 16 Channel:
- .1 Channels: 16
- .2 Type: Form A SPST Relay (dry contact)
- .3 Max switching voltage: 240 VAC
- .4 Isolation:
  - .1 Isolated in groups of 4.
  - .2 Logic to contact: 1500 VAC (1 minute).
  - .3 Chassis to contact: 1500 VAC (1 minute).
  - .4 Output group to output group: 1500 VAC (1 minute).
- .5 Contact rating:
  - .1 0.625 A, 30 VDC or 250 VAC (Resistive),
  - .2 1000 VAC between open contacts,
  - .3 10 A maximum per module.
- .6 Max switching load:
  - .1 5 A, 30 VDC (150 W Resistive).
  - .2 5 A, 250 VAC (1250 VA Resistive).
- .7 Service Life:
  - .1 $2x10^7$ mechanical.
  - .2 $1x10^5$ at 5 A, 30 VDC or 250 VAC.
- .8 Indicating LEDs: Channel status (ON / OFF) for each channel.
- .9 Acceptable Products:
  - .1 Schneider Electric Modicon BMX DDO 1602,
  - .2 No alternates or substitutes will be accepted.

.3 Universal Discrete Inputs/Outputs (DIO):
- .1 Voltage: 24 VDC.
- .2 Inputs: Current sourcing.
- .3 Outputs: Current sourcing.
- .4 Channels: 8.
- .5 Indicating LEDs: Channel status (on/off) for each channel.

.4 Analog Inputs (AI)
- .1 Channels: 14 external + 2 internal
- .2 Type: Single ended

.3 4 – 20mA inputs and one 0 - 32.768 V input for battery voltage monitoring.

.4 Input impedance:

.1 20 kΩ for 0 – 10V inputs,

.2 60 kΩ for 0 - 32.768V inputs,

.3 250 Ω for 0 - 20mA inputs,

.5 Resolution:

.1 15 bits over the 0 – 10V measurement range.

.2 14 bits over the 0 - 5V measurement and 0 - 20mA measurement range.

.6 Accuracy:

.1 +/- 0.1% at 25 °C.

.2 +/- 0.2% over temperature range.

.7 Response time: 100ms typical for 10% to 90% signal change.

.8 Acceptable Products:

.1 Schneider Electric Modicon BMX AMI 0810,

.2 No alternates or substitutes will be accepted.

.5 Analog Outputs (AO)

.1 Channels: 4.

.2 Type: Single ended, 0 - 20mA.

.3 Maximum load resistance:

.1 925 Ω with 24 VDC input voltage.

.2 375 Ω with 12 VDC input voltage.

.3 250 Ω with input voltage at power supply turnoff

.4 Resolution: 12 bits.

.5 Accuracy:

.1 +/- 0.15% at 25°C.

.2 +/- 0.25% over temperature range.

.6 Response time: 0.5 ms to 2 ms for 10% to 90% signal change.

.7 Acceptable Products:

.1 Schneider Electric Modicon BMX AMO 0410,

.2 No alternates or substitutes will be accepted.

.14 Expansion I/O Modules:

.1 Discrete Input Module, 24 VDC, 16 point:

.1 Channels: 16.

.2 Voltage: 24 VDC.

.3 Current sinking: Required

.4 Power Requirements: 5V (supplied from controller via ribbon cable)

.5 Indicating LEDs: Channel status (ON / OFF) for each channel.

.6 Mounting: 35 mm DIN rail.

.15 Required Accessories:

.1 Include all accessories including cables, terminators, backplanes, memory, batteries, and other components required to make the system operable.

.16 Acceptable Products:

.1 Controller: Schneider Electric Modicon M580,

.2 No alternates or substitutes will be accepted.

2.2 PLC PROGRAMMING SOFTWARE

.1 These products were standardized by the City via RFP 756-2013. No alternates or substitutes will be accepted.

.1 Utilize Schneider EcoStruxure Control Expert for programming the PLC.

2.3 USB MEMORY STICK

.1 Provide a minimum 2 GB USB memory stick as part of the Commissioning process, with the following:

.1 Latest application program, with documentation,

.2 PLC hardware user manuals,

.3 PLC software user manuals.

.2 Locate the memory stick in a pocket in the control panel.

Part 3 Execution

3.1 HARDWARE INSTALLATION

.1 Install the PLC and associated components in PLC Control Panel CP-F81 as per manufacturer's instructions and recommendations.

.2 Update the processor and all updatable modules with the latest firmware.

3.2 PLC PROGRAMMING SERVICES

.1 General Requirements:

.1 Where program logic is required, program in a manner to make the program easy to follow and maintain.

.2 Where function block programming is required, insert comments into the program to clarify all items not readily apparent.

.3 Utilize commonly accepted good programming practices.

.4 Where function block programming is specified, utilize function blocks to encapsulate common systems and sections of code.

.5 Where creation of tags is required, all tag names are to be named and identified using positive logic. Where required, provide comments to clarify the states.

.6 Where PID control loops are required, tune PID control loops to provide steady and acceptable equipment operation.

.7 Where PLC generated alarms are required, configure alarms generated in the PLC into two types:

.1 Automatic reset alarms clear upon the alarm condition being removed. Provide logic as required to ensure that fast cycling of the alarm does not occur.

.2 Manual reset alarms require reset via the “Reset” pushbutton on the control panel.

.2 Provide all required PLC programming as per the Functional Requirements Specification.

.3 Program and configure the PLC using Schneider Electric Unity Pro.

3.3 PLC COMMISSIONING SERVICES

.1 Provide all required PLC commissioning services as per Section 40 80 11.

.2 Upon completion of commissioning, load latest software onto USB stick.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 All Control Panels shall be built by a CSA/cUL-approved manufacturer and shall bear the CSA/cUL seal with the manufacturer's file number.

.2 All Control Panels shall be factory assembled and pre-wired. The Control Panel wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

.3 Supply, install, wire and test all components inside the Control Panels according to the specifications herein and the drawings.

1.2 SUBMITTALS

.1 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 the 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 shall be performed at the discretion of the Contract Administrator at no additional charge based upon the pre-shipment submittals.

.2 If requested, demonstrate and test the control panel in presence of the Contract Administrator designated representative at no additional cost.

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 automation Drawings.

.2 All indoor control panels shall be NEMA 12 or as indicated on the 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 Enclosure brand shall be Hoffman or approved equal in accordance with B7.

2.3 POWER SOURCE

.1 Each power source must be protected by a CSA approved circuit breaker or fuse.

.2 The location of each power source shall be clearly shown.

.3 Panels powered by more than one 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 35 mm, 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 Mounting: TS-35 DIN rail.

.2 Voltage rating:

.1 600 V for general control circuits.

.2 600 V for power circuits.

.3 Manufacturer: Phoenix Contact or approved equal in accordance with B7.

.2 Terminal blocks shall be designed for the size of the wires to be connected to them. Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.3 Each terminal shall bear an identification number on both sides.

.4 Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The supplier must supply and install such components when required.

.4 Ground Bus Bar:

.1 Supply ground bus bar(s) 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 (1) wire termination per screw.

.5 Pushbuttons, Switches and Indicator Lights:

.1 When required, all control panel pushbuttons, switches and indicator lights shall be at least NEMA 12 (or better) type devices.

.2 Manufacturer to be Schneider Electric or approved equal in accordance with B7.

.6 Programmable Logic Controllers:

.1 As per section 40 94 43.

.7 Annunciator Light Panel:

.1 Lights: LED, Full Voltage, 30 x 30mm, colour and arranged as indicated on the Drawings, engraved text as indicated on the Drawings,

.2 Rating: 24 VDC,

.3 Approvals: CSA,

.4 Manufacturer: IDEC SLC30 series. No substitutions will be accepted.

.8 General Purpose Relays:

.1	Coil Voltage:	As indicated on the Drawings.
.2	Indication:	LED.
.3	Diode:	Provided.
.4	Contact arrangement:	As indicated on the Drawings
.5	Contact Rating:	5A (120 VAC), 5A (24 VDC).
.6	Approvals:	CSA.
.7	Manufacturer:	Omron or approved equal in accordance with B7.

.9 24 VDC Uninterruptible Power Supply:

.1	Input:	100 - 240 VAC.
.2	Output:	24 VDC, 10 A (adjustable 22.5-29.5 VDC).
.3	Monitoring outputs:	24 VDC, Alarm, Battery Mode, Battery Charge.
.4	Manufacturer:	Phoenix Contact QUINT-UPS/24DC/10 (2320225) or approved equal in accordance with B7.

.10 24 VDC External Battery Pack:

.1	Voltage:	24 VDC.
.2	Battery:	VRLA-AGM, 20 Ah,
.3	Manufacturer:	Phoenix Contact UPS-BAT/VRLA/24DC/20 AH (1348516) or approved equal in accordance with B7.
.4	Battery Mount:	Phoenix Contact, Mounting Case (1134645) or approved equal in accordance with B7.

.11 External Battery Enclosure:

.1	Protection:	NEMA 12
.2	Enclosure Mount:	Indoor, Wall
.3	Material:	Mild Steel
.4	Features:	As indicated on drawings
.5	Manufacturer:	Hoffman, A202010LP or approved equal in accordance with B7.

.12 Cellular Modem:

.1 Supplied by City.

.13 Antenna:

.1	Mounting:	Enclosure
.2	Connector:	SMA(M)

.3 Protection: IP67 Waterproof
.4 Feature: Dual 4G LTE/3G/2G MIMO
.5 Dimensions: Diameter 146 mm, Height 82 mm
.6 Operating Temperature: -40°C to 85°C
.7 Manufacturer: Red Lion/Pantheon, ANT-MA741ABI001 or approved equal in accordance with B7.

.14 Antenna Enclosure:

.1 Mounting: Field, Outdoors
.2 Material: Fibreglass
.3 Protection: NEMA 4X
.4 Features: As indicated on drawings
.5 Manufacturer: Hammond or approved equal in accordance with B7.

.15 PSTN Modem:

.1 Type: PSTN modem / Ethernet Switch.
.2 Protocol: PPP (point-to-point).
.3 Maximum Data Rate: 56 kbps.
.4 Compatibility: V.90, V.34, V.32, V.32 bis, V.22 bis, V.21.
.5 Ports:
.1 Ethernet:
.1 Quantity: 5.
.2 Speed: 10/100 Mbit (automatic negotiation).
.3 Connector: RJ45.
.2 Telephone:
.1 Line (input), Phone (output).
.2 Connector: RJ11.
.6 Supply Voltage: 24 VDC.
.7 Operating temperature: -40 to +75°C.
.8 Mounting: 35 mm DIN Rail.
.9 Approvals: CSA.
.10 Model: Phoenix Contact PSI-DATA/BASIC-MODEM/RS232 (2313067) or approved equal in accordance with B7.

.16 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.

.17 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 opposite side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.4 All wires and cables inside the control panels shall be identified on both ends with non-erasable markers.

.5 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels. Wrap-around or self-adhesive markers shall not be permitted.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.6 Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.7 The routing of all analog, digital, power, and networking wiring and cabling inside the control panels shall be segregated as much as possible by the type of signal they are carrying.

.8 All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.9 All analog twisted-pair wiring shall be 18 AWG shielded such as Belden No. 8760, or 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 wiring shall be 16 AWG TEW stranded conductor.

.11 All 120 VAC power wiring shall be 14 AWG TEW stranded conductor, minimum.

.12 All 24 VDC and 24 VAC power wiring shall be 12 AWG TEW stranded conductor, minimum.

.13 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.14 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door such that there is sufficient slack to minimize strand fatigue and breaking. Each end of the loop shall be properly supported.

.15 Ethernet Patch Cords:

.1 Requirements:

.1 Cat-6.

.2 Jacket colour: Blue.

.16 Wiring Duct:

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or 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.

.17 Wire ties shall be non-metallic.

.18 Wiring shall be arranged to be readily accessible for inspection and maintenance.

.19 The wiring arrangement shall not interfere with access to panel-mounted devices or spaces for future equipment.

.18 Overcurrent Protection

.1 Panel-mounted devices and all control circuits shall be protected by appropriately sized fuses or circuit breakers.

Part 3 Execution

3.1 COMPONENT INSTALLATION

.1 Components on the front of the panel shall be identified with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.2 Each component inside the control panel shall be identified with a nameplate corresponding to the Drawings.

.3 All non-DIN rail mountable devices in the control panel shall be mechanically affixed to the back panel with either tapped or self-tapping screws.

.4 All control devices shall be mounted so that any component can be replaced without removing the sub-panel or other components.

.5 Components and/or auxiliary instruments mounted at the rear of the panel shall be readily accessible and their installation shall not be affected by, or interfere with the removal of any panel instrument.

.6 Nameplates shall be made of 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. Provide a minimum of two (2) spare fuses of each fuse size.

.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 wire and terminal identification using a computerized device. Handwriting is not acceptable.

.2 Label wires and terminals as shown on drawings.

.3 Install label above each terminal block with terminal block name.

3.3 TESTING

.1 Testing of the control panels shall be completed to the greatest extent possible prior to the FAT, and shall include at minimum:

.1 Provide a signed and dated inspection sheet with all tests performed listed on it.

.2 The list of the various test procedures described hereunder is not restrictive, and does not relieve the control panel manufacturer of their responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.

.3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.

.4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.

.5 Tests to include:

.1 Power supply functionality.

.2 PLC component functionality.

.3 Point to point tests of all inputs and outputs.

.4 Power terminal voltage verification.

.5 Relays and switches functionality.

.6 Receptacle functionality.

.7 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 Contract Administrator and/or the City of Winnipeg.

3.5 SPARE COMPONENTS

.1 Supply two (2) 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, at least thirty (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 Materials

.1 Provide equipment, visual and audio aids, and materials necessary for training.

.2 Supply hardcopy binder manual for each trainee, describing in detail data included in each training program. Contract Administrator will provide number of trainee attendees.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.5 Training Program

.1 Operations Training:

.1	Location:	Bannatyne Flood Pumping Station.
.2	Duration:	Four (4) hours.
.3	Number of trainees:	Coordinate with Contract Administrator prior to training.
.4	Audience:	City of Winnipeg Operations and maintenance personnel.

.5 Content:

.1 General system overview.

.2 Description of system components.

.3 Presentation of the control panel and system operation.

.4 Presentation on the pump soft starters and system operation.

1.6 Monitoring Of Training

.1 Contract Administrator to monitor training program and may modify schedule and content for the Contractor at no additional cost.

Part 2 PRODUCTS

2.1 General

.1 Not Applicable.

Part 3 EXECUTION

3.1 Training

.1 Provide on-site training to City of Winnipeg personnel, as indicated above.

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 (1) year past Total Performance date.

.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 of Winnipeg when the system is not functioning correctly.

.2 Qualified control personnel shall be readily available to provide on-site service upon a critical failure, whenever required.

.1 A critical failure is the inability to operate of any critical system supplied by the Vendor.

.2 Critical systems include, but are not limited to:

.1 Communication networks,

.2 PLC system, and

.3 Instrumentation.

.3 Perform work continuously until system is restored to a reliable operating condition.

.4 Response Time:

.1 The response time to emergency service calls is to be less than four (4) hours.

.5 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 defects 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 of Winnipeg.

Part 2 Products

2.1 NOT APPLICABLE.

.1 Not applicable.

Part 3 Execution

3.1 NOT APPLICABLE.

.1 Not applicable.

END OF SECTION