Part 1 General

1.1 ADMINISTRATIVE

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

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

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

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

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

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

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

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

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

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

.10 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.

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

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

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

.1 Shoring
.2 Reinforcing Steel
.3 Metal Fabrications
.4 Stem Extensions.
.5 Structural Connection Details
.6 Prefabricated Wood Trusses
.7 Metal Roofing Systems

.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. Examination of each Shop Drawing shall be indicated by stamp, date and signature of a responsible person of the sub-contractor for supplied items and of the General Contractor for fabricated items. Shop Drawings not stamped, signed and dated will be returned without being reviewed and stamped "Re-submit". Ensure that the following are verified:

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

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

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

.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 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.

.5 Contractor to monitor the shoring for movement on a daily basis and provide a written weekly report showing the daily records to the Contract Administrator.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 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 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. A minimum of 6 ACH of continuous ventilation is required in below grade drywell areas.

.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 as required for temporary pumping, construction power, lighting, and other requirements during shutdowns.

.2 The existing power supply may be utilized for power, provided that there are no operational impacts associated with the use of the power. Maintain sufficient power for pump operation at all times.

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

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

1.7 TEMPORARY COMMUNICATION FACILITIES

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

1.8 FIRE PROTECTION

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

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

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.

.1 Ensure that access and parking for a minimum of one truck is provided adjacent to the wastewater pumping station, for use 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 FACILITY ELECTRICAL SUPPLY AND DISTRIBUTION

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

1.11 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.

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

Part 2 Products

.1 Not Used.

Part 3 Execution

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.2 HOARDING

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

1.3 GUARD RAILS AND BARRICADES

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

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

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

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

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Conform to reference standards, in whole or in part as specifically requested in 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 Shop Drawings and cutsheets of all equipment and materials,

.1 Do not utilize the shop drawing submittals as these may have been marked “Reviewed as Noted” and would therefore have inaccurate information. Provide “clean” cutsheets without review comments.

.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.

.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 Canadian Standards Association (CSA International)

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

1.2 SUBMITTALS

.1 Product Data:

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

.2 Shop Drawings :

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

Part 2 Products

2.1 MASONRY UNITS

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

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

2.2 REINFORCEMENT AND CONNECTORS

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

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

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

2.3 MORTAR AND GROUT

.1 Mortar: to CSA A179.

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

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

.2 Mortar Type: S 25 MPa strength,

.3 Grout: to CSA A179, Table 3.

2.4 ACCESSORIES

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

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

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

Part 3 Execution

3.1 INSTALLATION

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

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

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

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

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

3.2 CONSTRUCTION

.1 Exposed masonry:

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

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

.2 Building-In:

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

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

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

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

.5 Install loose steel lintels over openings where indicated.

.3 Concrete block lintels:

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

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

.4 Support of loads:

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

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

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

.5 Provision for movement:

.1 Leave 3 mm space below shelf angles.

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

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

.6 Interface with other work:

.1 Cut openings in existing work as indicated.

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

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

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

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

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

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

.2 For concrete backing, insert flashing into reglets.

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

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

.3 Lap joints 150 mm and seal with adhesive.

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

3.3 REINFORCING AND CONNECTING

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

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

3.4 BONDING AND TYING

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

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

3.5 REINFORCED LINTELS AND BOND BEAMS

.1 Reinforce masonry lintels and bond beams as indicated.

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

3.6 GROUTING

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

3.7 ANCHORS

.1 Supply and install metal anchors as indicated.

3.8 LATERAL SUPPORT AND ANCHORAGE

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

3.9 SITE TOLERANCES

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

3.10 FIELD QUALITY CONTROL

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

3.11 CLEANING

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

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

3.12 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

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

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

.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).

.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 CAN/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.

.8 Isolating Sleeves

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

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

.10 Hot Dipped Galvanized Steel Repair Material

.1 Galvalloy and Gal-Viz

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

.12 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.

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

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

.15 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 CAN3-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 Top coat 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: Shop painted to Section 099123 - Painting, colour as shown on drawings or as directed by the Contract Administrator. Touch up as required after installation.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate.

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

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

3.2 ERECTION

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

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

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

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

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

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

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

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

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

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

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

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

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

3.3 PIPE RAILINGS

.1 Install pipe railings as indicated.

3.4 ACCESS LADDERS

.1 Install access ladders in locations as indicated.

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

3.5 CHANNEL AND HSS ACCESSORIES

.1 Install steel channel frames to openings as indicated.

3.6 CLEANING

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

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

3.7 PROTECTION

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

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

END OF SECTION

Part 1 General

1.1 REFERENCES

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

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

.2 Canadian Gas Association (CGA).

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

.3 Canadian General Standards Board (CGSB)

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

.4 Underwriters Laboratories of Canada (ULC).

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

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

- .1 Material Safety Data Sheets (MSDS).

1.2 SUBMITTALS

.1 Product Data:

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

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

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

Part 2 Products

2.1 INSULATION

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

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

2.2 ACCESSORIES

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install insulation after building substrate materials are dry.

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

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

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

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

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

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

3.3 EXAMINATION

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

.2 Prior to commencement of work ensure:

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

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

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

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

1.2 SUBMITTALS

.1 Product Data:

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

.1 Product characteristics.

.2 Performance criteria.

.3 Limitations.

.2 Quality assurance submittals:

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

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

Part 2 Products

2.1 SHEET VAPOUR BARRIER

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

2.2 ACCESSORIES

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

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

.3 Staples: minimum 6 mm leg.

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

Part 3 Execution

3.1 INSTALLATION

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

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

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

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

3.2 EXTERIOR SURFACE OPENINGS

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

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.4 LAP JOINT SEALS

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

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.5 ELECTRICAL BOXES

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

.1 Install moulded box vapour barrier.

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

3.6 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI).

.1 ANSI B18.6.4, Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws.

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

.1 ASTM D2369, Test Method for Volatile Content of Coatings.

.2 ASTM D2832, Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.

.3 ASTM D5116, Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.4 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.5 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-93.2, Prefinished Aluminum Siding, Soffits and Fascia, for Residential Use.

.3 CAN/CGSB-93.3, Prefinished Galvanized and Aluminum-Zinc Alloy Steel Sheet for Residential Use.

.4 CAN/CGSB-93.4, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.

.5 CGSB 93.5, Installation of Metal Residential Siding, Soffits and Fascia.

.4 Canadian Standards Association (CSA International).

.1 CSA B111, Wire Nails, Spikes and Staples.

.5 Underwriters' Laboratories of Canada (ULC).

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

1.2 SUBMITTALS

.1 Product data: submit manufacturer's printed product literature, specifications and data sheets.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

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

Part 2 Products

2.1 SOFFIT & EXPOSED TRIM

.1 Soffit: to CAN/CGSB-93.2, Type B, Class 1, colour to be selected from manufacturer's standard colours, medium gloss, plain pattern surface, flat sheet 'V' crimped for stiffness, vented 0.1 m² of opening for every 30 m² of building area preformed with elongated slits and small perforations.

.2 Exposed trim: inside corners, outside corners, starter strip and trim of same material, colour and gloss as soffit, with fastener holes pre-punched.

2.2 WALL PANEL FACADE & EXPOSED TRIM

.1 Wall panels: 36" (914mm) coverage with 1.5" (38mm) deep major ribs at 6" (150mm) o/c. CL6025 as manufactured by VicWest Steel or EliteRib as manufactured by Westman Steel, or approved equal in accordance with B7. Install in horizontal orientation.

.2 Fabricated from 24 gauge galvanized sheet steel, ASTM A653M, Grade 230 or higher, with Z275 zinc coating.

.3 Fabricated from 24 gauge galvalume sheet steel, ASTM A792M, Grade 230 or higher, with AZ150 or higher aluminum-zinc coating

.4 Finish: pre-painted with colours of proven durability for exterior exposure, Perspectra-Plus, WeatherXL, or approved equal paint system. Colour to be selected from manufacturer's standard range

.5 Exposed trim: inside corners, outside corners, starter strip and trim of same material, colour and gloss as wall panel.

2.3 FASTENERS

.1 Nails: to CSA B111, aluminum alloy, of type recommended by manufacturer, colour matched to soffit.

.2 Screws: Minimum #12 size, colour matched to wall panel, c/w integral neoprene washers.

2.4 CAULKING

.1 Sealants: in accordance with manufacturer's recommendations.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install soffit in accordance with CAN/CGSB-93.5M, and manufacturer's written instructions.

.2 Install continuous starter strips, inside and outside corners, trim, and flashings.

.3 Maintain joints true to line, tight fitting, hairline joints.

.4 Attach components in manner not restricting thermal movement.

.5 Install outside corners, fillers and closure strips with carefully formed and profiled work.

.6 Install soffit and fascia cladding as indicated.

.7 Caulk junctions with adjoining work with sealant.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Aluminum Association (AA).

.1 AA DAF-45, Designation System for Aluminum Finishes - 9th Edition.

.2 AA ASM-35, Specifications for Aluminum Sheet Metal Work in Building Construction, Section 5.

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

.1 ASTM A167, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.5 ASTM B32, Standard Specification for Solder Metal.

.6 ASTM B370, Standard Specification for Copper Sheet and Strip for Building Construction.

.7 ASTM D523, Standard Test Method for Specular Gloss.

.8 ASTM D822, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-37.5, Cutback Asphalt Plastic Cement.

.2 CAN/CGSB-37.29, Rubber-Asphalt Sealing Compound.

.3 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.

.4 CAN/CGSB-93.1, Sheet Aluminum Alloy, Prefinished, Residential.

.4 Canadian Standards Association (CSA International).

.1 CAN/CSA A123.3, Asphalt Saturated Organic Roofing Felt.

.5 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC).

.1 CCMC, Registry of Product Evaluations.

1.2 SUBMITTALS

.1 Submit product data sheets.

.2 Submit shop drawings sealed by an Engineer registered in the Province of Manitoba indicating arrangements of sheets and joints, types and locations of fasteners and special shapes and relationship of panels to structural frame, and anchorage details to the Contract Administrator for review prior fabrication and installation.

.3 Prefinished roof deck supplier to design connections to substructure for 2.0 kPa uplift, or as required by NBCC if greater.

.4 Roof system fabricator is responsible for complete design and engineering of snow/ice guard system for sheet metal roofing. Guards shall be finished to match roof panels.

1.3 QUALITY ASSURANCE

.1 Roofing Contractor must be a member in good standing with the Roofing Contractors Association of Manitoba.

.2 The contractor is responsible for ensuring that the design, supply and total installation of this project are supervised and executed by fully trained and qualified personnel.

.3 Installer shall demonstrate at least five years experience in projects similar in scope.

.4 The materials and installation shall meet the applicable standards of the National Building Code, Underwriters Laboratories of Canada (ULC), the Canadian Standards Association (CSA) and any other applicable codes, standards and by-laws.

.5 Written confirmation of conformance with these standards shall be provided to The City.

1.4 GUARANTEE

.1 Provide a written guarantee, signed and issued in the name of The City of Winnipeg stating that the entire roofing system is guaranteed against leaking for a period of two (2) years from the date of completion.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Marquis 450 roof panels as manufactured by VicWest Steel or approved equal in accordance with B7 .

.2 Snap-Loc roof panels with ribs at 16” (450mm o/c) as manufactured by Westman Steel or approved equal in accordance with B7.

.3 Roof panels:

.1 Fabricated from 24 gauge galvanized sheet steel, ASTM A653M, Grade 230 or higher, with Z275 zinc coating.

Fabricated from 24 gauge galvalume sheet steel, ASTM A792M, Grade 230 or higher, with AZ150 or higher aluminum-zinc coating.

.2 Finish: pre-painted with colours of proven durability for exterior exposure, Perspectra-Plus, WeatherXL, or approved equal paint system. Colour to be selected from manufacturer’s standard range.

.3 Colour sample to be approved by Contract Administrator.

.4 Metal flashings, trim, closures exposed to view: prefinished steel sheet of same gauge and finish as roof panels.

.5 Sheet metal accessory components not exposed to ground level view: galvanized steel sheet, minimum 24 gauge.

.6 Screws anchors: as recommended by roofing supplier. Use galvanized anchors, with length and size to meet roof system design.

.7 Deck closures: gauge and profile as recommended by manufacturer

2.2 WATERPROOF MEMBRANE

.1 Self-adhesive, modified bitumen sheet, minimum 1 mm (40 mils) thick, non-slip surface. Acceptable material: IKO Armour Gard Ice and Water Protector, W.R. Grace Ice and Water Shield; Domtar Eaveshield; Nordshield Water Stopper; Bakor Eave Guard; BPCO ProGard; EMCO Gripgard, or approved equal in accordance with B7.

2.3 FASCIA, GUTTERS AND DOWNSPOUTS

.1 Form fascia and trim of prefinished steel sheet of same material, thickness, and finish. Colour to be selected from manufacturer's standard range.

.2 Form gutters and downspouts of prefinished steel sheet of same material, thickness, finish and colour as roof panels, conforming to sizes and profiles indicated. Seal joints against leakage. Colour to be selected from manufacturer's standard range.

.3 Provide goosenecks, outlets and necessary fastenings.

.4 For open type downspouts where indicated, fabricate of prefinished steel sheet with same finish and colour on both sides of sheet. Colour to be selected from manufacturer's standard range. Submit samples to Contract Administrator for review prior to ordering material

.5 Gutter hangers, purpose made, concealed type. Spikes and ferrules not permitted.

Part 3 Execution

3.1 WATERPROOF MEMBRANE INSTALLATION

.1 Install self-adhesive membrane in accordance with manufacturer's instructions.

.2 Roll out sheets and press firmly to substrate. As installation progresses roll with hand roller to ensure positive bond.

.3 Set first course along eaves. Overlap each succeeding course over lower. Side and end laps minimum 75 mm. Ensure full bond to roof deck and sealed at side and end laps. Avoid excessive bubbles and fish mouths.

.4 Flash and seal around openings and items penetrating roof deck. Cut and fit membrane neatly and snug fitting, leave no gaps. Seal with mastic sealant. Make water tight.

3.2 METAL ROOFING INSTALLATION

.1 Install metal roofing system in strict accordance with reviewed shop drawings and manufacturer's instructions.

.2 Install factory manufactured panels in longest practical lengths with special panels to suit valleys and penetrations. Provide a continuous locked seam, mechanically locking the hold down clips into the seam.

.3 Design of roofing system to provide for differential movement between the new roofing system of the existing structure and the new roofing system of the addition.

.4 Provide notched and formed closures, to shed water, at changes in pitch and at peaks, ridges and eaves.

.5 Remove all drillings, filings, and cuttings immediately from roof as work progresses to prevent damage to installed panels and trims.

3.3 FIELD QUALITY CONTROL

.1 Inspection of roof application may be carried out by an independent agency selected by the Contract Administrator.

.2 Notify inspection agency minimum 48 hrs. prior to commencing roofing operations to arrange inspections. Permit agency full access to all portions of work.

.3 Note that the last inspection is to be a “final inspection”, carried out after all roofing is complete, including installation of equipment and openings, and shall be in the presence of the Contract Administrator and the Contractor.

3.4 TOUCH-UP AND CLEANING

.1 Touch up minor paint abrasions with touch-up paint provided by roof panel manufacturer to match colour of roof panels.

.2 Clean roof by dry-wiping.

.3 Leave job site completely clean.

END OF SECTION

Part 1 General

1.1 Work Included

.1 Prefinished Metal Caps, Transition, Drip, Gable, Valley, Eave and associated flashings.

1.2 REFERENCES

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

.1 ASTM A653/A653M-[07], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.

.2 Canadian Roofing Contractors Association (CRCA)

.1 Roofing Specifications Manual [1997].

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-[M77], Sheathing, Membrane, Breather Type.

1.3 Existing Conditions/Protection

.1 Exercise care when working on or about roof surfaces to avoid damaging or puncturing membrane or flexible flashings.

.2 Place plywood panels on roof surfaces to Work of this section and access routes. Keep in place until completion of work.

1.4 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.

.4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.2 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.

1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with contractor's representative and the Contract Administrator.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Store covered, off ground and handle by methods that prevent damage from twisting, bending and rubbing.

.3 Protect flashings and finish from impact and scraping. Cover surfaces susceptible to damage.

1.7 Job Conditions

.1 Prevent damage to adjoining wall surfaces and roofing.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Zinc coated steel sheet: Minimum 24 gage, commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

.2 Aluminum-Zinc coated steel sheet: Minimum 24 gage, commercial quality to ASTM A792/A792M, with AZ150 or higher designation zinc coating.

2.2 PREFINISHED STEEL SHEET

.1 Minimum 24 gage, commercial quality Sheet Metal Material (zinc or aluminum-zinc as above), pre-painted with colours of proven durability for exterior exposure, Perspectra-Plus, WeatherXL, or approved equal paint system. Colour to be selected from manufacturer’s standard range.

2.3 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint. “Top services Thick Black” by Glidden

.2 Rubber –asphalt sealing compound : conforming to requirements of CGSB 37 – GP-5M.

.3 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

.4 Fasteners: of same material as sheet metal, to CSA B111, ring thread/ flat head roofing nails of length and thickness suitable for metal flashing application.

.5 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.6 Solder: to ASTM B32, alloy composition 50% Tin and 50% lead .

.7 Flux: Commercial quality as recommended by sheet metal manufacturer

.8 Underlay for Metal Flashing: No.15 asphalt felt in accordance with CSA A123.3-M.

.9 Touch-up paint: as recommended by prefinished material manufacturer.

.10 Joint Sealant : install joint sealant in accordance with Specification 079210

2.4 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details as indicated.

.2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints with “S” lock seams maintaining a 22 mm lap on all joints .

.3 Hem exposed edges on underside 13 mm. Mitre and seal corners with sealant.

.4 Fabricate cap flashings to lap 100 mm over base flashings.

.5 All sections to be flat lock type except corners. Fabricate corners minimum 460 mm, mitred, soldered or welded as one piece.

.6 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.7 Provide gravel stops with 125 mm minimum deck flange and 110 mm minimum fascia.

.8 Form gum boxes from 0.71 mm galvanised steel with 75 mm minimum upstand and 100 mm one piece flanges. Solder joints. Make pans wider than member passing through roof membrane by 50 mm minimum on all sides.

.9 Supply splash pans from 0.71 mm galvanised steel.

.10 Fabricate roof scuppers from 0.71 mm pre-painted galvanised sheet steel with one piece deck flange 150 mm minimum. Contour scupper to cant strips.

.11 Backpaint flashing with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

Part 3 Execution

3.1 EXAMINATION

.1 A Prior to commencing installation, thoroughly examine other work upon which this Work is dependent. Report any deficiencies discovered, propose adjustments to the engineer and obtain written authorization before proceeding.

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.2 Back-paint sheet metal with bituminous isolation coating on surfaces in contact with concrete, masonry cementitious materials or dissimilar metal.

.3 Set flashings in place not later than seven days after installation of the membrane on any particular section of the roof.

.4 Install flashings with maximum distances between joints of 1200 mm for parapet face flashings, 1200 mm for cap flashings, 300 mm wide or greater on the top surface, and 2400 mm for all other flashings.

.5 Insert metal flashings into reglets to form tight joint and caulk into reglet with sealant compound.

.6 Fasten flashings using 0.75 mm thick by 150 mm long anchor clips on the fascia face and screws or annular ringed nails on the opposite face.

.7 Fasten flashings up to 1200 mm in length with galvanised steel clips through the extended "S" locks and in addition at mid length for flashings over 1200 mm in length.

.8 Fit flashings together so that one end of each section is free to move in the joint.

.9 Locate flashing screws at 200 mm minimum above roof membrane.

.10 Fill gum boxes with plastic cement in two equal lifts and separate lifts with one ply of organic felt, precision cut to fit box.

.11 Apply two plys of organic felt stripping over flanges of gum box and extend down face of curb. Reinforce stripping with a 2 ply of woven glass cloth.

.12 Bed and secure in place 0.71 mm thick, 600 mm x 600 mm x 25 mm high lip, galvanised steel splash pans to roof with hot asphalt at end of downspouts spilling out on roof.

.13 Set gravel stop in place with nails on bed of plastic cement. Apply a strip of organic felt in plastic cement over gravel stop. Mop over a second strip of organic felt reinforced with 2-ply glass cloth.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

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

3.5 CLEANING

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

.2 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 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.

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.

.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.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

- .1 ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM B29, Specification for Refined Lead.
- .3 ASTM B749, Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .2 CGSB 41-GP-19M, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

- .1 G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .2 CSA W59, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association, (CSDMA).

- .1 CSDMA, Specifications for Commercial Steel Doors and Frames.
- .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors.

.5 National Fire Protection Association (NFPA)

- .1 NFPA 80, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

- .1 CAN4-S104, Fire Tests of Door Assemblies.
- .2 CAN4-S105, Fire Door Frames Meeting the Performance Required by CAN4-S104.

.7 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

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

.9 CAN/ULC-S704, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 DESIGN REQUIREMENTS

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M for ratings specified or indicated.

1.3 SHOP DRAWINGS

.1 Submit shop drawings sealed by an engineer registered in the Province of Manitoba clearly indicating each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware, fire rating and finishes.

Part 2 Products

2.1 MATERIALS

.1 Fabrication Standards Fabricate doors and frames to Canadian Manufacturing Specification for Steel Doors and Frames, except where specified otherwise.

.2 Steel: Commercial grade steel to ASTM A568-81, Class 1, hot-dip galvanized to ASTM A527-80.

2.2 DOOR CONSTRUCTION

.1 Insulated core, welded seam: For exterior use. Reinforced construction. Provide urethane foam insulated cores to R.S.I. of 1.76 (R=10). Laminated by adhesive to face sheets. Reinforced for hardware.

.2 Component part thickness: 1.2 mm (18 gauge).

2.3 FRAME CONSTRUCTION

.1 Mitred or mechanically jointed and continuously welded on the inside of the profile. Welded joints to be ground to a smooth uniform finish.

.2 Component part thickness: 1.6 mm (16 gauge).

.3 Butt joints of mullions and transoms: accurately cope, securely weld and grind smooth.

.4 Blank, reinforce, drill and tap for mortised butts and strike. Protect cut-outs in masonry and concrete with mortar guard boxes. Reinforce for surface mounted hardware. Prepare each door for rubber bumpers, two for double door openings.

.5 Top hinge reinforcement: weld in top hinge reinforcement with 20mm leg to hinge reinforcement, 25mm to frame.

.6 Insulation: provide foam-in insulation in all exterior frame cavities.

2.4 DOOR HARDWARE

.1 Hinges CB1960 114 x 102 NRP 630 Stanley

.2 Passage Set D10S 626 Schlage

.3 Deadbolt B860 626 Schlage (tamperproof "Medeco" cylinder – keyed to match City requirements).

.4 Flushbolts FB6 626 Glynn Johnson

.5 Weatherstrip 770C Reese

.6 Sweep Seals 773C Reese

.7 Astragal 275C Reese

.8 Threshold S205A Reese

.9 Door Stop/Holder F26 626 Glynn Johnson

2.5 FRAME ANCHORS

.1 Frames for installation shall be provided with minimum four steel anchors of suitable design.

2.6 KEYING

.1 Keys to match The City's existing "Medeco" system. The City to provide lock number before keying.

.2 Provide The City with keys in triplicate for every lock.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.2 DOOR INSTALLATION

.1 Install doors and hardware in accordance with templates and manufacturer's instructions.

.2 Adjust operable parts for correct function.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation. Secure anchorages and connections to adjacent construction.

.2 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after

frames are built-in. Make allowances for deflection of structure to ensure structural loads are not transmitted to frames

.3 Caulk perimeter of frames between frame and adjacent material.

.4 Maintain continuity of air barrier and vapour retarder.

3.4 FINISH

.1 Paint doors and frames in accordance with Section 09 91 23 - Painting in colour approved by Contract Administrator.

3.5 FINISH REPAIRS

.1 Touch up finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

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 to be white.

.5 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 SECTION INCLUDES

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

- .1 Hard drawn copper for domestic water services and seal water piping inside building.
- .2 Soft copper tubing inside building.

.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) - 2010.

.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 PIPING

.1 Domestic water piping systems within building.

.1 Above ground: copper tube, hard drawn, type K to ASTM B88M.
.2 Buried, embedded, final connection to pump seal water: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

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

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

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

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

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

2.3 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.

2.4 GATE VALVES

.1 NPS 2 and under, soldered:

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

.2 NPS 2 and under, screwed:

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

2.5 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.

2.6 SWING CHECK VALVES

.1 NPS 2 and under, soldered:

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

.2 NPS 2 and under, screwed:

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

.2

2.7 BALL VALVES

.1 NPS 2 and under, screwed:

.1 Class 150.

.2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and 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 REFERENCES

.1 American Water Works Association (AWWA).

.1 AWWA C511-17, 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 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: Apollo, Watts or approved equal in accordance with B7.

2.2 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.

2.3 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 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.

3.4 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.5 STRAINERS

.1 Install with sufficient room to remove basket.

3.6 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.

3.7 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 weatherstripping, 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 B209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.2 ASTM C449/C449M-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.

.3 ASTM C553-13, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

.4 ASTM C612-14, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

.5 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 Mineral fibre: fibreglass type RFFRK rigid duct insulation, 50mm thickness.

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 IDENTIFICATION

.1 Provide in accordance with Section 23 05 54 - Mechanical Identification.

Part 3 Execution

3.1 UNIT HEATER UH-U64 & UH-U68 CONTROL

.1 Execution requirements for unit heater controls are specified in Section 40 92 00.

3.2 ELECTRIC DUCT HEATERS HCE-U62 AND HCE-U65 CONTROL

.1 Execution requirements for electric duct heater HCE-U62 and HCE-U65 control are specified in Section 40 92 00.

3.3 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 for piping, valves and fittings for gas fired equipment.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5, Pipe Flanges and Flanged Fittings.

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

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

.4 ASME B18.2., Square and Hex Bolts and Screws Inch Series.

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

.1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.

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

.3 ASTM B75M, Standard Specification for Seamless Copper Tube [Metric].

.4 ASTM B837, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.

.3 Canadian Standards Association (CSA International)

.1 CSA W47.1, Certification of Companies for Fusion Welding of Steel.

.4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)

.1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.

.2 CAN/CSA B149.2, Propane Storage and Handling Code.

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

.1 Material Safety Data Sheets (MSDS).

1.3 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 piping, fittings and equipment.

.2 Indicate on manufacturer’s catalogue literature following: valves.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

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

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 NATURAL GAS SERVICE

.1 Arrange with the local utility for the modification of a gas service to 34.5 kPa supply pressure. Pay applicable fees and assessments relative to modifying the service and establish clearly with the utility the work to be completed by this section.

.1 Manitoba Hydro Contact: Sonny Tacdiran
Gas Projects Energy Services Advisor
204 360 5174
stacdiran@hydro.mb.ca

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:

.1 NPS 1/2 to 2, screwed.
.2 NPS2 1/2 and over, plain end.

.2 Copper tube: to ASTM B837.

2.2 JOINTING MATERIAL

.1 Screwed fittings: pulverized lead paste.

.2 Welded fittings: to CSA W47.1.

.3 Flange gaskets: nonmetallic flat.

.4 Brazing: to ASTM B837.

2.3 FITTINGS

.1 Steel pipe fittings, screwed, flanged or welded:

.1 Malleable iron: screwed, banded, Class 150.
.2 Steel pipe flanges and flanged fittings: to ASME B16.5.
.3 Welding: butt-welding fittings.
.4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
.5 Bolts and nuts: to ASME B18.2.1.
.6 Nipples: schedule 40, to ASTM A53/A53M.

.2 Copper pipe fittings, screwed, flanged or soldered:

.1 Cast copper fittings: to ASME B16.18.

.2 Wrought copper fittings: to ASME B16.22.

2.4 VALVES

.1 Provincial Code approved, lubricated plug type.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PIPING

.1 Install in accordance with applicable codes, CAN/CSA B149.1, supplemented as specified.

.2 Install drip points:

.1 At low points in piping system.

.2 At connections to equipment.

3.3 VALVES

.1 Install valves with stems upright or horizontal unless otherwise approved by Contract Administrator.

.2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 PAINTING

.1 Natural gas piping to be painted yellow in accordance with Section 09 91 23 - Painting.

3.5 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

.2 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports, in acceptable format, to verify compliance of work with Contract.

.3 Obtain reports within three (3) days of review and submit immediately to Contract Administrator.

3.6 ADJUSTING

.1 Purging: purge after pressure test in accordance with CAN/CSA B149.1.

.2 Pre-Start-Up Inspections:

.1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.

.2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.7 CLEANING

.1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems CAN/CSA B149.1 supplemented as specified.

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation 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 A480/A480M-15, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-15, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.4 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

.1 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 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.

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")

.2 All duct supports and accessories in the Wet Well: 304 stainless steel.

.3 Metal supports in contact with stainless steel outside the Wet Well: galvanically isolated from the stainless steel.

Part 3 Execution

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 iinstalled in accordance with the recommendations of the SMACNA Low Velocity Ductwork Standards. Double thickness turning vanes installed in all 90^{o} 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

Part 1 General

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, 2006.

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 wet 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 Fabricate from the same material as duct.

.2 Opposed blade: symmetrical about pivot point.

.3 Maximum blade height: 100 mm.

.4 Bearings: 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 double clevis arms with 4.8 x 19 tie bars pivoting on 9.5 mm diameter pivot pins with lock type retainers.

.6 Blade Seals: TPE, mechanically attached to blade.

.7 Channel frame: 16 ga. hat channel

.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.

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.

.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 Electronic Commutation type motor (ECM) (as per schedule)

.1 Motor enclosure: Open type.

.2 DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.

.3 Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.

.4 Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.

.5 Motor speed controllable down to 20% of full speed (80% turndown).

.6 Speed controlled by a factory supplied, two speed controller, each discreet speed adjusted by a potentiometer.

.2 Induction

.1 Motor enclosure: TEFC.

.2 Permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the scheduled voltage and phase.

.6 Disconnect Switch

.1 By Division 26.

.2 Inline Centrifugal

.3 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.

.5 Utility Centrifugal

.1 Housing

.1 Discharge position specified on equipment schedule.

.2 Constructed of heavy gauge galvanized steel, painted steel, or aluminum with air tight lock formed seams.

.3 Shall be easily rotated in the field to any of the eight standard discharge positions.

.2 Housing Supports and Drive Frame

.1 Housing supports are constructed of heavy gauge galvanized or painted steel with formed flanges.

.2 Drive frame is constructed of heavy gauge galvanized or painted steel to support the motor and provide reinforcement for the housing.

.3 Prepunched mounting holes for installation.

.3 Access Door

.1 Bolted.

.2 Provides access for inspection and cleaning of wheel.

.4 Drain Connection

.1 Threaded.

.2 Provided to drain moisture from the bottom of the fan housing.

.5 Shaft Seal

.1 Shaft seal is on aluminum rub ring which seals around the shaft.

.6 Isolation

.1 Neoprene mount

.6 Acceptable materials: Greenheck, Cook, Twin City, 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 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 SUMMARY

.1 Section Includes:

.1 Outdoor air and exhaust louvers for commercial and industrial use.

1.2 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.

1.3 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.

1.4 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 Louvers

.1 General

.1 Louvers as specified on drawings or in schedules.

.2 All diffusion equipment shall be rigidly constructed with rubber gaskets installed to prevent leakage between the outlet and duct.

.2 Size: as per schedule.

.1 Construction:

.1 Extruded aluminum, alloy, 6063-T5, minimum 2.0 mm thick, welded.

.2 Blades: 38 mm thick, stationary, straight profile.

.3 Insect screen" 18 x 16 x 0.3 mm aluminum, removable.

.3 Finish:

.1 Mill finish.

.4 Performance:

.1 Designed to withstand 120 Pa wind load (equiv. to 160 kph wind).

.2 Free area: 65% or greater.

.5 Acceptable materials: Price, Ventex, Titus 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 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, registers and diffusers of same generic type, products of one manufacturer.

2.2 SUPPLY GRILLES AND REGISTERS

.1 General: General: Single deflection register with opposed blade dampers operable from register face, same material as register.

.2 Types A, B, C

.1 Material: stainless steel

.2 Border: stainless steel, 32 mm, all welded construction.

.3 Blades: deflection as per schedule, horizontal face bars.

.4 Finish: mill.

.5 Balance damper; opposed blade, stainless steel, as per schedule.

.6 Acceptable materials: Price, Nailor or approved equal in accordance with B7.

.3 Type D

.1 Material: steel

.2 Border: steel, 32 mm.

.3 Blades: single deflection, 45 degrees, horizontal face bars.

.4 Finish: White powder coat.

.5 Acceptable materials: Price, Nailor, Titus, Tuttle, and Bailey 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.

.2 Type C:

.1 Fasteners: oval head cadmium plated screws in countersunk holes where fastenings are visible.

.3 Type A,B:

.4 Fasteners: stainless steel screws in countersunk holes.

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 52.1- [1992], Gravimetric And Dust Spot for Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.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- [M80], "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.

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: 50 mm.

.6 Acceptable material: Camfil Farr 30/30 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.

.2 Related Sections:

.1 Section 01 33 00 - Submittal Procedures.
.2 Section 26 05 00 - Common Work Results - for Electrical.

1.2 SUBMITTALS

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

.2 Submit product data and include:

.1 Heater: total kW rating, voltage, phase.
.2 Number of stages.
.3 Rating of stage: rating, voltage, phase.
.4 Heater element watt/density and maximum sheath temperature.
.5 Maximum discharge temperature.
.6 Physical size.
.7 Unit support.
.8 Performance limitations.
.9 Clearance from combustible materials.
.10 Internal components wiring diagrams.
.11 Minimum operating airflow.
.12 Pressure drop at operating airflow.

Part 2 Products

2.1 DUCT HEATERS

.1 Duct heaters: flange type.

.2 Capacity: as per schedule.

.3 Elements: as per schedule.

.4 Size: as per schedule.

.5 Cabinet: galvanized steel.

.1 Frame shall be corrosion-resistant and made of galvanized steel of suitable gauge as required by CSA. Coils shall be made of high grade Nickel-Chrome alloy and shall be insulated by floating ceramic bushings from the frame. Coil terminal

pins shall be in stainless steel, mechanically secured and insulated from the frame by means of non-rotating ceramic bushing

.6 Controls:

.1 Factory mounted and wired in control box. Use terminal blocks for power and control wiring to temperature controller.

.2 Magnetic contactors.

.3 Control transformers.

.4 SCR controller; heater to modulate based on a 0 – 10V input.

.7 Electrical:

.1 CSA or ULc approved and bears the label.

.2 Fail safe, automatic reset and manual reset disc-type thermal cut-outs. Cut-outs shielded from accidental impact and de-energize the heater in case of insufficient airflow.

.3 Magnetic contactors, factory wired 24V transformer.

.4 Main disconnect switch supplied by Division 26.

.5 NEMA 1 enclosure.

.8 Heating unit shall be equipped with magnetic contactors as required, factory-wired 24 volts transformer, airflow sensor, built-in modulating controller and sensor, disconnect switch and protective screen.

.9 Frame shall be corrosion-resistant and made of galvanized steel of suitable gauge as required by CSA. Coils shall be made of high grade Nickel-Chrome alloy and shall be insulated by floating ceramic bushings from the frame. Coil terminal pins shall be in stainless steel, mechanically secured and insulated from the frame by means of non-rotating ceramic bushing.

.10 Acceptable materials: Price, Nailor, Thermolec, Titus or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Install heater in accordance with manufacturer's instructions.

.2 Make power and control connections to CSA C22.2 No.46.

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.
- .7 Limitations.
- .8 Colour and finish.

.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 HEATERS

.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 24 VAC, mechanical.

.4 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: Ouellet OAS or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Suspend unit heaters from ceiling or mount on wall as indicated.

.2 Install thermostats in locations indicated.

.3 Make power and control connections.

3.2 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 requirements of Division 1.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1-2018 except where specified otherwise.

.2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

1.3 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for 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.

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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 to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

1.7 ELECTRICAL EQUIPMENT MODIFICATION

.1 Where electrical equipment is field modified, arrange for special inspection and pay all associated fees.

1.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.9 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic lamicoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

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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 and branch circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.11 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.12 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and the Contract Administrator.

.2 Lamicoid 3 mm thick plastic engraving sheet, red face, white core, mechanically attached with self tapping screws, 20mm text.

1.13 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: 432 x 279 mm minimum size.

.2 Drawings:

.1 1-0304U-E0002 Single Line Diagram

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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 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 50mm 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.

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 Division

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.

.3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.

.4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

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.5 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

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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 or RWU90.

.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, 1000V.

.4 Inner jacket: polyvinyl chloride material.

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.5 Armour: interlocking aluminum.

.6 Overall covering: polyvinyl chloride material.

.7 Fastenings:

.1 One hole malleable iron / steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. 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 explosionproof seal.

.6 All metal-clad cable fittings, for jacketed and non-jacketed interlocked armour cable, shall incorporate an easily-removable armour stop

.7 (not requiring fitting disassembly) ensuring proper positioning of the cable armour during cable termination.

.8 Approved products:

.1 T&B Startech XP series or approved equal in accordance with B7.

2.3 ACIC/CIC CONTROL CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

.2 Conductors, copper, size as indicated.

.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 minute. Investigate resistances less than 50 megaohms, or deviations between parallel conductors. Conductors with insulation resistance values, at one minute, less than 25 megaohms, or that deviate from other similar conductors by more than 50% will be rejected.

3.4 INSTALLATION OF CONTROL CABLES

.1 Ground shields at one end only. Where possible, ground shields at the end where power is supplied to the cable. Utilize shield grounding bar in panels, where present, to ground overall shields. Individual pair shields to be grounded on appropriate terminals.

.2 Shield drain wires, at the ungrounded end, are to be taped back to the cable. Fully insulate the shield. Do not cut the shield drain wire off.

.3 ACIC cable may be installed in cable tray, provided that:

.1 The cable tray does not contain power cables, unless specifically authorized by the Contract Administrator in writing.

.2 The ACIC cable voltage rating is equal or greater than the highest voltage contained in the cable tray.

3.5 TERMINATIONS AND SPLICES

.1 Wire nuts are permitted only in the following circuits:

.1 Lighting circuits.

.2 Receptacle circuits.

.2 Exercise care in stripping insulation from wire. Do not nick conductors.

□

.3 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

.4 Where screw-type terminals are provided on equipment and instrumentation, terminate field wiring with insulated fork tongue terminals.

.1 Manufacturer: Thomas and Betts, Sta-Kon, or approved equal in accordance with B7.

3.6 INSTALLATION IN CONDUIT

.1 Utilize cable grips, appropriately selected to accommodate the type and geometry of the cable.

.2 Utilize cable pulling lubricant, compatible with the cable and conduit.

3.7 CABLE INDENTIFICATION

.1 Install cable tags.

3.8 TESTING

.1 Test all power conductors 10 AWG and larger in accordance with 26 08 05.

END OF SECTION

Part 1 General

1.1 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 MATERIALS

.1 Rod electrodes: copper clad steel, 19 mm diameter by 3 m long.

.2 Conductors: bare, stranded, medium hard drawn copper wire.

.1 Size: as shown on the drawings or 2/0 AWG minimum for grounding electrode connections.

Part 3 Execution

3.1 INSTALLATION

.1 Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of local authority having jurisdiction.

.2 Install connectors and cadweld in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors during and after construction.

3.2 ELECTRODE INSTALLATION

.1 Install ground rod electrodes.

.1 Ground rods to be configured as shown on the drawings.

.2 Top of rods to be at least 150mm below finished grade.

.3 Accurately measure and mark the location of the actual ground electrodes on the as-built drawings.

.2 Install 2/0 AWG copper wire to connect ground electrodes.

.1 Connect each electrode to all others.

.2 Connect two electrodes back to the building via separate copper wire connections.

.1 Install separate parallel copper wires in separate trenches, in a manner that simultaneous disconnection of both conductors by inadvertent digging is unlikely.

.2 Minimum separation to be 1 metre, until wire in conduit against the building.

.3 Install 27mm PVC conduit to 300mm below grade, with LB type fitting above main floor level.

.4 Entrance to the building may be via one or two wall penetrations. If one wall penetration is utilized, provide T conduit fitting above grade to two below grade conduit stubs.

.3 Provide sufficient slack between ground rods and connections to the building to avoid breaking stresses.

.4 Minimum depth of burial: 450mm

.3 Make required grounding connections.

.1 Utilize thermo-weld connections to the ground rods.

.2 Utilize thermo-weld connections or approved compression type connectors for underground wire to wire connections.

.4 Install ground rod electrodes at location shown on the drawings.

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.

.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 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.

.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 26 05 34.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

□

.1 One-hole aluminum straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole aluminum straps for conduits and cables larger than 50 mm.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels, with maximum centre spacing as indicated above.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.14 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for splitters, junction, pull boxes, and cabinets.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.76, Splitters

1.3 SUBMITTALS

.1 Submit shop drawings for junction boxes including JB-U72 (Temporary Load Bank Connection Junction Box) 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 construction for NEMA 4X junction and pull boxes.

2.2 TEMPORARY LOAD BANK CONNECTION JUNCTION BOX (JB-U72)

.1 Requirements:

.1 Enclosure:

.1 Mounting: Wall / Surface.

.2 Type: NEMA Type 4.

.3 Lockable via pad lock (pad lock to be supplied by City).

.2 Ungrounded Terminals:

.1 Type: Feed-through lugs with Allen-head set screws.

.2 Rating: 300 A, 600 VAC (minimum).

.3 Size: Suitable for 350 MCM cable.

.4 Quantity: 4.

.3 Grounded Terminals:

.1 Type: Feed-through lugs with Allen-head set screws.

.2 Rating: 200 A, 600 VAC (minimum).

.3 Size: Suitable for 2/0 AWG cable.

.4 Quantity 1.

.4 Cable Entry:

.1 Permanent Connection to GEN-U72 power connection.

.1 Location: Side, bottom or rear of enclosure.

□

.2 Type: Conduit.

.2 Temporary Load Bank Connection:

.1 Location: Bottom of enclosure.

.2 Size: Suitable for 350 MCM cable.

.3 Provide 103 mm hole at bottom of enclosure for incoming load bank cable. Seal hole with hole cover.

.5 Junction box to be CSA approved and constructed by a CSA approved panel shop.

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: U73E-2 (Panel U73E, 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 Material Requirements:

.1 Main Floor: PVC

.2 Wetwell: Metal

2.2 SURFACE MOUNTED OUTLET BOXES, METAL

.1 General Requirements:

.1 Acceptable materials:

.1 Cast Aluminum

.2 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 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 by the Canadian Electrical Code.

.2 Support boxes independently of connecting conduits.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.4 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: U73E-2 (Panel U73E, 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 Material Requirements:

.1	Main Floor non-hazardous circuits:	PVC
.2	Main floor to wetwell hazardous circuits:	Metal (threaded)
.3	Wet Well:	Metal (threaded)

2.2 RIGID PVC CONDUIT

.1 Meets CSA C22.2 No. 211.2.

.2 Minimum conduit 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 size: 19 mm, unless specifically indicated on the drawings or approved by the Contract Administrator.

2.4 CONDUIT FASTENINGS

.1 One hole straps to secure surface conduits 50 mm and smaller. Two hole straps for conduits larger than 50 mm.

□

.2 Strap material to match conduit material.

.3 Beam clamps to secure conduits to exposed steel work.

.4 Channel type supports for two or more conduits or as shown in the drawings.

.5 Threaded rods, 6 mm dia. 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 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.

.3 Avoid routes that would interfere with any potential maintenance activities such as but not limited to:

.1 Roof hatches.

.2 Mechanical Dampers.

.3 Building/Equipment door openings.

.4

.5 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 to provide drainage.

.13 Surface Conduits

.1 Run parallel or perpendicular to building lines.
.2 Group conduits wherever possible on suspended or surface channels.
.3 Provide a minimum space of 12 mm between conduits.
.4 Do not pass conduits through structural members except as indicated.
.5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
.6 Install spacers as required to provide a space between the conduits and the supporting surface, with a minimum space as follows:
.1 Above grade spaces not classified as 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 conduit	0.75 m
.2	35mm conduit	0.75 m
.3	41mm conduit	1.2 m
.4	53mm conduit	1.5 m
.5	63mm conduit	1.5 m
.6	78mm conduit	1.5 m
.7	91mm conduit and larger	2.0 m

3.4 METAL CONDUIT

.1 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.2 Mechanically bend conduits over 19 mm in diameter.

.3 Concrete Penetrations:

.1 Sleeves for Aluminum Conduit

.1 Install schedule 40 galvanized steel pipe, sized for free passage of conduit.

.2 Seal and fire stop penetration around conduit with CSA approved assembly for the installation conditions.

.3 For wall, partitions, and ceilings the sleeve ends shall be flush with the finish on both sides but for floors they shall extend 50 mm above finished floor level or housekeeping pad level.

.4 Maximum spacing between supports for rigid metallic conduit:

.1	16mm conduit:	1.0 m
.2	21mm conduit:	1.5 m
.3	27mm conduit	1.5 m
.4	35mm conduit	2.0 m
.5	41mm conduit and larger	2.5 m

3.5 LIQUID-TIGHT FLEXIBLE CONDUIT

.1 Use as raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water.

□

.2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus four times the conduit diameter.

.3 Provide a separate ground wire within 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 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 190 mm planks pressure treated, water repellent preservative.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 After sand bed specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation:

.1 As shown on drawings.

.6 After sand protective cover specified in Section 31 23 10 - Excavating, Trenching and Backfilling, is in place, install continuous row of 38 x 190 mm pressure treated planks as indicated to cover length of run.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).

.2 CSA C9, Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.3 PRODUCT DATA

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

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2 No.47.

.2 Requirements:

.1 Type: ANN.

.2 Single phase, kVA as indicated, 600V input, 120/240V output, 60 Hz.

.3 Voltage taps: 2.5% full capacity above and below normal.

.4 Windings: Copper.

.5 Insulation: Class H, 220ºC.

.6 Temperature rise: 115ºC at continuous full load.

.7 Basic Impulse Level (BIL): 10 kV.

.8 Hipot: 4kV.

.9 Average sound level: To meet the local municipal & building codes and meet at minimum the following criteria:
45 dB max. up to 45 kVA
50 dB max. up to 150 kVA

.10 Impedance at 170°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 transformer for ventilation.

.3 Install transformers in level upright position.

.4 Install non-combustible insulating board, extending 300mm around transformer on all sides, behind transformer to meet CEC code requirements.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Make primary and secondary connections in accordance with wiring diagram.

.8 Mount transformers to reduce direct and transmitted noise. Mount core and coils of transformers.

.9 Make connections to transformers in flexible conduit, entering the enclosure below the coils.

.10 Energize transformers after installation is complete.

.11 Adjust tap connections to give a continuous secondary voltage of 120 volts phase to neutral, under load.

3.2 TESTING

.1 Utilize test form provided. Complete test form in full.

.2 Perform an insulation-resistance test. Individually test each winding with all other windings grounded, and test winding to winding, with both windings ungrounded. The

test voltage shall be 1000 VDC, unless otherwise indicated by the manufacturer. The test duration shall be one minute.

.3 Measure and record the voltage on the primary and secondary of the transformer. Adjust the tap position as required. Record final tap position and voltage.

Schedule 26 12 17-1: Transformers

Identifier	Location	Size	Voltage	Enclosure Type
XFMR-U73E	Motor Room	15 kVA	600:120/240V, 1Ø	CSA 1

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 for motor control centre 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-U70)

.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: Padmount.
- .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 Provide new concrete pad for mounting CSTE. 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-U70.

.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-U70 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-U70.

.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.

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 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, or as indicated.

.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: 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 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-U73E”.

.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 common backboard.

.3 Mount panelboards to height of two (2) metres to top of cover, as required by Code, or as indicated.

.4 Connect loads to circuits.

3.2 TESTING

.1 Test in accordance with Section 26 08 05.

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 and details of provision for future extension.
- .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

.1 600 VAC, 60 Hz, Wye connected, 3 Phase, 4 Wire.

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

.2 Floor mounting, free standing, enclosed dead front.

.3 Indoor NEMA Type 1A (gasketed) enclosure, front mounting.

.4 Suitability for Service Entrance: Yes.

.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.

.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 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 and/or bottom.

.14 Provision for outgoing cables to exit via top and/or bottom.

.15 Removable lifting means.

.16 Provision for future extension of both ends of motor control centre 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-U71”, “MCC-U72E”.

.2 Line 2 is to be the voltage, for example “600V, 3-Phase”.

.3 Line 3 is to be the rating, for example “600A, 4-Wire”.

2.4 SILLS

.1 Continuous channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 BUSBARS

.1 Main horizontal and branch vertical, three phase high conductivity, tin plated copper busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: As indicated 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 centre.

.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 UL standard (ANSI/UL 1449 3rd 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 3rd Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

.1 L-N, L-G, N-G:

.1 120/208 V: 700V

.2 347/600 V: 1500V

.2 L-L:

.1 120/208 V: 1200V

.2 347/600 V: 3000V

.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 (MCC-U71.PM)

.1 Where indicated on the drawings, provide a microprocessor based multifunction power meter.

.2 Requirements:

.1 Multifunction electrical measurement on 3 phase power systems.

.2 User programmable for voltage range to any PT ratio.

.3 Integrated display.

.4 Accept a direct voltage input range of up to 347 Volts Line to Neutral, and a range of up to 600 Volts Line to Line.

.5 Accept a current input of up to 5 Amps nominal, 10 Amps full scale.

.6 Programmable for current to any CT ratio. The use of DIP switches for selecting 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, ESL-U72E1

.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 sec.

.7 Automatic reset (restart) delay:

.1 Adjustable from 0.6 to 64 sec.

.2 Adjustable random restart delay from 3 to 15 sec.

.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 575 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 MCC 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 push button 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 face, black lettering, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Motor control centre main nameplate	70 x 120 mm	1 line	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 exterior light grey to ANSI 61 grey enamel, unless otherwise specified.

.2 Paint interior white, unless otherwise specified.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during construction.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.15 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 pad below the MCC lineups as per the drawings.

.2 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.

.3 Make field power and control connections as indicated.

.4 Ensure correct overload settings are applied.

.5 Coordinate concrete pad with bevelled edges as shown on the Drawings, sized to suit MCCs, install and level channel sills and mount MCCs.

3.2 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 Perform tests in accordance with Section 26 05 01 - Common Work Results - For Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 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(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.144.1-06(R2011), 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(July 2001), 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 (HS-U600, HS-U650)

.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.

.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.

.2 Receptacles of one manufacturer throughout project.

.3 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: U73E-2 (Panel U73E, circuit 2)

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers and circuit breakers operating on 600V, 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, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

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

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and Circuit breakers to CSA C22.2 No. 5

.2 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, 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-U70.MCB (CSTE-U70 MAIN BREAKER)

.1 Requirements:

.1	Frame Size:	600 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:	0.40 – 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:	2 – 15 * 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-U71.MCB (MCC-U71 MAIN BREAKER)

.1 Requirements:

.1	Frame Size:	800 Amps
.2	Sensor Rating:	600 Amps
.3	Interrupting Rating:	25 kA @ 600 VAC
.4	Trip Unit Type:	Electronic LSI, Factory Sealed
.5	Long Time PU:	0.42 – 1.00 A * Sensor Rating (Adjustable)
.6	Long Time Delay:	0.5 – 24 sec (Adjustable)
.7	Short Time PU:	1.5 – 10 * LTPU (Adjustable)
.8	Short Time Delay:	0.0 to 0.4 sec (Adjustable)
.9	Instantaneous:	2 – 15 * Sensor Rating (Adjustable)
.10	Poles:	3
.11	Model:	Schneider Electric PowerPact P series with Micrologic 5.0 A (Ammeter) series trip unit, or approved equal in accordance with B7.

2.4 MCC-U71.CB-U72E (MCC-U72E FEEDER BREAKER)

.1 Requirements:

.1	Frame Size:	400 Amps
.2	Sensor Rating:	300 Amps
.3	Interrupting Rating:	18 kA @ 600 VAC
.4	Trip Unit Type:	Electronic LSI, Factory Sealed
.5	Long Time PU:	125 – 450 A (Adjustable)
.6	Long Time Delay:	Fixed

□

.7	Short Time PU:	1.5 – 10 * LTPU (Adjustable)
.8	Short Time Delay:	Fixed
.9	Instantaneous:	2 – 15 * Sensor Rating (Adjustable)
.10	Poles:	3
.11	Model:	Schneider Electric PowerPact L series with Micrologic 3.3S series trip unit, or approved equal in accordance with B7.

2.5 MCC-U72E.CB-U01, MCC-U72E.CB-U02 (PUMP STARTER BREAKERS)

.1 Requirements:

.1	Frame Size:	250 A
.2	Sensor Rating:	200 A
.3	Trip Unit Type:	Electronic LI, Factory Sealed
.4	Long Time PU:	0.40 – 1.00 A * Sensor Rating (Adjustable)
.5	Long Time Delay:	0.5 – 24 sec (Adjustable)
.6	Short Time PU:	1.5 – 10 * LTPU (Adjustable)
.7	Short Time Delay:	Fixed
.8	Instantaneous:	2 – 15 * Sensor Rating (Adjustable)
.9	Poles:	3
.10	Model:	Schneider Electric PowerPact L series with Micrologic 3.2 series trip unit, or approved equal in accordance with B7.

2.6 THERMAL MAGNETIC BREAKERS < 100A

.1 Requirements:

.1	Trip Rating:	As shown on the drawings.
.2	Interrupting Rating:	18 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-C22.1-2018, 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.

.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, Appleton.

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 diagram.

.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 nameplate, 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-U010-3). 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: -10°C to +40°C.

.5 Logic inputs: Qty 4, 24 VDC, programmable

.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 ATS48 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 1.

.2 Rated for 120 VAC, 60Hz.

.9 Acceptable products:

.1 Omron H3CR-A8E complete with Omron PF085A.

.7 Current Transducers (IT-U010, IT-U020):

.1 Power Supply: 120 VAC, 60 Hz.

.2 Input: 0 - 5A, 60 Hz.

.3 Output: 4 - 20 mA.

.8 Current Meters (II-U010, II-U020):

.1 Type: Analog

.2 Input: 0 - 5 A, 60 Hz.

.3 Display Range: 0 - 200 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 UL/CSA listed, NEMA size as shown on the drawings.

.1 Smallest size of starter: NEMA size 1, unless otherwise indicated

.2 IEC rated starters are not acceptable.

.2 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 INTRODUCTION

This specification defines the technical requirements related to the design, fabrication, factory testing, supply, delivery to the specified location, for a skid mounted 3ϕ, 600 VAC standby natural gas fueled generator c/w Automatic Transfer Switch and all ancillary equipment specified herein and as indicated on the drawings and datasheets.

This Specification shall be read in conjunction with the drawings and other documents forming part of the Tender/Purchase Order documents.

The generator shall be completely fabricated, assembled, factory tested and bear CSA/cUL certification at the manufacture's facilities and shipped to site ready for field installation.

1.2 CODES AND STANDARDS

The most recent adopted version of the following standards:

A. Cenelec EN 61000-6-4:2007 (BS EN 61000-6-4:2007+A1:2011) – Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments.

B. Cenelec EN 61000-6-2:2005 (BS EN 61000-6-2:2005) – Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments.

C. CSA C282-15 – Emergency Electrical Power Supply for Buildings.

D. CAN/CSA-E61131-2-06 (R2011) – Programmable Controllers - Part 2: Equipment Requirements and Tests (Adopted IEC 61131-2:2003, second edition, 2003-02, including Corrigendum 1:2004, with Canadian deviations)

E. EEC 89/336/EEC, 91/368/EEC, 3/44/EEC, 93/68/EEC – Electromagnetic compatibility,

F. Manitoba Building Code (MBC)

G. NFPA 37 – Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, 2015 Edition.

H. UL 508 – Standard for Industrial Control Panels
23 (Note that as of Jan. 27, 2017, UL 508 will be replaced by the UL 60947 series and **UL-508 series approvals will be withdrawn**),

1.3 SUBMITTALS

A. Provide Submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 26 05 01 – Common Work Result – Electrical.

B. Submit shop drawings:

1. Complete set of dimensioned equipment drawings showing plan and elevations of the proposed generator set and drive system including anchoring requirements
2. Interconnecting wiring diagrams.
3. Field wiring cable list, conduit list.
4. Weight of all equipment.
5. Engine mechanical data at varying loads up to full load, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.
6. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
7. Material List.
8. Generator resistances, reactances (including transient and sub-transient), and time constants.
9. Generator current decrement curves.
10. Generator motor starting capability.
11. Generator thermal damage curve.
12. Jacket water heater connection diagram, heater wattage and voltage.
13. Alternator space heater connection diagram, heater wattage and voltage.
14. Control panel schematics.
15. Generator set synchronization details and wiring diagrams
16. Generator set controller details and wiring diagrams
17. Control interconnection diagrams / interface with the ATS
18. Manufacturer's written warranty.
19. Emissions data (sound and environmental).
20. Breaker specifications, including auxiliary contacts, shunt trips and trip unit curves.
21. Complete list of accessories provided.

C. Product Data:

1. Submit manufacturer’s printed product literature, specifications and datasheets and include product characteristics, performance criteria, and limitations. Specific model shall be indicated.

D. Owner’s Manual:

1. Paper and digital copies of owner’s manual specific to the product supplied must be provided in accordance with the requirements of CSA C282. General operating instructions, preventative maintenance, wiring diagrams, schematics and parts exploded views specific to the supplied model must be included.

1.4 OPERATIONS & MAINTENANCE (O&M) MANUAL

A. Provide submittals in accordance to Section 01 78 00 – Closeout Submittals and Section 26 05 01 – Common Work Results – Electrical.

B. Prepare installation, operating and maintenance (O&M) manuals in the formats and quantities required by Section 01 78 00.

C. Each of the O&M Manuals shall include, at a minimum, the following:
1. All Shop drawing information.
2. Signed and sealed equipment "As Manufactured" drawings.
3. Certified product test reports.
4. Certificates of compliance.
5. Certified Arc-flash type test data.
6. CSA certificates of inspection for the provided equipment, or Manitoba Office of the Fire Commissioner, Inspection and Technical Services Manitoba "Special Inspection" certificate for the provided equipment.
7. Handling and installation instructions, including equipment anchorage information and provisions.
8. Operating and maintenance instructions.
9. Complete component list.
10. Recommended maintenance practices and procedures.
11. Recommended spare parts list.
12. CT curves and data sheets.
13. Equipment and component Manufacturer's detailed instructions, installation and maintenance manuals.
14. Standard cut sheets for OEM devices.
15. Component manuals for all devices/equipment/relays incorporated into the equipment.
16. Metering equipment settings and programming information.
17. Site Testing & Commissioning Procedures, and recommendations and precautions for setting into operation.
18. Test plan and inspection records.
19. Certified copies of all test reports.
20. Nameplate rubbings.
21. Such additional information, instructions, data, recommendations, and procedures that the Manufacturer considers to be pertinent.

1.5 QUALITY ISSURANCE

A. Prior to shipment, the manufacturer shall factory test the generator and associated control and protection equipment and switchgear in accordance with the requirements of clauses 2.11 – FACTORY TESTING,

B. A certified test and compliance report shall be submitted within seven (7) days of the successful completion of the tests.

C. Accept equipment on site and inspect for shipping damage.

D. When long term storage (> 1 week) is required, the equipment shall be stored indoors in a heated environment, or shall be covered with a weather-proof heated hording. For short term storage (≤ 1 week) and during installation protect equipment from weather and moisture by covering with heavy plastic or canvas and by maintaining heat within the enclosure in accordance with manufacturer's instructions.

PART 2 Products

2.1 GENERAL

A. Maximum unit overall dimensions including frame rails and lifting eyes:
1. Width: 1262 mm
2. Height: 1413 mm (not including exhaust outlet)
3. Length: 2588 mm

B. Quality and Experience

All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. Units and components offered under these specifications shall be covered by the manufacturer's standard warranty on new machines, a copy of which shall be included in the submittal.

C. Torsional Vibration

The system shall be free of injurious torsional and bending vibrations within a speed range from 10% below to 10% above synchronous speed.

D. Guards

The system shall be adequately guarded both physically and electrically for protection of operating personnel.

E. Layout

The layout of the Generator Room is based on the generator from the first named manufacturer listed herein and as shown on the Contract Drawings. The Contractor is responsible for coordinating layout changes and interface connections to other work and equipment which is different than that shown on the Drawings if alternative manufacturers are proposed. The Contractor will be responsible for coordinating this work and the changes will be at sole expense of the Contractor.

2.2 ENGINE

A. The engine shall be a stationary, liquid cooled, 150 kW, 60 Hz, 1,800 rpm, four-cycle design, vertical inline or V-type, with dry exhaust manifolds. It shall have six (6) cylinders with minimum total displacement of 14.2 liters and be manufactured in the United States or Canada.

B. The engine shall be water cooled with a unit mounted radiator, fan (with guard), water pump, and closed coolant recovery system providing low coolant level alarm. The radiator shall be designed for operation in ±40 °C ambient temperatures.

C. Radiator duct flange shall be shipped loose by generator set manufacturer, and shall be installed with flexible boot vibration isolator by Contractor.

D. Intake air filter(s) with replaceable element(s) c/w service indication shall be mounted on the unit.

E. The integral engine mounted natural gas fuel system shall consist of gas pressure regulator and carburetors. The carburetor shall be a diaphragm type which includes a load screw for fuel ratio adjustment and throttle body to control the air-fuel mixture to the engine.

F. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have full flow oil filter(s) with internal bypass and replaceable element(s).

G. The engine shall be equipped with a battery charging DC alternator with an integral "solid state" voltage regulator.

H. The engine shall be equipped with a unit mounted, thermostatically controlled jacket water heater to aid in quick starting. Power supply for the jacket water heater shall be from a 120 VAC, 1-phase, or 240 VAC 1-phase supply. The Genset manufacturer shall provide all required thermostatic controls, contactors, control transformers, inside an enclosure. The wattage shall be as recommended by the manufacturer. The jacket water heater shall be sized to allow the genset to start at -40ºC ambient temperature (even though the genset room will normally be heated). The contractor shall provide proper branch circuit from normal utility power source.

I. Sensing elements shall be located on the engine for:
1. Low oil pressure alarm/shutdown.
2. High coolant temperature alarm/shutdown.
3. Low coolant level shutdown.
4. Overspeed shutdown.
5. Overcrank shutdown.
6. Emergency stop shutdown.
7. Low coolant temperature alarm.
8. Low battery voltage alarm.
9. High battery voltage alarm.
10. Unit control selector switch not in auto alarm.
11. AC battery charger failure alarm.
12. Fuel alarms (programmable).

J. Sensors shall be connected to the control panel using a prefabricated wiring harness(es), each connectors shall be sealed to prevent corrosion and all wiring shall be run in flexible conduit(s) for protection from the environment and moving parts.

K. The following equipment is to be provided by the engine-generator set manufacturer and shipped loose with the generator set for installation by the Contractor:
1. Approved fuel lines to connect the engine to the external natural gas supply and return lines.
2. Approved isolation valves, pressure gauge for natural gas fuel supply line as indicated on the Contract Drawings.
3. AC Battery Charger.
4. Vibration isolators.

L. The engine speed shall be controlled by an isochronous governor. Speed regulation during steady state operation shall be ±0.2 Hz.

M. The Generator set shall be capable of accepting a block load of 100% of the block load nameplate rating.

N. Generator set performance shall meet the requirements of the latest version of CSA C282-15.

O. Acceptable manufacturers:
1. Generac,
2. Or approved equal in accordance with B7.

2.3 COOLING SYSTEM

A. The cooling air flow requirement (fan air flow across radiator) shall be a maximum of 259.4 m3/min (9,162 scfm).

2.4 FUEL SYSTEM

A. The engine shall be natural gas powered, with an electronic pressure regulator. Regulator shall be suitable for indoor installations by the Authority Having Jurisdiction and capable of meeting the stationary gas engine fuel requirements at the rated load. Vent to a safe location

B. Operating fuel pressure shall be between 7in. H_20 to 11in. H_20, or as specified in supplier data sheet.

2.5 GENERATOR ALTERNATOR

A. The alternator shall be of the 4 poles revolving field type, wired for 600 VAC, 3Ø, 60 Hz, rated at 200 kW minimum, 0.8 pf , stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter. The alternator shall be suitable for use with grounded neutral connection system.

B. The alternator rotor shall be connected to the engine by means of a gear type coupling to ensure permanent alignment.

C. The alternator shall meet temperature rise standards for Class "H" insulation; operate within Class "F" temperature rise standards for extended life. All leads shall be extended into an AC connection panel.

D. The alternator and regulator shall sustain at least 300% short circuit current for 10 seconds during 3 phase fault conditions.

E. The alternator shall be equipped with an internally mounted space heater. Heater supply shall be 120 VAC 1 Ø or 240 Vac 1Ø. The Genset manufacturer shall provide the appropriate fusing, disconnects, breakers, contactors, controls, control transformer, etc. The alternator heater(s) shall be automatically disconnected when the engine is running and shall have an independent means of being disconnected or switched off for maintenance.

F. The alternator terminal box shall be arranged for top connection of the outgoing load cable(s) and the neutral cable(s). The terminal box shall be oversized and shall include adequate space for the installation of cable terminations, neutral current transformers (if mounted in the terminal box), cable gland connectors, and for bending and training of the load and neutral cables.

2.6 GENERATOR MAIN MOLDED CASE CIRCUIT BREAKER (GEN-U72.MCB)

A. Requirements:

1.	Frame Size:	400 Amps
2.	Sensor Rating:	250 Amps
3.	Interrupting Rating:	18 kA @ 600 VAC
4.	Trip Unit Type:	LSI
5.	Long Time Pickup:	0.8 – 1.0 * Sensor Rating (Adjustable)
6.	Long Time Delay:	1.0 – 10 sec (Adjustable)
7.	Short Time Pickup:	2 – 10 * Sensor Rating (Adjustable)
8.	Short Time Delay:	1.0 – 10 sec (Adjustable)
9.	Instantaneous:	2 – 10 * Sensor Rating (Adjustable)
10.	Poles:	3
11.	Auxiliary Contacts:	Qty 1 Form A and Qty 1 Form B dry-contacts or Qty 1 Form C dry-contact

B. Auxiliary contacts minimum rating shall be 125 VDC, 5 A

C. Provide three (3) terminals along for field connection of auxiliary contacts that are pre-wired to breaker auxiliary contacts positions (Common, Normally Open and Normally Closed).

2.7 GENERATOR LOAD BANK MOLDED CASE CIRCUIT BREAKER (GEN-U72.LB)

A. Requirements:

1.	Frame Size:	400 Amps
2.	Sensor Rating:	250 Amps
3.	Interrupting Rating:	18 kA @ 600 VAC

4. Trip Unit Type: Thermal Fixed, Adjustable Instantaneous.
5. Instantaneous: 2 – 10 * Sensor Rating (Adjustable)
6. Poles: 3
7. Shunt Trip: Qty 1 – Coil rated 24 VDC.

B. Shunt trip coil voltage shall be rated for operation of 24 VDC powered from external source.

C. Provide two (2) terminals along for field connection of auxiliary contacts that are pre-wired to breaker shunt trip positions (Positive and Negative).

2.8 AUTOMATIC TRANSFER SWITCH

A. Rating: 600V, 300A, 3 phase, 4 wire, 60 Hz.

B. Provide contactors or switches mounted on common frame, in double throw center-off arrangement, mechanically and electrically interlocked, solenoid operated, with CSA 12 enclosure.

C. Ensure that ATS and relay contacts, coils, springs and control elements are accessible for inspection and maintenance from front of ATS panel without removal or disconnection of power conductors.

D. Provide silver plated auxiliary contacts to initiate emergency generator start-up on failure of normal power. Provide high pressure silver alloy main contacts, protected by arc disruption means.

E. Operational sequence of the ATS shall be as described in Section 2.6 of this Specification.

F. Provide all conductors/cabling between the Generator main breaker terminals and the ATS along with generator load bank terminals and temporary load bank connection as well as all wiring/cabling required for the proper functioning of the equipment.

G. Provide space for a minimum 4C 350 MCM type TECK90 1kV cables on both the “normal” and “load” side of the ATS, connections for these cables shall accommodate long barrel standard NEMA two (2) hole lugs provided by Others. 600 VAC cabling between the Generator load breaker terminals and the “Generator connections of the ATS shall employ type Teck-90 1KV cables and long barrel standard NEMA two (2) hole lugs.

H. Dry-Contact status outputs:
1. Indication of “On Utility Power” – Qty 4 Form A or Form C dry-contacts
2. Indication of “On Generator Power” – Qty 4 Form A or Form C dry-contacts
3. Indication of ‘Alarm” – Qty 2 Form A or Form C dry-contacts.

2.9 CONTROLS

A. The generator unit control system shall be a fully integrated control system enabling remote diagnostics and building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and critical generator operations. The generator controller shall also provide seamless digital integration with the engine's electronic management system. Generator controller shall utilize separate voltage regulators and speed governors to integrate with the engine management system.

B. The generator control system shall meet all requirements of CSA C282 for standby engine generators.

C. Communications shall be supported with building automation via the Modbus protocol over Ethernet.

D. The control system shall be environmentally sealed including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The generator set control shall be tested and certified to the following environmental conditions:

1. -40°C to 70°C Operating Range.
2. 95% humidity non-condensing, 30°C to 60°C.
3. IP22 protection.
4. 5% salt spray: 48 hours, 38°C, 36.8 V system voltage.
5. Sinusoidal vibration: 4.3G RMS, 24-1000 Hz.
6. Electromagnetic Capability:
    a. 89/336/EEC, 91/368/EEC, 3/44/EEC, 93/68/EEC,
    b. BS EN 61000-6-4:2007+A1:2011,
    c. BS EN 61000-6-2:2005.
7. Shock withstand: 15G.

E. Diagnostic capabilities shall include time-stamped event and alarm logs, ability to capture operational parameters during events, and simultaneous monitoring of all input and output parameters.

F. The Controller shall include the ability to accept six (6) programmable digital inputs, two dedicated digital inputs, six programmable form "A" dry contacts, two programmable form "C" dry contacts, and two digital outputs. The signals shall be programmable for either high or low activation using programmable Normally Open (NO) or Normally Closed (NC) contacts.

G. The control panel shall display all user pertinent generator set parameters including, but not limited to, the following:

1. Alarm Conditions:
    a. Low oil pressure alarm,
    b. High coolant temperature alarm,

c. Low coolant temperature alarm,
d. CCV filter,
e. Low battery voltage,
f. High battery voltage,
g. Unit control switch not in “automatic” position alarm.
h. AC Battery charger failure,
i. Loss of excitation,
j. Instantaneous over-excitation,
k. Time over-excitation,

2. Shutdown Conditions:
a. Low oil pressure,
b. High coolant temperature,
c. Loss of coolant,
d. Overspeed,
e. Overcrank,
f. Emergency stop activated,
g. Generator shutdown.
h. Generator over voltage.
i. Generator under voltage.
j. Generator over frequency.
k. Generator under frequency.
l. Generator reverse power.
m. Generator overcurrent.
n. Voltage Regulator,
o. Loss of excitation,
p. Instantaneous over-excitation,
q. Time over-excitation,
r. Loss of sensing.

H. Access to and manipulation of the internal operating set points and alarm limits shall be by password protected.

I. Control Wiring and Connections

1. Current Transformer Wiring and Connections
a. Current transformer wiring shall be minimum # 10 AWG, 600 V, 90 °C (minimum).
b. All current transformer wiring shall utilize stud or screw connections and “ring” type crimp lugs. The use of self retaining compression type spade lugs or “push-on” blade terminals and lugs are NOT acceptable for CT wiring.
c. All current transformer wiring shall connect into shorting terminal blocks for testing purposes.
d. Current transformers shall be rated as shown on the Drawings.
e. Current transformers shall be ANSI standard relay class and have their accuracy established in accordance with the connected burden and ANSI C57.13 but shall be at least:
i. 10C200, Thermal factor 130% for all phase CTs.

ii. 10C50, for all zero sequence CTs.

f. Zero sequence CTs shall be manufacturer's standard design, and shall be properly rated and tested for use in medium voltage switchgear installations.

g. Zero sequence CTs windows shall be dimensioned to allow passage of the specified cables complete with NEMA standard 2-hole pattern long barrel double crimp type lugs and high voltage cable terminations.

h. Zero sequence CTs shall be mounted in such a manner as to permit its easy removal for installation of cables complete with high voltage terminators and cable gland connectors.

2. Wiring Rules (other than engine mounted wiring except as noted)

a. Provide terminal blocks for incoming and outgoing control connections.

b. All wiring (including engine mounted wiring) shall be tagged and identified on both ends of every wire using printed heat shrink sleeve type wire markers. Hand written numbering is NOT acceptable. The wire numbering scheme shall be such that the wire numbers change only when going through a device (coil, contact, etc.); wire numbers at both ends of the same wire shall be identical. All wires on a given terminal block or connector position shall bear the same number.

c. Wires shall be run in continuous lengths, without splices between connection points, be installed in channels, ducts, or neatly tied and clamped to the supporting structure or panel. Self-stick/adhesive type wire/cable clamps are acceptable ONLY if additionally secured by means of screws.

d. All wiring originating from a compartment must be first routed to terminal blocks.

e. Connections to external circuits shall be brought to modular, asymmetrical DIN rail mounted snap-on construction, pressure type terminal blocks, with marking strips.

f. The terminal blocks for external connections shall grouped together and easily accessible, visible and positioned near the compartment's field control cable and inter-cell wiring entry/exit points.

g. All wiring not terminated on devices shall be terminated on terminal blocks. Not more than two (2) wires shall be connected to any device terminal or at any one terminal side. Interconnecting jumpers between terminal block positions shall be counted in the above 2 wire per side limitation. General and control wiring shall utilize self retaining compression type spade lugs where wiring is terminated on hardware (relays, meters, switches, etc).

h. Where wiring between cells crosses shipping splits the manufacturer shall supply keyed separable plug and socket type in-line insulated connector(s) to permit separating the cells at the shipping splits without having to un-terminate wiring. The connector shall be sized to accommodate the wire gauge and current carrying capacity of the inter-cell conductors, shall be of a locking design to prevent separation in service due to vibration or other causes and shall be securely screwed or clamped to the structure(s).

i. Where wiring crosses between structure sections (i.e. inter-cell connections), or where wiring (control cables) exits the equipment to connect to other equipment it shall be landed on terminal blocks at both ends. Devices external to the cell (contacts, coils, etc.) shall not be "loop" connected but shall be wired back to the terminal blocks in the cell or panel on an individual device basis.

j. Soldered connections and splices in wiring are not permitted.

2.10 OPERATIONAL CHARACTERISTICS

A. Provide equipment of a standard product line, which have been proven to give reliable service under similar conditions. Ensure they are reliable and fast starting, with rapid loading capabilities and capability of continuous supply to the essential loads, under the ambient and environmental conditions that will prevail at the site.

B. The Generator shall be capable of operating in an automatic mode under the supervision of the Generator Control Panel and the Automatic Transfer Switch (ATS).

C. Generator shall be used to supply power to critical process equipment. In the event of a normal power interruption, the Automatic Transfer Switch (ATS) shall:

- Monitor the "normal" supply for loss of voltage, phase failure, and frequency,
- Detect failure of the "normal" supply and after an adjustable time delay, to confirm that the loss of normal power is not a transient event or "brownout" condition, order the Genset to start,
- Isolate the "Emergency MCC" from the "Normal" supply,
- Detect that the Genset has successfully started and that the output of the Generator is within the required voltage and frequency tolerance limits, and the Generator is ready to accept load,
- Transfer the "Emergency MCC" to the "Generator" supply,
- Continue to monitor the "Normal" supply for its restoration,

D. On restoration of the "Normal" supply the ATS shall:

- Monitor the "normal" supply for an adjustable time delay, to confirm stability of the restored "Normal" power supply system, then
- Isolate the "Emergency MCC" from the "Generator" supply,
- Pause for an adjustable time delay to allow connected motor residual voltages to decay, and,
- Transfer the "Emergency MCC" to the "Normal" supply,

- After an adjustable time delay to permit the Generator and Engine to cool, order the Genset to shut down.

E. Additionally the ATS shall include provisions to allow the exercising of the Genset as follows:

1. Either with or without load transfer, manually selectable at the ATS,
2. By manual operator initiation at the ATS, or
3. Automatically on a time or calendar based user selectable program.

F. Generator System Load Management Control

1. The generator system load management controls shall generate an alarm if the measured generator load exceeds a preset percentage of the on-line generation capacity for an established period of time. The alarm shall be displayed on the generation system HMI and shall also be issued as a fail-safe contact output. The load level alarm set point shall be user adjustable and shall be password protected.
2. If the connected load exceeds the capacity of generation system, resulting in a decrease in generator system frequency to a specified, adjustable setpoint or less, the generation system load management controls shall signal the plant PLC / operator to initiate load shedding to reduce the plant load to within the generation system capacity. The generator set point shall be in accordance with codes and standards, nominally the maximum frequency reduction shall not exceed ten (10) percent for greater than three (3) seconds.

G. HMI – Human/Machine Interface

1. HMI system interface shall be via a LCD character display with pushbuttons, or a touch screen display.
2. Provide a local emergency-stop pushbutton.

2.11 EXHAUST SYSTEM

A. Heavy duty critical type horizontally mounted stainless steel, insulated exhaust, residential silencer with condensate drain, plug and flanged couplings, and insulation blanket exhausting through wall using insulated wall thimble. Exhaust piping to utilize welded connections. No bolted flange connections, except at the generator flex output, will be accepted.

B. Heavy duty stainless steel exhaust pipe.

C. Fittings and accessories as required.

D. Wall thimble: double ventilated metal thimble not less that 300mm larger in diameter than the exhaust pipe as per CSA B149.1 and NFPA 37.

E. Insulation: 75 mm calcium, magnesium, silicate rated to 1100 ^{0}C.

F. Jacket: 0.5 mm aluminum, longitudinal and circumferential slip joints with 50 mm laps, 19 mm wide steel banding at minimum 300 mm spacing.

G. Pipe hanger support blocks: ceramic fiber blocks rated to 1260^{0}C.

2.12 STARTING SYSTEM

A. Provide a 24 VDC electric starting system with positive engagement.

B. Unit mounted thermal circulation type water heater(s) (jacket water heater) shall be installed on the engine. The heater power rating shall be sized by the manufacturer to maintain jacket water temperature at 40 °C with a minimum ambient temperature of -40ºC. Heater supply voltage shall be 240 VAC, 1Ø, 60 Hz.

C. The engine heater(s) shall be automatically disconnected when the engine is running and shall have an independent means of being disconnected or switched off for maintenance.

2.13 ENCLOSURE.

A. Generator set shall be suitable for indoor application and no external weather enclosure is required. The genset shall be designed to start and run at an ambient temperature of -40ºC to allow for the possibility of heating system malfunctions. Generator combustion and cooling air is at outdoor ambient temperatures and will not be tempered.

2.14 FACTORY TESTING

A. All testing indicated in this section is supplemental to the requirements of Specification 26 08 05 – Acceptance Testing.

B. QUALITY ASSURANCE REQUIREMENTS

1. Submit an Inspection and Test Plan in accordance with this specification, applicable Standards and NETA Acceptance Testing Standards.

C. SHOP INSPECTION AND TESTING

1. Equipment will be subject to inspection at the following stages of manufacture:
   a. Prior to shop testing,
   b. Prior to packaging for shipment.
2. Test equipment to ensure satisfactory operation prior to shipping. Provide Certification of Satisfactory performance.
3. Test and inspect all equipment, materials, works in accordance with scope of work, specifications, all applicable codes, standards, regulations, laws and provide Certification and Records.
4. Provide the Contract Administrator, or designate, with proper access to work, equipment, tools and facilities for carrying out such inspection, test, witness

inspection or test points, surveillance or audit, whether it is in preparation or progress.

5. Provide upon request, the following information:
   a. Non-destructive test records/results,
   b. Welding procedures and welder qualifications,

D. ROUTINE FACTORY TESTS

1. Test the equipment per applicable standards and provide test data.

2. The Contract Administrator, or designate, reserves the right to witness any or all tests.

3. Prior to proceeding with the tests, provide in writing, a list of the tests to be performed at least four weeks before the tests are scheduled to begin, and an approximate schedule, with dates anticipated for the tests.

4. The equipment shall be tested at the manufacturing plant prior to shipment and in accordance with the latest applicable standards.

E. DESIGN TESTS (TYPE TESTS)

1. For the design tests, include the following:
   a. Dielectric tests,
   b. Power frequency voltage withstand on auxiliary equipment and control circuits,
   c. Partial discharge,
   d. Radio interference,
   e. Temperature rise,

2. The tests classified by the standards as optional may be carried out or waived at Contract Administrator's discretion, e.g., tests for radio interference, tests with simulated internal arcing fault, operational tests in extreme atmospheric conditions, etc.

3. Perform the design tests in the manufacturer's plant or elsewhere by an internationally recognized laboratory.

4. Where design type test results have been previously obtained and have been certified by an internationally recognized testing laboratory, they may be acceptable in lieu of the above specified type tests at the discretion of the Contract Administrator.

F. FACTORY ACCEPTANCE TESTS (FAT)

1. Witness Factory Acceptance Tests (FAT) are required for the Individual Engine Generator Sets and Incorporated Controls as well as for the Integrated Generator System/Controls and Generator Switchgear.

2. The FAT for the Individual Engine Generator Sets and Incorporated Controls shall be carried out at the generator set Manufacturer's factory prior to packing and shipment to Site.

3. The Individual Engine Generator Set and Incorporated Controls FATs shall include, but not be limited to, the following for each engine generator set:
   a. Starting test,
   b. Starting battery capacity test,
   c. Verification of the correct functioning of all engine protection shutdowns and alarms,
   d. Engine speed governor functionality verification,
   e. Alternator excitation functionality verification,
   f. Alternator Voltage regulator functionality (no-load, ¼ load, ½ load, ¾ load, full load) ,
   g. A block load application test of the engine generator set at "block load" nameplate rating, the block load shall be applied in a single step,
   h. A full load run test at the generator set nameplate KVA/KW rating. Test duration shall be a minimum of six (6) hours at full capacity after both engine and alternator temperatures have stabilized. For the purposes of this test temperature stability shall be defined as $\Delta t \leq 0.5$ °C/hr for both engine and generator. In accordance with the requirements of CSA C282 this test may be run at 1.0 Pf if the alternator has been previously tested at the factory to full capacity at 0.8 Pf. If the alternator has not been factory load tested at 0.8 Pf, the FAT test shall be conducted at 0.8 Pf.

4. Prior to proceeding with the Individual Engine Generator Sets and Incorporated Controls FAT tests the manufacturer shall provide, in writing, a written Inspection and Test Plan in accordance with the requirements of Specification Section 26 08 05 – Acceptance Testing. The Inspection and Test Plan shall include a detailed list of the tests to be performed, test procedures, sample data forms, and a testing schedule with anticipated test dates. Provide a minimum of two (2) weeks notice to the Contract Administrator before the tests are scheduled commence.

5. The Integrated Generator System/Controls and Generator Switchgear FAT should preferably be carried out at the generator set Manufacturer's factory. The location for this testing shall be subject to the agreement of the Contract Administrator, or designate.

6. The Integrated Generator System/Controls and Generator Switchgear FAT shall be conducted at 1.0 Pf and may be conducted at a reduced load capacity of 2MW total system loading.

7. The Integrated Generator System/Controls and Generator Switchgear FAT shall include, but not be limited to, the following:
   a. Verification of automatic generator set automatic starting, synchronization, and connection of the engine generator sets to the generator switchgear bus,
   b. Verification of Isynchronous governor functionality (no-load, ¼ load, ½ load),
   c. Verification of demand and load sharing between the two (2) engine generator sets at the above loadings,

d. Verification of correct operation of generator switchgear protection relay systems,
e. Verification of automatic shutdown and disconnection of the engine generator sets from the generator switchgear bus.

8. Prior to proceeding with the Integrated Generator System/Controls and Generator Switchgear FAT tests the manufacturer shall provide, in writing, a written Inspection and Test Plan in accordance with the requirements of Specification Section 26 08 05 – Acceptance Testing. The Inspection and Test Plan shall include a detailed list of the tests to be performed, test procedures, sample data forms, and a testing schedule with anticipated test dates. Provide notice a minimum of two weeks before the tests are scheduled commence.

PART 3 Execution

3.1 MANUFACTURER'S INSTRUCTION

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

3.2 INSTALLATION

A. The following equipment shall be installed for each engine-generator set:

1. A heavy duty, flooded lead acid 24 VDC battery (or two 12VDC batteries to be wired in series) shall be shipped loose by the generator set manufacturer.

2. An automatic means shall be provided for maintaining the storage battery in a charged condition. The battery charger shall be as follows:
   a. Fully automatic, dual-rate type with float and equalize modes,
   b. Float voltage shall be 2.17 volts per cell,
   c. Equalize voltage shall be 2.33 volts per cell,
   d. Shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, DC ammeter, DC voltmeter, and fused AC input,
   e. Input voltage shall be 120 VAC, 1Ø, from a 15A circuit,
   f. Charger shall have LED annunciation for low DC volts, rectifier failure, loss of AC power, high DC volts,
   g. Shall be wall-mounting type,
   h. Shall be capable of recharging a battery discharged by two full cranking cycles to 80% of capacity within four (4) hours and to full capacity within twelve (12) hours,
   i. Output rating shall not be less than 10 Amperes.

3. The battery charger shall be shipped loose by the generator set manufacturer and shall be installed and connected by the Contractor.

B. Contractor shall install the complete electrical generating system including all fuel connections in accordance with the manufacturer's recommendations as reviewed by the Contract Administrator.

C. Contractor shall supply and install anchors for the engine/generator base in the pad and connect to isolating devices on base.

D. Batteries shall be filled with electrolyte, charged and connected.

E. Contractor shall supply and install interconnecting wiring between engine/generator, switchgear, load bank, remote annunciator, dampers and other equipment.

F. Contractor shall provide power connections to all accessories. Use a separate suitably sized branch circuit for each separate component.

3.3 FIELD TESTING

A. Provide factory trained technicians to verify the completed installation and to perform an initial startup and testing as per Section 26 08 05 – Acceptance Testing.

B. All testing indicated in this section is supplemental to the requirements of Specification 26 08 05 – Acceptance Testing.

C. Initial site installation performance tests shall be performed in accordance with the requirements of CSA C282, Section 10.

1. The “Operational Test” shall be performed in accordance with the requirements of CSA C282 Clause 10.2.1, the operational test shall be continued for a period of one (1) hour, after which normal power shall be restored to the station and satisfactory re-transfer to normal power and cool-down and shutdown of the emergency generator sets shall be verified. The Operational Test shall be performed with all trades and manufacturer representatives on site along with the Contract Administrator, City of Winnipeg personnel and the Office of the Fire Commissioner representative. Fix any deficiencies noted by the Office of the Fire Commissioner to fulfill of all code requirements. Final Operational Test by the Contract Administrator and Office of the Fire Commission will be conditional upon fulfillment of all requirements.

2. Following the “Operational Test” the “Maximum Site Design Load Test” shall be conducted by connecting the generator sets to the load bank individually and operating each generator set at its rated nameplate unity power factor capacity until stable engine and alternator temperatures have been achieved followed by an additional 4 hours at rated capacity. The generator set load for this test shall be applied immediately upon the engine reaching its rated speed, and the rated nameplate “block load” shall be applied in a single step.

3. All data shall be recorded in accordance with the requirements of CSA C282, and a detailed report shall be submitted in accordance with Section 26 08 05 – Acceptance Testing.

4. The initial site installation performance tests shall be performed under the control and supervision of the Manufacturer's factory trained technicians.

D. Provide Contract Administrator with detailed photos of the generator set, and generator set controls during and after construction.

3.4 DEMONSTRATION AND TRAINING

A. Provide demonstration by factory trained representative in use and maintenance of Generator set Systems.

1. Allocate a minimum of two (2) separate 8-hour for training sessions. The date for each training session will be set by the Contract Administrator. Note that the training sessions will NOT be on two (2) successive days.

2. Training shall include, but not be limited to the following items:
   a. Overall system description and theory of operation,
   b. Automatic operation,
   c. Manual operation,
   d. Safeties and protective relaying,
   e. Recommended system check lists and log sheets in accordance with the requirements of CSA C282,
   f. Recommended preventive maintenance,
   g. Instruction on the operation of the assembly and major components within the assembly.

3.5 FINAL ACCEPTANCE

A. If required by final field testing/commissioning results make adjustments/or changes such that an efficient and fully operational installation is achieved. Such adjustments or requirements shall be to the suppliers account. Final acceptance by the Contract Administrator will be conditional upon fulfillment of all requirements.

B. For equipment subject to inspection by a government ministry, department, or agency, submit original copies of the test data reports and all other documentation required for the final field inspection of the equipment by the government ministry, department or agency.

C. Following completion of the work, issue a history docket comprised of the quality certificates, inspection and test records, and all other relevant documents related to manufacture and testing for the Contract Administrator's record files.

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.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

.3 Install a permanent label or lamacoid for all luminaires indicating the circuit(s) contained within.

.1 Example: U73E-2 (Panel U73E, circuit 2)

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install rigid aluminum conduit for luminaires as indicated.

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 schedule on 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.

.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 shown on the drawings.

.3 Make all connections and test system.

.4 Make connections to grounding as required.

.5 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 SUMMARY

.1 Section Includes:

.1 Materials, applications, installation and verification for excavating, trenching and backfilling.

1.2 REFERENCES

.1 City of Winnipeg (CW)

.1 CW3110 – Sub-Grade, Sub-Base, and Base Course Construction.

.2 CW3170 – Earthwork and Grading

.3 CW3230 – Full-Depth Patching of Existing Slabs and Joints.

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

.1 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

.5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.4 Canadian Standards Association (CSA International)

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

.1 CSA-A3001, Cementitious Materials for Use in Concrete.

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

1.3 DEFINITIONS

.1 Rock : any solid material in excess of 1 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m^3 bucket. Frozen material not classified as rock.

□

.2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.3 Unclassified excavation: excavation of deposits of whatever character encountered in Work.

.4 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 mm in any dimension.

.5 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.6 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.7 Unsuitable materials:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136:

.2 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.

.8 Sub-grade – the natural in-situ material.

.9 Sub-base – where required, the layer of material provided between the sub-grade and the base course.

.10 Base course – the layer of material immediately underlying the pavement

1.4 SUBMITTALS

.1 Upon request, submit material test results to the Contract Administrator a minimum of two weeks before excavation begins.

Part 2 Products

2.1 MATERIALS

.1 Sub-Base Materials

.1 Sub-base material of the type(s) shown on the Drawings or indicated in the Specifications will be supplied in accordance with the following requirements:

.2 Suitable site sub-base material will be of a type approved by the Contract Administrator.

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.3 Clay borrow sub-base material will be of a type approved by the Contract Administrator.

.4 Crushed sub-base material will be crushed aggregate, crushed limestone or crushed concrete pavement.

.5 Crushed sub-base material will be well-graded and conform to the following grading requirements:

Canadian Metric	Percent of Total Dry Weight Passing each Sieve		
Sieve Size	50 mm max.	100 mm max.	150mm max.
150 000			90-100%*
100 000		97-100%	75-90%
50 000	100%		
25 000		30-50%	50% max.
5 000	25-80%		
80	5-18%	5% max.	

* The maximum allowable size is 300mm.

.6 150 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading 1 of ASTM C535, Test for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 50 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than 40% when tested in accordance with grading A of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.8 Crushed concrete sub-base material will be a mixture of reclaimed Portland Cement concrete and asphaltic concrete. The contents of the material will be limited to the following percentages based on weight.

.1 minimum of 85% recycled Portland Cement concrete

.2 maximum of 15% recycled asphaltic concrete

.3 maximum of 3% clay

.4 maximum of 1% foreign material

.2 Base Course Materials

.1 Base course material will be approved by the Contract Administrator.

.2 Base course material will consist of sound, hard, crushed rock or crushed gravel and will be free from organic or soft material that would disintegrate through decay or weathering.

.3 The base course material will be well graded and conform to the following grading requirements:

Canadian Metric	Percent of Total Dry Weight Passing each Sieve

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Sieve Size	Granular	Crushed Limestone
25 000	100%	
20 000	80-100%	100%
5 000	40-70%	40-70%
2 500	25-50%	25-60%
315	13-30%	8-25%
80	5-15%	6-17%

.4 Base course material when subjected to the abrasion test will have a loss of not more than 35% when tested in accordance with grading B of ASTM C131, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.5 The material passing the 315 sieve will have a liquid limit not greater than 25 and a plasticity index not greater than 6.

.6 Where base course is being placed under an asphaltic concrete pavement, the aggregate retained on a No. 5 000 sieve will contain not less than 35% crushed aggregate as determined by actual particle count. Crushed aggregate will be considered as that aggregate having at least one fractured face.

.3 Asphalt Cuttings for Base Course Material

.1 Asphalt cuttings produced from planing of asphalt pavements or overlays in accordance with CW 3450 may be used as a base course material where indicated in the Specifications or as approved by the Contract Administrator.

.2 Asphalt cuttings will be well graded and have a maximum particle size of 40 mm.

.4 Lime or Portland Cement

.1 Use either Lime or Type 10 normal Portland Cement for drying the sub-grade.

.2 Supply Lime in accordance with CSA A82.43.

.3 Supply Portland Cement in accordance with CSA A5.

.5 Imported Fill Material

.1 Imported fill material will consist of low to medium plastic clays or mixtures of sand and clay, uniform in texture.

.2 The fill material shall be free of wood, vegetation, concrete rubble or stones larger than 25 mm in diameter.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

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3.2 PAVEMENT REMOVAL

.1 Remove existing concrete pavement, including curbs and asphalt overlays at locations as shown on the Drawings or as directed by the Contract Administrator. Remove all pavements to a combined thickness of 300 millimetres, unless otherwise indicated in the Specifications.

.2 Remove existing asphalt pavement including asphalt curbs at locations as shown on the Drawings or as directed by the Contract Administrator. Remove pavement to a maximum thickness of 150 millimetres, unless otherwise indicated in the Specifications.

.3 Saw-cut the existing pavement full-depth along the limits designated for removal.

.4 Utilize backhoe type equipment unless approved otherwise by the Contract Administrator.

.5 Dispose of material as per the following:

.1 Haul and dispose of waste material excavated from the Site including surplus, suitable, unsuitable and other material removed in accordance with the Specifications to a disposal location approved by the Contract Administrator.

.2 The City reserves the right to direct material to be hauled to a local site indicated in the Specifications.

.3 Clean up material dropped or spilled during hauling operations as directed by the Contract Administrator.

3.3 EXCAVATION

.1 Excavate in-situ material to the depth to accommodate the pavement structure as shown on the Drawings or as directed by the Contract Administrator.

.2 Stockpile suitable in-situ material and suitable site sub-base material at locations on site as directed by the Contract Administrator.

.3 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.4 Dispose of surplus suitable site material and unsuitable material such as frost heaving clays, silts, rocks and rubble as per Section 3.2.5.

.5 Strip and stockpile topsoil from the site in a manner which will prevent contamination of topsoil with underlying soil materials. Stockpile the stripped topsoil at locations on site for later use.

.6 The limits of excavation will be taken as a vertical plane 450 mm beyond the limits of the proposed pavement except when slip form paving equipment is specified for placement of the concrete pavement, the limits of excavation will be increased to a vertical plane 750 mm beyond the limits of the proposed pavement.

.7 During excavation, the Contractor will be advised by the Contract Administrator as to which areas have an unsuitable sub-grade. Extend the excavation either to the lower limit of the unsuitable material or to a depth as directed by the Contract Administrator.

.8 Remove wooden poles, concrete bases, or tree stumps encountered under pavements to the top of subgrade or 1 m below the bottom of the pavement surface, whichever depth is greater.

.9 Backfill and compact over-excavated areas with sub-base material approved by the Contract Administrator.

.10 Excavate additional material beyond the boulevard grading and ditch grading limits as directed by the Contract Administrator.

3.4 PREPARATION OF SUB-GRADE AND PLACEMENT OF SUB-BASE

.1 Compact the sub-grade after the bottom of the excavation has been approved by the Contract Administrator.

.2 Compact areas of suitable sub-grade material, the full width of the excavation, to a minimum of 95% Standard Proctor Density.

.3 Place and compact suitable site sub-base material before placing any new sub-base material, as directed by the Contract Administrator.

.4 Place and compact crushed sub-base material with or without geogrid as directed by the Contract Administrator in accordance with CW 3135.

.5 Place and compact sub-base materials in layers to a depth of 3 times the maximum aggregate size or as directed by the Contract Administrator. Compact to a minimum of 100% Standard Proctor Density, for the full width of the excavation, and each layer must be levelled and approved by the Contract Administrator before the succeeding layer may be placed.

.6 Layering, mixing or blending of crushed concrete with crushed aggregate or crushed limestone sub-base materials is not allowed.

.7 Recompact or replace any layer, which has been rejected as directed by the Contract Administrator.

.8 When excess water has been applied, either by sprinkling operations or by precipitation, to cause local or continuous pondage, soil compaction will not be permitted until sufficient soil drying has occurred, creating a condition lending itself favourably to compacting operations. Exercise necessary precautions to protect compacted areas against excess wetting from any natural or artificial sources of water application.

.9 Should excess moisture from continuous or heavy precipitation threaten to unduly delay the completion of the Contract. Apply in writing to the Contract Administrator requesting permission to use Lime or Portland Cement to dry out the clay sub-grade or sub-base material at specific location(s).

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3.5 PLACEMENT OF SUB-BASE WITH GEOTEXTILE FABRIC

.1 Install separation or separation/reinforcement geotextile fabric in accordance with CW 3130.

.2 For stable sub-grades, place and compact sub-base material to a minimum depth of 150 mm.

.3 For unstable sub-grades, place and compact sub-base material to a minimum depth for 300 mm or greater thickness as directed by the Contract Administrator.

.4 Place sub-base material by end-dumping methods and level with front-end loader type of equipment as approved by the Contract Administrator to avoid damage to the geotextile fabric and minimize sub-grade failures.

.5 Layering, mixing or blending of crushed concrete with crushed aggregate or crushed limestone sub-base materials is not allowed.

.6 Avoid sudden stops or sharp turns by construction equipment during placement of sub-base materials.

.7 Construction traffic will not be allowed to travel on the placed sub-base material until approved by the Contract Administrator.

3.6 PLACEMENT OF BASE COURSE MATERIAL

.1 Place and compact base course material to a minimum 75 mm thickness for pavement and approaches to a minimum of 100% Standard Proctor Density for the full width of the excavation unless otherwise shown on the Drawings or as directed by the Contract Administrator.

.2 Level the compacted base course to the finished base course elevation.

.3 Maintain the finished base course until the pavement is placed.

.4 Place and compact base course material as a levelling course to a maximum thickness of 50 mm for sidewalks and miscellaneous concrete slabs, to 90% Standard Proctor Density.

.5 Place and compact base course material immediately beneath pavement forms to provide firm support.

3.7 PLACEMENT OF IMPORTED FILL

.1 Place fill materials to satisfy the grading requirements of boulevard and ditches.

.2 Supply material in accordance with Section 2.5 of this specification.

.3 Compact to a minimum of 90% Standard Proctor Density.

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3.8 GRADING

.1 Grading of areas to receive sod will be understood to mean the required excavation or backfilling to a depth up to 150 mm so that the areas medians, after compaction, are at a uniform depth of 100 mm below finished grade shown on the Drawings.

.2 Grade the areas to receive sod, unless otherwise shown on the Drawings or as directed by the Contractor Administrator.

.3 Remove all debris, stones and concrete rubble from the boulevards and medians before commencing grading.

.4 Excavate to a depth of up to 150 mm to meet the final grade 100 mm below finished boulevard grade.

.5 Place and compact suitable backfill material as approved by the Contract Administrator to a depth of up to 150 mm to meet the final grade 100 mm below finished boulevard grade.

.6 Supply backfill material in accordance with Section 2.1 of this specification.

.7 Compact backfill materials to a minimum of 90% Standard Proctor Density.

3.9 QUALITY OF SUB-GRADE, SUB-BASE, AND BASE COURSE LAYERS

.1 Determine the Standard Proctor Density for the sub-grade, sub-base and base course materials at the optimum moisture content in accordance with ASTM Standard D698. The field density of each sub-grade, sub-base and base course layers will be a percentage of the applicable Standard Proctor Density, in accordance with in Sections 3.3, 3.4 and 3.5 of this specification.

.2 Utilize quality control tests to determine the acceptability of the sub-grade, sub-base and base course layers, as placed and compacted before the succeeding layer may be applied.

.3 Verify the field density of the compacted layers by Field Density Tests in accordance with ASTM Standard D1556, Test for Density of Soil in Place by the Sand-Cone Method, or ASTM Standard D2922, Test of Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

.4 The frequency and number of tests will be as directed by the Contract Administrator.

.5 Fill promptly, holes made by the removal of samples from the layers with appropriate material and thoroughly compact so as to conform in every way with the adjoining material.

3.10 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Protect open excavations against flooding and damage due to surface run-off.

.3 Dispose of water in a manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

3.11 BACKFILLING

.1 Vibratory compaction equipment is required.

.2 Do not proceed with backfilling operations until completion of following:

.1 The Contract Administrator approved installations construction below finished grade.

.2 Inspection, testing, approval, and recording location of underground utilities.

.3 Removal of concrete formwork.

.4 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

.5 Place backfill material in uniform layers not exceeding 150 mm compacted thickness. Compact each layer before placing succeeding layer.

.6 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 150 mm.

.7 Install drainage system in backfill as directed by The Contract Administrator.

3.12 RESTORATION

.1 Prior to construction, inspect the grassed, pavement and gravel surfaces within and adjacent to the Site with the Contract Administrator to record the current condition. After construction and site cleanup is complete, re-inspect the condition with the Contract Administrator.

.2 Restoration of grassed areas removed or damaged as result of construction activities will be restored in accordance with CW 3510. Restoration of grassed areas will not be measured for payment and shall be included as part of the Work being done.

.3 Pavement damaged or removed as a result of construction activities will be restored in accordance with CW3230 and CW 3410. Restoration of the pavement will not be measured for payment and shall be included as part of the Work being done.

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END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and application of two identical storm pumps.

.2 Replace the entire existing pumps and drivers and appurtenances including couplers connecting the pump discharge to existing piping at the Keewatin Underpass Pumping Station in accordance with the specifications herein.

.3 No additional payment will be made for additional components that are required for a complete and operating system.

.4 Only one (1) pump shall be replaced at a time. Refer to tender contract document section E11.3.

.2 Related Sections:

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 01 - Common Work Results – Electrical

.3 Section 40 05 01 – Common Work Results – Automation

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.1 Canadian Electrical Code

.2 Hydraulic Institute (ANSI/HI)

.1 ANSI/HI M100 Pump Standards

.2 ANSI/HI 2.1-2.2 Nomenclature and Definitions (Vertical Pumps)

.3 ANSI/HI 2.4 Installation, Operation, and Maintenance (Vertical Pumps)

.4 ANSI/HI 9.6.4 Vibration Measurements and Allowable Values

.5 ANSI/HI 9.8 Pump Intake Design

.6 ANSI/HI 14.6 Rotodynamic Pump Tests

.3 ASTM International

.1 ASTM A36/A36M – Standard Specification for Carbon Structural Steel

.2 ASTM A48/A48M – Standard Specification for Gray Iron Castings

.3 ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated, Welded and Seamless

.4 ASTM A269/A269M – Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

.5 ASTM A312/A312M – Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

.6 ASTM A582/A582M – Standard Specification for Free-Machining Stainless Steel Bars

.7 ASTM B505 / B505M – Standard Specification for Copper Alloy Continuous Castings

.8 ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Applications

.4 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA MG-1 – 2016 Motors and Generators

1.3 SUBMITTALS

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

.2 Submit for review applicable Contractor's Documents including product data, shop drawings, shipping and storage instructions, installation manuals including installation and test plans, testing procedures, marking procedures, pre-commissioning procedures and operation and maintenance manuals.

.3 Submit product data and drawings including:

.1 Pump manufacturers certified performance curve showing operating point (capacity/head, horsepower, efficiency and NPSHr) and preferred operating range (POR).

.2 Pump speed torque curve.

.3 Pump performance data.

.4 General arrangement drawing

.5 Materials of pump construction including cross-section drawings for strainer, bowl assembly, column assembly, open lineshaft, underground discharge, head/driver support, packing gland, and seal water connection.

.6 Hydraulic friction loss values for pump column and lineshaft.

.7 Thrust load calculation

.8 Thrust bearing life calculation

.9 Shaft critical speeds analysis

.10 Pump bowl factory test procedure

.11 Coatings schedule and product data sheets

.12 Motor drawing, specifications and performance data

.4 Submit Shipping and Storage Data and Instructions including:

.1 Shipping method and weights

.2 Spare parts included with order

.3 Short and long term storage requirements

.5 Submit Operation and Maintenance Manuals including but not limited to:

.1 General arrangement and detail drawings

.2 Detailed service and maintenance schedules (weekly, monthly, annual, etc.)

.3 Seal water operation and maintenance requirements

.4 Instructions for adjustment of the impeller height and replacements of parts.

.5 Parts catalogue

Part 2 Products

2.1 STORM PUMPS

.1 General

.1 This specification includes the design, supply, transportation, handling, installation, testing, marking, pre-commissioning, and commissioning of two vertical mixed-flow propeller open lineshaft pumps. Each unit shall include bowl assembly, suction strainer, column, below grade discharge elbow, lineshafting, seal water system including solenoids, motor, motor support pedestal, sole/foundation plate, anchor bolts, and all ancillary items for a complete installation.

.2 The pumps shall be of the vertical submerged axial flow propeller/mixed flow type. The pump is to be suspended from a soleplate and mounting baseplate at the ground floor (Elev. 232.800 m). The pumping element shall be suspended on a sufficient length of column to permit dewatering the sump to Elev. 222.300 m. The centreline of the horizontal discharge shall be below the mounting baseplate at Elev. 230.750 m. The discharge connection shall be grooved for a rigid type pipe coupling. The suction inlet shall be flared to resist the formation of damaging vortices. The complete unit when operating within the specified head range shall be free of excessive vibration, cavitation and noise. The column sections shall be flanged on each end with a register machined on centers to assure positive alignment when connected to mating parts. The pump driver shall incorporate a thrust bearing capable of withstanding the hydraulic thrust produced by the pump when operating at any condition in the specified head range of the pump. Design shall be such that no damage will occur in the event of reverse rotation caused by backflow of water through the pump.

.3 Pumps will be used to pump surface water collected from the underpass drainage system having a temperature range of 0ºC to 30ºC and will operate under conditions of flooded suction.

.2 Quality Assurance

.1 Pumps, complete with necessary guards and all other specified accessories and appurtenances shall be provided to closely match that of the original pumps for hoisting into place through existing floor openings and fit up to discharge piping. Changes to existing infrastructure will not be accepted.

.3 Performance

.1 The pump(s) shall be designed for continuous operation under normal service.

.4 Operation Criteria

Flow	TDH	Max. Pump Speed (rpm)	Max. Solids Passage	Min. Submergence Over Bell
511 L/s (8100 gpm)	9.4 m (31 ft)	1175	65 mm	1450 mm

.1 The total dynamic head (TDH) shall be as measured at the bowl assembly with 3.048 m (10 ft) of column including an above ground discharge elbow.

.2 Minimum water level shall be at Elev. 222.300 m

.3 Pumps are to be mounted at Elev. 232.800 m with the sump floor at Elev. 220.594 m.

.4 Pump discharge centreline shall be at Elev. 230.750 m.

.5 Driver size shall be limited to 100 HP maximum in the hydraulic curve range.

.6 Maximum pump speed is 1200 rpm.

.7 Voltage shall be 575 VAC.

.8 Liquid pumped is storm drainage with a maximum temperature of 29 deg. C.

.9 Bowl efficiency shall be minimum 80% at the duty point.

.10 Pumps shall be operated in the manufacturer's published performance curve range.

.5 Acceptable Pump Manufacturers

.1 Pentair / Fairbanks

.2 Cascade

.3 Flowserve

.4 Xylem

.5 Or approved equal in accordance with B7.

.6 Pumps

.1 The pump will be counter-clockwise rotation when viewed from above.

.2 The propeller shall be of bronze construction conforming to ASTM B584, C83600. They shall be of one-piece construction, mixed-flow fixed pitch vane design capable of passing a 65 mm solid. Vane leading edges shall be rounded to prevent accumulation of fibrous material. Propeller(s) shall be statically and dynamically balanced to limit vibration and supported on both sides by sleeve-type bearings for stability.

.3 Propeller(s) are to be secured to the shaft by means of a steel drive collet and bronze lock nut to prevent axial movement.

.4 Propeller location within the bowl shall be adjustable by means of a top shaft-adjusting nut.

.5 Durable metal nameplates shall be securely attached to each pumping unit supplied. Pump nameplates shall indicate the serial number, capacity, head, rpm, and other pertinent data. Motor nameplates shall indicate the serial number, voltage, phase, hertz, rpm, horsepower, service factor, NEMA Design, insulation class and any other pertinent data.

.6 The design of the pumps, and selection of materials, shall be such that galvanic corrosion is avoided. Using dissimilar metals in contact that may result in galvanic corrosion is not permitted.

.7 Provide 316 stainless steel bolts, nuts, screws for all of the pump. Provide bolting isolation kit where dissimilar metals are in contact.

.7 Bowls

.1 The bowls shall be made of close-grained cast iron conforming to ASTM A48 CL30. Castings shall be free from blowholes, sand holes and shall be accurately machined and fitted to close dimensions.

.2 Pump bowl shall be minimum 16 inch.

.3 Bowls shall be flange connected.

.4 Bowls shall be designed with smooth passages to ensure efficient operation.

.5 Each bowl assembly shall include a cast iron suction bell of the flared inlet type incorporating a permanently grease-packed bronze bearing. The suction bell shall incorporate a minimum of three guide vanes designed to minimize entrance losses and reduce vortexing.

.6 A bronze sand cap shall be provided with each pump to prevent entrance of sand into the suction bell bearing.

.7 The discharge bowls shall be provided with a bronze bearing immediately above the propeller as well as a bronze connector bearing.

.8 Bowls shall be fitted with a 316 stainless steel basket strainer.

.8 Propeller Shafts

.1 Propeller shafts shall be of stainless steel construction conforming to ASTM A582 (416 stainless steel) designed to transmit the drive torque required.

.2 The shafts shall be supported by bronze bearings located on both sides of each propeller.

.9 Columns

.1 Column pipe shall be not less than 508 mm (20 inches) nominal diameter. Bottom section may be tapered to match the pump bowl size.

.2 Column pipe wall thickness shall be 0.375 inches minimum.

.3 Column pipe shall be flanged and furnished in sections not over 3.1 meters (10 feet) in length.

.10 Lineshafts

.1 Lineshafting shall be of ample size to transmit the torque and operate the pump without distortion or vibration. Shaft dia. shall be minimum 1.25 inch.

.2 Lineshafting shall be made of 416 SS and be furnished in sections not over ten feet in length.

.3 Lineshafting shall be coupled with extra-strong threaded stainless steel couplings machined from solid bar steel.

.4 Lineshaft bearings shall be neoprene or similar and be retained in bronze guides.

.11 Discharge Assembly

.1 The pump discharge shall be of the below ground construction and consist of a driver mounting-base, underground elbow and riser pipe.

.2 The underground elbow shall be of fabricated steel (min. 0.375 inch thickness) and have a grooved end for Victaulic connection to discharge piping.

.3 All columns and discharge elbow shall be blasted and coated with a Polyamide Epoxy / Coal Tar corrosion resistant both inside and outside. Same coating shall be applied to the exterior surfaces of the new bowl assemblies.

.4 A driveshaft of the same material as the lineshaft shall extend through the sealing assembly of the driver-mounting base and be coupled to a vertical hollow shaft driver.

.12 Pump Head, Soleplate and Seal Water

.1 Pump head, fabricated steel construction, designed to support the pump and driver.

.2 Soleplate to suit existing floor opening.

.3 Shaft sealing assembly with packing box rated for 175 psi and seal/flush water connection.

.4 Seal/flush water piping, valves and appurtenances as shown on the drawings.

.5 Plug for column vent connection (an air release vent is not used for this installation).

.13 Vibration Limits

.1 The limits of vibration as set forth in the standards of the Hydraulic Institute shall govern.

.14 Horizontal Discharge Piping

.1 Existing horizontal discharge piping between pump column discharges and the discharge chamber are to remain. Contractor is to wire brush clean 300 mm length of piping from the connection to the pump and restore the finish to match the original pipe coating.

.2 Diameter: 500 mm. Contractor to confirm.

.3 New couplings: Victaulic Style 77, or approved equal in accordance with B7.

.15 Pump Motors

.1 Vertical motors specifically designed to drive vertical turbine pumps.

.2 Hollow shaft allows the pump head shaft to extend through the motor shaft and connect to an integral-mounted drive coupling.

.3 Thrust bearing capable of withstanding the weight of its rotor plus the hydraulic thrust produced by the pump when operating at any condition in the specified head range of the pump

.4 Impeller adjustment access at the top of the motor.

.5 Maximum 100 HP, 900 or 1180 rpm as required by pump design, 1.15 SF, NEMA WPI enclosure, 575 Volt, 3 Phase, 60 Cycles

.6 40 deg C ambient rated.

.7 Class F insulation, Class B rise at full load.

.8 Motors shall include high temperature alarm dry contact to monitor motor temperature. Contact shall be rated for 24 VDC.

.9 Motors shall be capable of ten (10) starts per hour on a continuous basis without temperature rise that could damage the motor.

.10 Non-reverse rotation ratchet.

.11 Lifting lugs.

.16 Factory Testing

.1 A certified factory performance test shall be performed on each bowl assembly in accordance with Hydraulic Institute Standards.

.17 Tools and Spare Parts

.1 Provide special tools or accessories required for maintenance, adjustment, assembly or disassembly of the pumping equipment supplied.

.2 Provide the following spare parts:

.1 Qty 1 set of wear rings

.2 Qty 1 set of bowl liners

.3 Qty 1 set of bearings

.4 Qty 1 impeller/propeller (trimmed to size)

.5 Qty 1 set of volute and casing gaskets

.3 Properly package spare parts to resist damage.

.4 Clearly identify package as to its contents.

.5 Spare parts shall be identical to those supplied in the pumps.

Part 3 Execution

3.1 INSTALLATION

.1 Install underpass pumps in accordance with manufacturer's instructions.

.2 Make power and control connections to CSA C22.2 No.46.

3.2 MANUFACTURER'S REPRESENTATIVE

.1 Arrange for a qualified Manufacturer's Representative to attend the site to review the installation work, verify correct installation, witness field testing, and provide operation and maintenance training.

.2 Allow for two (2) consecutive days on site.

3.3 TESTING

.1 Field test pumps to verify proper working order and verify performance.

3.4 TRAINING

.1 The Contractor shall include costs for providing training to City staff on the operation and maintenance of the Goods.

.2 Training for the pumping equipment shall be conducted on Site, in conjunction with commissioning. The Contractor shall provide a qualified instructor as well as the necessary course materials.

.3 Training shall be provided in one (1) session for operation and maintenance staff, and one (1) session for Electrical and Instrumentation staff.

.4 Training shall be completed in conjunction with commissioning of the Goods. The Contract shall not be considered complete until the training has been provided.

3.5 COMMISSIONING

.1 Attend the site during commissioning of the storm pumps to ensure that each pump functions as intended.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 40. This section supplements requirements of Division 1.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1-2018 except where specified otherwise.

.2 Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

1.3 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.3 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

.4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B4.

1.4 CARE, OPERATION AND START-UP

.1 Instruct City maintenance and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with 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 Lamicoid 3 mm thick plastic lamicoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
Size 8	35 x 100 mm	3 lines	5 mm high letters

.3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

1.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

1.10 SUBMITTALS

.1 Prior to delivery of any Products to Job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division 1.

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.

.3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.

.4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

.5 Manufacture of Products shall conform to revised Shop Drawings.

1.11 RECORD DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of Record Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. Record Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

1.12 O&M MANUAL

.1 Operations and Maintenance Manuals

.1 Refer to 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 CD in a sleeve 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 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 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.

.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 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).

.2 Testing of all discrete outputs by forcing the outputs in the PLC software and confirming the output is active using a pilot light or multi-meter.

.1 Confirm that the City's SCADA system is able to see the state transition.

.3 Testing of all analog inputs by using a 4-20mA or 0-10V process simulator (multi-meter with signal generating functions).

.1 Test the input at 0%, 50%, and 100% of full scale.

.2 Test the underrange (0.0 - 3.9 mA) and overrange (20.1 – 24.0 mA) operation.

.3 Confirm that the City's SCADA system as able to see each of the 0%, 50%, and 100% of full scale values as they are tested.

.4 Testing of all analog outputs by forcing the outputs in the PLC software and measuring the value with a multi-meter.

.1 Test the output at 0%, 50%, and 100% of full scale.

.2 Confirm that the City's SCADA system as able to see each of the 0%, 50%, and 100% of full scale values as they are tested.

.5 Testing of physical pushbuttons, selector switches, and pilot lights on the control panel(s).

.6 Testing of the PSTN (dial-up) modem by providing a temporary external telephone line connection to the modem, and allowing for the City's SCADA system to dial out and connect to the PSTN modem for confirmation that the PLC status and alarm signals can be read.

.1 Testing of all status and alarm signals is not required. Test only a small sample of signals, including at least two discrete points and two analog points.

.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.

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 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.

.2 Supplement the provided forms as required to make a complete commissioning report package. Utilize the specifications, drawings, and 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.

.2 Inform, and obtain approval from the Contract Administrator in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.3 Correct deficiencies 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 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 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 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 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.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant.

.3 Operating conditions: -40 to +55°C with 5 - 95% RH (non-condensing) unless otherwise specified.

2.2 EMERGENCY STOP PUSHBUTTONS (HS-U010-1, HS-U020-2)

.1 Supply and install enclosed two-position maintained emergency stop operator stations for the underpass pumps P-U01, P-U02 as indicated on the drawings.

.2 Requirements:

.1	Type:	Push-Pull / Twist to release
.2	Ingress Protection:	NEMA 4X
.3	Contact Life:	1,000,000 cycles
.4	Mechanical Life:	250,000 cycles
.5	Contact Rating:	10 A
.6	Contact Configuration:	As shown on the drawings
.7	Illumination:	Not required unless otherwise indicated.
.8	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 manufacturers recommended methods, procedures and instructions.

.2 Readily accessible to allow for unhindered operation and servicing.

.3 Wall installation:

.1 Located as shown on the drawings.

.2 Securely mounted.

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-C22.1-2015, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in 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 FLOAT SWITCHES (LSHH-U500)

.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 CONTROLLER, SENSOR (LIC-U500, LE-U500)

.1 Service:

.1	Fluid:	Water

.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 Provide handheld infrared programmer for configuration.

.6 Acceptable Products:

.1 Siemens MultiRanger 100 transmitter, 7ML5033-1CB00-2A

.2 Siemens Echomax XRS-5 transducer, 7ML1106-1CA20-0A

.3 Siemens Handheld Infrared 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.

.7 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-U621, TE-U651)

.1 Requirements:

.1 Sensor: 1097 ohms @ 25°C.

.2 Insertion: 150 mm duct mount with wiring box.

.3 Mounting: Duct

.4 Operating Range: -40°C to +121°C

.2 Acceptable products:

.1 Honeywell C7031B,

.2 Or approved equal in accordance with B7.

2.5 HVAC TEMPERATURE SENSORS (TE-U691, TE-U692, TE-U693, TE-U694)

.1 Requirements:

.1 Sensor: 1097 ohms @ 25°C.

.2 Insertion: 150 mm duct mount with wiring box.

.3 Mounting: Wall.

.4 Operating Range: -40°C to +121°C

.2 Acceptable products:

.1 Honeywell C7031G,

.2 Or approved equal in accordance with B7.

2.6 FAN FILTER DIFFERENTIAL PRESSURE SWITCH (PDSH-U610)

.1 Requirements:

.1	Type:	Electro-mechanical
.2	Dry Contact:	SPDT, rated for at least 0.2 Amps at 24VDC
.3	Operating Temperature:	0°C to +35°C, minimum
.4	Set Point:	125 Pa (0.5 "w.c) (adjustable)
.5	Pressure Range:	As Required
.6	Enclosure Rating:	NEMA 4 or NEMA 4X
.7	Approvals:	CSA or cUL
.8	Mounting:	Duct or Wall

.2 Acceptable products:

.1 United Electric H100K-540,

.2 Dwyer ADPS-04-1-N,

.3 Or approved equal in accordance with B7.

2.7 ROOM TEMPERATURE SENSOR WITH INTEGRAL TRANSMITTER (TT-U603, TT-U695)

.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 TH300.

.2 This product was standardized by the City via RFP 449-2014. No alternates or substitutes will be accepted.

2.8 ROOM TEMPERATURE SWITCHES – DUAL SWITCH OUTPUT (TSH-U671)

.1 Requirements:

.1 Functionality: Field adjustable switches, independently adjustable

.2 Outputs: Qty 2, SPDT dry contacts

.3 Operating Temperature: -10°C to +40°C minimum

.4 Sensor: Local

.5 Mounting: Wall

.6 Enclosure Rating: NEMA 4X

.7 Approvals: CSA or cUL

.2 Acceptable products:

.1 United Electric B402-120,

.2 Or approved equal in accordance with B7.

2.9 SEAL WATER PRESSURE SWITCH (PSL-U526)

.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.

2.10 SEAL WATER FLOW SWITCHES (FSL-U011, FSL-U021)

.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, 5 meter length.
.9 Approvals: CSA or equivalent

.2 Acceptable Products:

.1 IFM Efector SI5010,
.2 Or approved equal in accordance with B7.

2.11 CARBON MONOXIDE DETECTOR (AE-U560)

.1 Requirements:

.1 Operating Voltage: 120 VAC, 60 Hz.
.2 Gas Sensor Requirement: Carbon Monoxide.
.3 Carbon Monoxide Audio Alarm rated at 85Db.
.4 Carbon Monoxide Visual LED Strobe Light Alarm.
.5 Battery Backup Required.
.6 Detector resets automatically when CO clears.
.7 Mounting: Ceiling.
.8 CSA Approved.
.9 Operating Ambient Conditions:
.1 4 to 38 degrees Celsius.
.2 10 to 95% relative humidity, non-condensing.

.2 Acceptable Products

.1 Aartech Canada 7030BSLA.

.2 Or approved equal in accordance with B7.

2.12 COMBUSTIBLE GAS DETECTOR & SENSOR (AIT-U550, AE-U550)

.1 Requirements:

.1 Combustible gas detection for natural gas (methane) application.

.2 Transmitter mounting: wall

.3 Sensor: Methane IR Sensor, remote ceiling mount

.4 Local LCD display showing % LEL

.5 Alarms: Integral Horn and Red Strobe

.6 Power supply: 24 VDC

.7 Analog Output: 4 – 20 mA

.8 Enclosure ingress rating: NEMA 4X

.9 Factory calibrated sensor, ready to perform immediately after installation.

.10 Operating temperature range: -40°C to +60°C

.11 Approvals: CSA or cUL

.12 Local pushbuttons or infrared remote controller to facilitate on-site configuration and calibration.

.13 Outputs:

.1 Qty 3 dry-contact, output form C relays, configurable.

.1 Relay 1 function: Gas Alarm status (set for 5% of LEL)

.2 Relay 2 function: Gas Alarm status (set for 5% of LEL)

.3 Relay 3 function: Gas Detector Fail/Trouble status

.2 Provide methane gas calibration kit for testing the gas sensor.

.3 Acceptable products:

.1 MSA Ultima X5000.

.2 The supply of gas detection equipment for the City of Winnipeg has been standardized under RFP 123-2014. No alternates or substitutes will be accepted.

.4 Purchase or Quotation:

.1 All requests for purchase or quotation shall reference RFP 123-2014 to receive discount pricing that the City has negotiated with the Vendor.

.2 Contact: CB Engineering, 5040-12A Street SE, Calgary, AB, T2G 5K9.

.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.

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 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 AND SENSORS

.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 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

.5 Field adjust setpoint on temperature switches as per the drawings.

.6 Make adjustments as directed by the Contract Administrator.

3.3 PRESSURE SWITCHES AND TRANSMITTERS

.1 Mount in readily accessible location to allow for quick easy replacement and servicing without special tools or skills.

.2 Field adjust setpoint on pressure switches as per the drawings.

.3 Make adjustments as directed by the Contract Administrator.

3.4 GAS DETECTOR TRANSMITTERS

.1 Mount in readily accessible location to allow for quick easy replacement and servicing without special tools or skills.

.2 Provide test piping line such testing can be done at 1m above finished floor. Test piping line shall use SS ¼" tubing with spacers and connectors.

.3 Field adjust setpoint on gas detector auxiliary relay contacts as per the drawings.

.4 Make adjustments as directed by the Contract Administrator.

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 shall be present to supervise the commissioning, initial operation, and functional testing of the equipment.

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 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight assembly.

.3 Operating conditions: 0°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-U600, TIC-U650 & TIC-U690)

.1 General: digital, stand alone, configurable controller

.2 Power supply: 24 VAC.

.3 Sensor Inputs:

.1 Two (2) 1097 Ohms PTC at 25°C.

.2 Sensed temperature range: -51°C to +132°C.

.4 Discrete Inputs: One (1) 18V, 3.5 mA for monitoring dry contact

.5 Mounting: 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-U601, FV-U602, FV-U603, FV-U691, FV-U692, FV-U693)

.1 Requirements:

.1 Direct mount proportional type.

.2 Spring return type for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Torque as indicated on the drawings.

.4 Damper actuator to drive damper from full open to full closed in less than 150 seconds.

.5 Spring return to drive damper from full open to full closed in less than 25 seconds at normal room temperature.

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Field configurable.

.8 Shaft Diameter: 8.0mm to 16.0mm (3/8” to 5/8”).

.9 Electrical Connection: 0.9 metres (3 ft), 18 AWG, plenum rated cable.

.10 Overload protection: Required.

.11 Auxiliary Switches: Not required.

.12 Power supply as indicated on the drawings

.13 Operating range: 0 - 10 or 2 - 10 VDC as indicated on the drawings.

.14 Position Feedback: Required, 0-10 VDC output.

.15 Operating Temperature: -30°C to +50°C.

.16 Housing: NEMA 2 or IP54 or better.

.17 CSA or cUL.

.18 Acceptable Manufacturer:

.1 Belimo,

.2 Johnson Controls,

.3 Or approved equal in accordance with B7.

2.4 ELECTRONIC DAMPER ACTUATORS, ON/OFF (FV-U671, FV-U672, FV-U694)

.1 Requirements:

.1 Direct mount on-off type.

.2 Spring return type for "fail-safe" in Normally Closed position for dampers FV-U671 and FV-U672.

.3 Spring return type for "fail-safe" in Normally Open position for damper

FV-U694.

.4 Torque as indicated on the drawings.

.5 Damper actuator to drive damper from fully open to fully closed in less than 30 seconds.

.6 Spring return to drive damper from fully open to full closed in less than 30 seconds at normal room temperature.

.7 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.8 Direction of Rotation: Field configurable.

.9 Shaft Diameter: 8.0mm to 16.0mm (3/8" to 5/8").

.10 Electrical Connection: 0.9 metres (3 ft), 18 AWG, plenum rated cable.

.11 Overload protection: Required.

.12 Auxiliary Switches: One SPDT, adjustable operation between 0 and 95°.

.13 Power requirements: As indicated on the drawings.

.14 Operating Temperature: -30°C to +50°C.

.15 Housing: NEMA 2 or IP54 or better.

.16 CSA or cUL.

.17 Acceptable Manufacturer:

.1 Belimo,

.2 Johnson Controls,

.3 Or approved equal in accordance with B7.

2.5 SOLENOID VALVES (XV-U011, XV-U021)

.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.

2.6 ELECTRIC DUCT HEATER CONTROL (HCE-U62, HCE-U65)

.1 Modulating 0-10 VDC signal from Temperature Controller TIC-F600.

2.7 UNIT HEATER CONTROLLER (UH-U64)

.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. Mount in a conspicuous location.

3.3 TESTING AND COMMISSIONING

.1 Calibrate and test control devices for accuracy and performance in accordance with Section 40 80 11 – Automation Commissioning.

3.4 UNIT HEATER CONTROL

.1 Temperature controlled by wall mounted thermostat provided by unit heater manufacturer. Mount thermostat in the location shown on the drawings.

3.5 ELECTRIC DUCT HEATER HCE-U62 CONTROL

.1 Modulating 0-10 VDC signal from Temperature Controller TIC-U600.

3.6 ELECTRIC DUCT HEATER HCE-U66 CONTROL

.1 Modulating 0-10 VDC signal from Temperature Controller TIC-U660.

3.7 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-U62 setpoint: 15°C (adj.).

.2 Damper FV-U601: OPEN.

.3 Damper FV-U602: CLOSED.

.4 Damper FV-U603: OPEN.

.5 Supply Fan SF-U63: ON.

.6 Damper FV-U603: weighted to provide station pressure of 25 Pa relative to the outdoor air pressure.

.2 Unoccupied

.1 Duct heater HCE-U62 setpoint: 15°C (adj.).

.2 Damper FV-U601: 25% OPEN.

.3 Damper FV-U602: 75% OPEN (mechanically linked to FV-U601).

.4 Supply Fan SF-U63: ON.

.5 Damper FV-U603: weighted to provide station pressure of 25 Pa relative to the outdoor air pressure.

3.8 GENERATOR ROOM VENTILATION CONTROL

.1 Automatic control of outdoor air, mixed air, and exhaust air dampers based on generator running status and room temperature.

.1 Generator Running

.1 Temperature Sensors (TE-U691, TE-U692, TE-U693, TE-U694) setpoint: 15°C (adj.).

.2 Damper FV-U691: Enable (modulating based on temperature).

.3 Damper FV-U692: Enable (modulating based on temperature).

.4 Damper FV-U693: Enable (modulating based on temperature).

.2 Generator Not Running

.1 Temperature Sensors (TE-U691, TE-U692, TE-U693, TE-U694) setpoint: 15°C (adj.).

.2 Damper FV-U691: Disable (CLOSED).

.3 Damper FV-U692: Disable (CLOSED).

.4 Damper FV-U693: Disable (OPEN).

3.9 GENERATOR ROOM COMBUSTION AIR CONTROL

.1 Automatic control of combustion air damper based on generator running status.

.1 Generator Running

.1 Damper FV-U694: OPEN.

.2 Generator Not Running

.1 Damper FV-U694: CLOSED.

3.10 WET WELL VENTILATION CONTROL

.1 Automatic control of supply and exhaust fans.

.1 Occupied:

.1 Duct heater HCE-U65 setpoint: 4°C (adj.).

.2 Dampers FV-U661 and FV-U662: OPEN.

.3 Supply Fan SF-U66: HIGH SPEED (660 L/s).

.2 Unoccupied:

.1 Duct heater HCE-U63 setpoint: 4°C (adj.).

.2 Dampers FV-U661 and FV-U622: OPEN.

.3 Supply fan SF-U66: OFF.

3.11 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-U81.

.3 The City utilizes a remote SCADA system that interfaces with the 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.

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 shall fully own all PLC programming logic supplied, and may utilize the software provided for any purpose including:

.1 Modification and revision.

.2 Use at other City facilities.

.2 The City may turn the software over to a 3rd party, for use at any City owned facility.

.3 Provide source code for all custom software and function blocks, or any other software logic utilized in the application.

.1 Source code for base function blocks provided by the PLC manufacturer are not required.

1.6 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 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 The programming languages (ie. ladder, function block) to be utilized

.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 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 CD sleeve with CD containing 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 drawings. Suitable product will be a PLC system produced by a major, international industrial automation vendor.

.3 Provide all required hardware for a complete installation.

.4 Modularity

.1 The construction of the PLC is to be an integrated processor, power supply, and I/O unit, utilizing additional separated I/O expansion modules that are located adjacent to the main unit on DIN rail.

.5 Self-Tests, Diagnostics and Failure Modes

.1 Integrity of controller hardware and software to be constantly monitored by an intrinsic series of continuously running self-tests and diagnostics.

.2 Immediately report abnormal results as system alarms.

.3 Have predictable failure mode upon an error. At a minimum, faults are to generate a system alarm.

.4 Equipment may have the ability to diagnose degradations to performance that may not yet adversely affect operator functions or be a permanent failure. When such conditions are automatically noted, the system is to journal the event in the Historian and have the capability to report such information selectively, as either a system alarm or a message on the programming workstation.

.6 Processors:

.1 Qty 1, 32-bit ARM7 microcontroller, 32 MHz clock.

.2 Qty 2, Microcontroller co-processors, 20 MHz clock.

.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

.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.

.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: 5V, 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.

.13 On-board Inputs and Outputs:

.1 Discrete Inputs (DI):

.1 Channels: 32

.2 Voltage: 12/24 VDC.

.3 Current sinking.

.4 Meet IEEE C37.90.1 surge withstand capability.

.5 Indicating LEDs: Channel status (on/off) for each channel.

.2 Discrete Outputs (DO):

.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 min.)

.3 Chassis to contact: 1500 Vac (1 min.)

.4 Output group to output group: 1500 VAC (1 min.)

.5 Contact rating:

.1 3 A, 30 VDC or 250 VAC (Resistive),

.2 1000 VAC between open contacts,

.3 12 A maximum per common.

.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.

.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 - 32.768V 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.

.5 Analog Outputs (AO)

.1 Channels: 4

.2 Type: Single ended, 0-20mA

.3 Maximum load resistance:

.1 925 Ω with 24VDC input voltage

.2 375 Ω with 12VDC 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: 0.5ms to 2ms for 10% to 90% signal change.

.14 Expansion I/O Modules:

.1 Discrete Input Module, 24 VDC, 16 point:

.1 Channels: 16

.2 Voltage: 24 VDC

.3 Current sinking.

.4 Power Requirements: 5V (supplied from controller via ribbon cable)

.5 Indicating LEDs: Channel status (on/off) for each channel.

.6 Mounting: 35mm 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 Electric UnityPro (latest version).

.2 Supply UnityPro programming software and licenses are not included.

2.3 USB MEMORY STICK

.1 Provide a minimum 2GB 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 Control Panel CP-U81 as per manufacturer 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 ladder logic or 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 tagnames 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 UnityPro (latest version).

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 based upon the pre-shipment submittals.

.2 If requested, demonstrate and test the control panel in presence of the Contract Administrator designated representative.

Part 2 Products

2.1 GENERAL

.1 Construction of the control panels is required, in accordance with the supplied drawings.

.2 Control devices of each category shall be of same type and manufacturer.

2.2 ENCLOSURES

.1 Install lamacoids as per the control panel layout drawings.

.2 All indoor control panels shall be NEMA 12 or as shown on drawings.

.3 All enclosure angles and cut-outs shall be free of dents, gouges or weld marks, and shall present a clean, smooth appearance.

.4 No screws, fittings or other fastenings shall be used on external panel faces, which must be free of any marks, scratches or defaults.

.5 The door is to be a minimum fourteen (14) gauge steel plate, full height and flush with adjacent surfaces.

.6 The exterior of the control panel shall be painted ANSI 61 grey.

.7 The interior of the control panel shall be painted gloss white.

.8 All control panel doors shall be 900 mm (36 inches) wide maximum.

.9 All control panel doors shall open through 180 degrees without restriction.

.10 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 35mm, slotted.

.2 When used to mount terminals, rails shall be mounted on straight raisers (Rail support / Mounting feet) so as to raise them to the same height as the highest adjacent wiring duct.

.3 Raisers (Rail support / Mounting feet) shall not be used when rail hosts heavy components.

.3 Terminals

.1 Requirements:

.1 Mounting: TS-35 DIN rail.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.3 Manufacturer: Phoenix Contact or approved equal in accordance with B7.

.2 Terminal blocks shall be designed for the size of the wires to be connected to them. Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.3 Each terminal shall bear an identification number on both sides.

.4 Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The 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 wire termination per screw.

.5 Pushbutton, Switch and Indicator Light

.1 When required, all control panel pushbuttons, switches and indicator lights shall be at least NEMA 12 (or better)-type devices.

.2 Manufacturer to be Schneider Electric or approved equal in accordance with B7.

.6 Programmable Logic Controllers

.1 As per section 40 94 43.

.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 per drawings
.2	Indication:	LED
.3	Diode:	Provided
.4	Contact arrangement:	As per 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	Battery:	7.2 Ah
.4	Monitoring outputs:	24 VDC, Alarm, Battery Mode, Battery Charge
.5	Manufacturer:	Phoenix Contact QUINT-UPS/24DC/10 (2320225) with UPS-BAT/VRLA/24DC/7.2AH (2320319) or approved equal in accordance with B7.

.10 Cellular Modem:

.1 Supplied by City.

.11 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:	35mm DIN Rail
.9	Approvals:	CSA
.10	Model:	Phoenix Contact PSI-DATA/BASIC-MODEM/RS232 (2313067) or approved equal in accordance with B7.

.12 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.

.13 Wiring

.1 Panel wiring shall be installed in a near and orderly manner.

.2 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.3 No more than two (2) conductors may be terminated under each terminal screw. All internal panel conductors shall be connected to the same side of a terminal block, and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.4 All wires and cables inside the control panels shall be identified on both ends with non-erasable markers.

.5 Identification 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 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.

.14 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.

.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 his responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.

.3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.

.4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.

.5 Tests to include:

.1 Power supply functionality

.2 PLC component functionality

.3 Point to point tests of all inputs and outputs

.4 Power terminal voltage verification

.5 Relays and switches functionality

.6 Receptacle functionality

.7 Modem and Ethernet switch functionality

.6 If the panel is modified after tests have been performed, tests shall be repeated at no additional cost.

3.4 SHIPMENT

.1 If any panel-mounted item is not available for installation before the panel is scheduled for shipment, wiring from the terminal block to the panel location for the item shall be completed, wire ends shall be formed exactly to the configurations required, and identifying sleeves shall be applied, ready for connection.

.2 Shipment of any panel having shortages of equipment shall be approved in writing by the City.

3.5 SPARE COMPONENTS

.1 Supply two spares of each fuse type and rating. Place in a clear plastic bag and attach to the panel door interior

END OF SECTION

Part 1 GENERAL

1.1 Submittals

.1 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to the Contract Administrator, 30 working days prior to anticipated date of beginning of training.

.1 List name of trainers, and type of visual and audio aids to be used.

1.2 Quality Assurance

.1 Provide competent instructors thoroughly familiar with all aspects of the instrumentation system installed in the facility.

.2 Contract Administrator reserves right to approve instructors.

1.3 Instruction

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of the system installed.

1.4 Training Materials

.1 Provide equipment, visual and audio aids, and materials necessary for training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.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: Keewatin Underpass Pumping Station.
.2 Duration: Four hours.
.3 Number of trainees: Coordinate with Contract Administrator prior to training.
.4 Audience: 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.

Part 2 PRODUCTS

2.1 General

.1 Not Applicable.

Part 3 EXECUTION

3.1 Training

.1 Provide on-site training to City personnel, as indicated above.

END OF SECTION

Part 1 General

1.1 MAINTENANCE SERVICES

.1 Not required.

1.2 SUPPORT SERVICES

.1 Duration:

.1 The duration of support services is to extend during the Warranty period (one year past Total Performance)

.2 Requirements:

.1 Provide telephone support for all products supplied (during regular business hours).

.2 Respond to emergency service calls (during regular business hours).

.3 Telephone Support:

.1 Telephone support to utilize service personnel knowledgeable in the products and have the required troubleshooting skills.

.2 No payment will be made for telephone support during the warranty period.

.4 Emergency Service Calls:

.1 Respond to service calls from the City when the system is not functioning correctly.

.2 Qualified control personnel to be available to provide on-site service upon a critical failure, whenever required.

.1 A critical failure is the inability to operate 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 then four 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 defect of the Contractor, no payment will be made to the Contractor.

.2 If the issue is determined to be due to failure of a physical component supplied, and covered under manufacturer's warranty, the Contractor will be paid for the service call.

.3 If the issue is determined to be due to an issue outside of the Contractor's responsibility, the Contractor will be paid for the service call.

.4 Payment will be based upon the rates specified in Form B.

.5 If the service call is subsequent to Total Performance, submit an invoice, based upon the established rates to the City.

Part 2 Products

2.1 NOT APPLICABLE.

.1 Not applicable.

Part 3 Execution

3.1 NOT APPLICABLE.

.1 Not applicable.

END OF SECTION