Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies additional requirements for equipment which has been pre-selected by the City of Winnipeg:

- .1 Centrifugal Pumps
  - .1 Three (3) 220 L/s pumps complete with motors, drive shafts, drive shaft guards, pump suction elbows, supports and spare parts.
  - .2 One (1) 340 L/s pump complete with drive shafts, drive shaft guards, pump suction elbows, supports and spare parts. This pump will be installed with the existing gas motor.
- .2 Gate Valves
  - .1 Two (2) 250 mm resilient seated non-rising stem gate valves – manually actuated.
  - .2 Two (2) 300 mm resilient seated rising stem gate valves – manually actuated.
  - .3 Five (5) 300 mm metal seated rising stem gate valves – manually actuated.
  - .4 Five (5) 350 mm metal seated rising stem gate valves – manually actuated.
- .3 Check Valves
  - .1 Three (3) 300 mm check valves with “hold-open” device.
  - .2 One (1) 350 mm check valve with “hold-open” device.

.2 Refer to Section 43 21 13 – Centrifugal Pumps, for the specifications of the centrifugal pumps and Section 40 05 52 – Process Valves, for the specifications of the process valves.

.3 Obtain details of the pre-selected equipment from Dillon Consulting Limited. Contact the Contract Administrator.

1.2 DESCRIPTION

.1 Pre-selection and pre-purchase of this equipment was made on the basis of competitive quotations.

.2 The Contractor shall be responsible for coordination with the supplier to ensure that the Site is prepared ready to receive the equipment based on the agreed upon date.

.3 The Contractor may contact the Contract Administrator for further clarification and/or details on the pre-selected equipment, supplier scope, conditions and Specifications only after a thorough review of the Contract Documents and direct communications with the named supplier.

Part 2 Products

2.1 GENERAL

.1 The pre-selected and pre-purchased equipment is as shown on the Drawings.

.2 The Contractor shall notify the Contract Administrator of equipment delivery dates.

Part 3 Execution

3.1 EQUIPMENT INSTALLATION – GENERAL

.1 All equipment installed under this Contract shall be installed by skilled trade people and in accordance with the manufacturer's recommendations.

.2 All installations shall be carried out in a workmanlike manner, taking all possible precautions to ensure proper alignment of equipment shafts and pipe connections to avoid transmission of piping weight reactions to the equipment at pipe connections.

.3 Before acceptance of the equipment by the Contract Administrator, it shall be inspected and final adjustments made by a qualified, competent representative of the manufacturer.

.4 The manufacturer shall provide a certificate of installation to the Contract Administrator when the equipment has been satisfactorily installed.

3.2 INSTALLATION AND COMMISSIONING

.1 The Contractor shall be responsible for the installation of the pumps and associated appurtenances.

.2 The supplier will conduct testing and commissioning performance tests in accordance with the Contract Documents.

3.3 TRAINING

.1 The supplier shall provide operating training, which shall include familiarization with the equipment, its maintenance and operation requirement, calibration and tuning, and review of the O&M Manuals.

3.4 PROGRAMMING, TESTING, START-UP AND COMMISSIONING

.1 Pre-purchase equipment supplier shall complete all programming.

.2 Pre-purchase equipment supplier shall provide start-up and commission. Contractor shall carry the cost of supporting services.

END OF SECTION

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 ten (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 accepted.

.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, 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 (1) 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 Submit one (1) electronic copy of Shop Drawings for each requirement requested in Specification sections and as Contract Administrator may reasonably request.

.3 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.

.4 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in the province of Manitoba as required in the Specifications.

.5 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.

.6 Submit one (1) electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where Shop Drawings will not be prepared due to standardized manufacture of product.

.7 Submit one (1) electronic copies of test reports for requirements requested in Specification sections and as requested by Contract Administrator.

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within three (3) years of date of Contract Award for the Work.

.8 Submit one (1) electronic copy of certificates for requirements requested in Specification sections and as requested by Contract Administrator.

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

.2 Certificates must be dated after award of the Contract complete with Project name.

.9 Submit one (1) electronic copy of manufacturers' instructions for requirements requested in Specification sections and as requested by Contract Administrator.

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

.10 Submit one (1) electronic copy of Manufacturer's Field Reports for requirements requested in Specification sections and as requested by Contract Administrator.

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

.11 Submit one (1) electronic copy of operation and maintenance data for requirements requested in Specification sections and as requested by Contract Administrator.

.12 Delete information not applicable to the Work.

.13 Supplement standard information to provide details applicable to the Work.

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

.15 The Contractor will be charged for the Contract Administrator subsequent reviews of submittal packages exceeding two submissions.

.16 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 Tender 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, initialed or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

1.3 PRODECURES

.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 Shop 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.

1.4 SAMPLES

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

.2 Deliver samples prepaid to Contract Administrator's business address.

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

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

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

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

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

1.5 MOCK-UPS

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

1.6 PROGRESS PHOTOGRAPHS

.1 Submit progress photographs.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 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 will be engaged by Contract Administrator for purpose of inspecting and/or testing portions of Work.

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

.3 Employment of inspection/testing agencies does not 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 Contract Administrator at no cost to Contract Administrator. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

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

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

1.4 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 PROCEDURES

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

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

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

1.6 REPORTS

.1 Submit four (4) copies of inspection and test reports to Contract Administrator, prior to inclusion with the O&M Manuals, in accordance with Section 01 33 00 – Submittal Procedures.

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

1.7 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Contract Administrator and may be authorized as recoverable.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 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 excavation and Site free from standing water.

1.4 WATER SUPPLY

.1 Provide potable water as required for construction Work.

1.5 TEMPORARY HEATING AND VENTILATION

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

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

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

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

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

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

.4 Maintain temperatures of minimum 10 degrees Celsius 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 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted.

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

.8 Ensure date of Substantial Performance and warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Contract Administrator.

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

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

.1 Conform to applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

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

1.6 TEMPORARY POWER AND LIGHT

.1 Provide construction power and light panel board. Provide circuit breaker and cabling and connect to empty circuit in panel board with spare capacity.

.2 Provide and maintain temporary lighting throughout the Work. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.7 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone fax data hook up, lines, 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 by-laws.

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-S269.2-[M1987(R2003)], Access Scaffolding for Construction Purposes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by the 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.

1.4 SCAFFOLDING

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

.2 Provide and maintain scaffolding and ladders.

1.5 HOISTING

.1 Provide, operate and maintain hoists, cranes required for moving of workers, materials and equipment.

.2 Hoists, cranes to be operated by qualified operator.

1.6 SITE STORAGE/LOADING

.1 Confine Work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

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

1.7 CONSTRUCTION PARKING

.1 Parking will be permitted on Site in public parking areas provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to Site including fire route access.

1.8 SECURITY

.1 Provide and pay for responsible security personnel to guard Site and contents of Site after working hours and during holidays.

1.9 OFFICES

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

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

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

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

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

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

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

.4 Furnished with one (1) desk, one (1) filing cabinet and two (2) chairs, all satisfactory to the Contract Administrator.

.5 All of the temporary structures provided by the Contractor for the Work 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.

1.10 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.

1.11 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.

1.12 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 firefighting 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.

1.13 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.

1.14 FACILITY ELECTRICAL SUPPLY AND DISTRIBUTION

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

1.15 PROTECTION AND MAINTENANCE OF TRAFFIC

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

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

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

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

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

.6 Verify adequacy of existing roads and allowable load limit on these roads.

.1 The Contractor is responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

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

.9 Dust control: adequate to ensure safe operation at all times.

.10 Provide snow removal during period of Work.

1.16 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from the Site daily.

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

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

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

1.17 FIRE ACCESS

.1 Maintain safe access for fire and rescue vehicles along south side of building.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 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 Erect temporary Site enclosures.

.2 Erect temporary Site enclosure.

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

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.

.2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

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

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

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

1.5 DUST TIGHT SCREENS

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

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

1.6 ACCESS TO SITE

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

1.7 PUBLIC TRAFFIC FLOW

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

1.8 FIRE ROUTES

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

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

.2 Be responsible for damage incurred.

1.10 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

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

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 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 borne by the City in event of conformance with the 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 the 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 the Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of 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.

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 the 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 MANUFACTURORS 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 the 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

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

.3 Include in 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 B7.

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 the Work from damage.

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

1.4 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

.5 Remove samples of installed Work for testing.

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

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

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

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

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

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

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

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

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

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

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

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

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

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

.5 Provide on-Site containers for collection of waste 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

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

.1 Diversion of Materials.

.2 Materials Source Separation Program (MSSP).

.3 Canadian Governmental Responsibility for the Environment Resources.

1.2 DEFINITIONS

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

.2 Recyclable: Ability of product or material to be recovered at end of its life cycle and re manufactured into new product for reuse by others.

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

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

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

.6 Separate Condition: Refers to waste sorted into individual types.

.7 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.3 SUBMITTALS

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

1.4 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by the Contract Administrator. Provide on-site facilities for collection, handling and storage of anticipated quantities of reusable and recyclable materials.

.3 Provide containers to deposit reusable and recyclable materials.

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

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

□

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

.7 Transport to approved and authorized recycling facility.

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

.9 Ship material(s) to site operating under certificate of approval or as directed by the City.

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

1.5 WASTE PROCESSING SITES

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

1.6 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

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

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

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

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

.10 On-site source separation is recommended.

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

.12 Provide waybills for separated materials.

1.7 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

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

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

□

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

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

1.8 USE OF SITE AND FACILITIES

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

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

1.9 SCHEDULING

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

Part 2 Product

2.1 NOT USED

Part 3 Execution

3.1 APPLICATION

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

3.2 CLEANING

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

.2 Clean-up work area as work progresses.

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

END OF SECTION

□

Part 1 General

1.1 SUBMITTALS

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

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

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

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

.5 Two (2) weeks prior to Substantial Performance of the Work, submit to the Contract Administrator: four (4) final copies of O&M Manuals in English.

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

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

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

.9 Pay costs of transportation.

1.2 FORMAT

.1 Organize data as instructional manual.

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

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

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

.5 Arrange content by systems under section numbers and sequence of table of contents.

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

.7 Text: manufacturer's printed data, or typewritten data.

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

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project; date of submission; names.

.1 Addresses, and telephone numbers of the Contract Administrator and Contractor with name of responsible parties.

.2 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

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

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

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

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

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

1.4 AS-BUILTS AND SAMPLES

.1 Maintain, in addition to requirements in General Condition, at Site for the Contract Administrator one (1) record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

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

.3 Label record documents and file in accordance with section number listings in list of contents of this project manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

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

.5 Keep record documents and samples available for inspection by the Contract Administrator.

1.5 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on a set of Contract Drawings.

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

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

.4 Contract Drawings and Shop Drawings mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications; mark each item to record actual construction including:

.1 Manufacturer, trade name and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by addenda and change orders.

.6 Other Documents; maintain manufacturer's certifications, inspection certifications, field test records, required by individual Specifications sections.

1.6 EQUIPMENT AND SYSTEMS

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

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

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

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

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

1.7 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

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

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

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

1.8 SPARE PARTS

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

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

.3 Deliver to Site; place and store.

.4 Receive and catalogue items. Submit inventory listing to the Contract Administrator. Include approved listings in O&M Manual.

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

1.9 MAINTENANCE MATERIALS

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

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

.3 Deliver to Site; place and store.

.4 Receive and catalogue items. Submit inventory listing to the Contract Administrator. Include approved listings in O&M Manual.

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

1.10 SPECIAL TOOLS

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

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

.3 Deliver to Site; place and store. Receive and catalogue items. Submit inventory listing to the Contract Administrator. Include approved listings in O&M Manual.

1.11 STORAGE, HANDLING AND PROTECTION

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

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

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

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

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

1.12 WARRANTIES

.1 Assemble approved information in binder and submit upon acceptance of Work. Organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to table of contents listing.

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

.3 Obtain warranties, executed in duplicate by Subcontractors, suppliers, and manufacturers, within ten (10) days after completion of applicable item of Work.

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

.5 Co-execute submittals when required.

.6 Retain warranties until time specified for submittal.

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

.3 Conduct joint eleven (11) month warranty inspection, measured from date of Substantial Performance, by the Contract Administrator.

.4 Respond in a timely manner to oral or written notification of required construction warranty repair Work.

.5 Written verification will follow oral instructions. Failure to respond will be cause for the Contract Administrator to proceed with action against the Contractor.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to City's personnel one (1) week prior to date of Substantial Performance.

.2 The City will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

1.2 QUALITY CONTROL

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

1.3 SUBMITTALS

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

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for the Contract Administrator approval. Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

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

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

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

1.5 PREPARATION

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

.2 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment.

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

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

.4 Prepare and insert additional data in O&M Manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

.1 Ensure amount of time required for instruction of each item of equipment or system is adequate as determined by the Contract Administrator.

.2 At a minimum allow for training of each system to two (2) separate groups of City personnel.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies requirements for testing, start-up, commissioning and trial operations of the works.

1.2 DEFINITIONS

.1 Testing: testing shall consist of hydrostatic, pressure, agitation, disinfection, dechlorination or other tests as described in the Specifications. Test results shall be documented.

.2 Start-up: start-up for each individual piece of equipment shall consist of the manufacturer's representative inspecting the installation, starting and running the equipment and making any adjustments. Start-up for each piece of equipment shall be considered complete when the Contract Administrator is notified, in writing, by the manufacturer's representative that the equipment is installed, checked and is in working order and ready to be put in continuous operation.

.3 Commissioning: commissioning shall consist of placing individual pieces of equipment and/or process subsystems into continuous operation. During commissioning, equipment shall be verified for mechanical, electrical, and control conformance with the Specifications. Commissioning shall be deemed complete when the Contract Administrator receives notification that the station is ready for trial operation.

.4 Trial operation: trial operation shall consist of placing all of the various systems of the works into continuous operation. Once all systems are on-line and working as a complete unit, the station will be operated continuously for fourteen (14) days. Trial operation shall be deemed complete after the station has been operating continuously for fourteen (14) days, and all process, mechanical and electrical equipment is free of vibration, overloading and overheating, and is functioning in accordance with specified rates, methods and performance.

.5 Special equipment performance test requirements may exceed commissioning and trial operations as outlined above.

.6 All equipment must be commissioned in accordance with the City of Winnipeg Standards.

1.3 SUBMITTALS

.1 The Contractor shall provide a detailed written description of the procedures they plan to follow for the start-up on each system, including methods of calibration, flow routes, tests and personnel involved. This procedure shall be submitted to the Contract Administrator at least four (4) weeks prior to start-up of the systems.

.2 The Contractor shall prepare a written procedure for commissioning and trial operations of the works. The Contractor shall accept the direction and co-ordination assistance of the Contract Administrator for both commissioning and trial operation.

.3 Start-up, commissioning and trial operations shall not commence until the procedure has been approved by the Contract Administrator.

.4 A forty-eight (48)-hour advance notice shall be given to the Contract Administrator before the testing and start-up of each system.

1.4 RESPONSIBILITY

.1 The Contractor shall be responsible for testing, start-up, commissioning and trial operation. The Contract Administrator will witness testing and start-up. The Contractor shall co-ordinate equipment supplier's representatives for start-up.

.2 Under no circumstance shall anyone other than a licensed operator from the City of Winnipeg operate this system.

.3 The operating authority shall be responsible for Water Quality Monitoring during trial operation.

1.5 TESTING AND START-UP

.1 When equipment installation has been completed by the Contractor to standards indicated by these Specifications, the Contractor shall arrange for the services of the equipment manufacturer's technical representative.

.2 The equipment manufacturer's technical representative shall inspect the installation to ensure that the equipment has been installed in accordance with the manufacturer's requirements. If the installation is not in order, the Contractor shall make adjustments in accordance with instructions of the Equipment Manufacturer's Technical Representative. The equipment shall be started and run, and adjustments made at this time.

.3 Following satisfactory start-up, the manufacturer's technical representative shall advise the Contract Administrator, in writing, that the installation has been installed, checked and is in working order.

1.6 COMMISSIONING AND TRIAL OPERATIONS

.1 Commissioning will not commence until all Work is complete and SCADA documentation per City of Winnipeg SCADA standards are issued for all systems.

.2 The Contract Administrator will request that the equipment be operated to demonstrate that it performs as specified. If the Contract Administrator notes deficiencies, the deficiency shall be corrected immediately by the Contractor. The Contractor shall advise the Contract Administrator, in writing, when the deficiencies have been corrected.

.3 Deficiencies of a serious nature, as determined by the Contract Administrator, shall be corrected by the manufacturer's representative.

.4 In the presence of the Contractor and Contract Administrator, a licensed operator from the City of Winnipeg will commission the works in accordance with the written procedure for commissioning. The Contractor shall provide sufficient manpower for the duration of the commissioning period. The Contractor shall make necessary adjustments during commissioning to put the works into continuous operation.

.5 During the trial operation period, the Contractor shall provide the manpower necessary to monitor and maintain the works in operation outside normal working hours to ensure continuous operation of the works.

.6 The station will be considered substantially performed and ready for use at the end of the 'Trial Operation Period' provided the fourteen (14) day running test has been satisfactorily completed and all other requirements of General Conditions, and Construction Lien Act have been met.

1.7 CONSTRUCTION COMPLETE CERTIFICATES

.1 The Contractor shall be required to prepare and use Construction Complete Certificate (CCC) for each system of the works.

.2 The CCC shall include the following:

- .1 Description of system.
- .2 Test results including areas for the Contract Administrator's and Contractor's Signature.
- .3 Test deficiencies.
- .4 Start-up results including areas for the Contract Administrator's and Contractor's signature.
- .5 Start-up deficiencies.
- .6 Instrument Calibration Sheets (as commissioned).
- .7 SCADA documentation per City of Winnipeg SCADA Standards.
- .8 Comments.

.3 The CCC shall include, as attachments, records such as suppliers' representatives' reports, alignment reports, instrumentation loop checks, as well as any other relevant information.

.4 The CCC shall conform to the requirements of the City of Winnipeg SCADA standards. All the relevant calibration and instrumentation testing and verification forms provided in the standards will be completed by the equipment supplier and Contractor and verified by the Contract Administrator.

.5 The Contract Administrator will provide to the Contractor the latest version of the City of Winnipeg standards.

1.8 OPERATOR TRAINING

.1 Provide operator training on equipment operation and maintenance.

.2 The training can be combined with start-up and commissioning.

1.9 BASIS OF PAYMENT

.1 Payment for testing, start-up and commissioning to be included in the Lump Sum Price for Commissioning in the Form B of Tender.

.2 The Lump Sum Price shall cover supply of all labour, materials, tools and equipment, including manufacturers' representatives, as specified, and/or required.

.3 Cost of remedying faults and correcting deficiencies, attributable to the Contractor and consequent additional tests and start-ups, shall be at Contractor's expense.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA S350, Code of Practice for Safety in Demolition of Structures.

1.2 EXISTING CONDITIONS

.1 Structures to be demolished to be based on their condition on date that Tender is accepted.

.2 Items to be salvaged, as identified by City and/or City's Representative, to be carefully removed protected and handed to City and/or City's Representative.

1.3 DEMOLITION DRAWINGS

.1 Where required by authorities having jurisdiction, submit for approval Drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.

.2 Temporary supporting structures and shoring systems are to be designed and submittals sealed by a structural Engineer licensed to practice in the province of Manitoba.

1.4 PROTECTION

.1 Prevent movement, settlement or damage of adjacent structures, services, parts of existing building to remain. Provide bracing, shoring and underpinning as required. Make good damage caused by demolition.

.2 Take precautions to support affected structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify the Department Representative or designate.

.3 Prevent physical intrusion and damage caused by environmental factors such as wind and rain and the spread of dust and contaminants by means of temporary plywood enclosures, screens, fencing, tarps and other means sealed against other areas of the building as required.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 PREPARATION

.1 Disconnect and re-route electrical and telephone service lines entering areas to be demolished in accordance with authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized to serve other areas of the building during period of demolition.

.2 Disconnect and cap designated mechanical services in accordance with authorities having jurisdiction where indicated.

.3 Do not disrupt active or energized utilities designated to remain undisturbed.

3.2 DEMOLITION

.1 Demolish and remove in general portions of exterior and interior walls, roofing, ceilings, structures, finishes, fixed furnishings and mechanical and electrical components in the area of work that are not to be incorporated in the completed Work.

.2 At end of each day's Work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interiors of parts to be demolished from exterior elements at all times.

.3 Demolish to minimize dusting.

.4 Do not sell or burn materials on Site.

.5 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

3.3 SALVAGE

.1 Items to be salvaged: As directed by Contract Administrator.

.2 Carefully dismantle items containing materials for salvage and stockpile salvaged materials on Site.

.3 All pumps and motors to be handed over to the City.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 The Contract Documents applied to the Work of this Section.

1.2 REFERENCES

.1 ASTM A36/A36M-14, Standard Specification for Carbon Structural Steel.

.2 ASTM A193/A193M-16, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, and Threaded Rod 60,000 psi Tensile Strength.

.4 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

.5 ASTM A325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric).

.6 ASTM F3125/F3125M-15a, Standard Specification for High-Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

.7 CAN/CGSB-85.10-99, Protective Coatings for Metals.

.8 Handbook of Steel Construction, 11th Edition (2016).

.9 CISC/CPMA 1-73a, Quick-Drying, One-Coat Paint for Use on Structural Steel.

.10 CISC/CPMA 2-75, Quick-Drying, Primer for use on Structural Steel.

.11 CAN/CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.12 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.13 CAN/CSA-S16-14, Design of Steel Structures.

.14 CAN/CSA-S136-12, North American Specification for the Design of Cold-Formed Steel Structural Members.

.15 CAN/CSA-S136.1-12, Commentary on North American Specification for the Design of Cold-Formed Steel Structural Members.

.16 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.

.17 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding.

.18 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.

.19 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.20 MPI-R2012, Architectural Painting Manual.

.21 MPI-R2012, Maintenance Repainting Manual: Interior Repainting.

.22 MPI-R2012, Maintenance Repainting Manual: Exterior Repainting.

.23 The Society for Protective Coatings (SSPC).

1.3 DESIGN REQUIREMENTS

.1 Design components, details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated on Drawings, and otherwise.

.2 Design shear connections to develop shear capacity of member being connected and show details on Shop Drawings.

.3 Design moment connections to develop moment capacity of member being connected and show details on Shop Drawings.

.4 Design all temporary bracings as required for structural stability during construction stages.

.5 Design all bolt connections with a minimum two (2) bolts in a connection.

.6 Submit sketches and design calculations signed and sealed by a Professional Engineer registered in the Province of Manitoba for non-standard connections.

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings including fabrication and erection documents and materials list in accordance with Section 01 33 00 – Submittal Procedures.

.2 For LEED projects, submit Shop Drawings with accompanying LEED Requirements and Environmental Procedures.

.3 Erection Drawings shall include details and information necessary for assembly and erection purposes, framing plans and grid lines, bearing details, framed openings, accessories, schedule of materials, camber and loading, fasteners and welds, and required temporary bracing.

.4 Additional erection drawings including sequence of erection and type of equipment used in the erection may be required.

.5 Ensure fabricator drawings showing designed assemblies, components and connections are signed and sealed by a Professional Engineer registered in the Province of Manitoba.

.6 All Shop Drawings to be reviewed and checked by the Contractor prior to submission to the Contract Administrator.

.7 Review of Shop Drawing by the Contract Administrator in no way relieves the Contractor responsibility for the accuracy of the Shop Drawings.

.8 Specify primer to be used for each member and components.

.9 Fabricator is to certify that all connection design and details including erection procedure have been supervised and carried out by a Professional Engineer registered in the Province of Manitoba.

1.5 QUALITY ASSURANCE

.1 If requested, submit two (2) copies of mill test reports two (2) weeks prior to fabrication of structural steel.

.1 Mill test reports to show chemical and physical properties and other details of steel to be incorporated in Work.

.2 Provide mill test reports certified by metallurgists qualified to practice in Canada.

.2 If requested, provide structural steel fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

.3 Submit welder’s Certificates.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

.2 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials to metal recycling facility.

.5 Divert unused paint material to hazardous material collections facility.

.6 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.

.7 Clean up and remove all rubbish and surplus materials from Site.

Part 2 Products

2.1 MATERIALS

.1 Structural steel: to CAN/CSA-G40.20/G40.21 (or ASTM A36/A36M) Grade 350W for rolled section and Grade 300W for plates and angles.

.2 Cold-formed structural members: to CAN/CSA-S136.

.3 Anchor bolts: to CAN/CSA-G40.20/G40.21 Grade 300W.

.4 High strength anchor bolts: to ASTM A193/A 93M.

.5 Bolts, nuts and washers: to ASTM A325/A325M.

.6 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.

.7 Primer: to CISC/CPMA1 for interior steel and to CISC/CPMA2 for exterior steel.

.8 Hot dip galvanizing: galvanize steel, for exterior steel and for where indicated, to CAN/CSA-G164, minimum zinc coating of 700 g/m^2.

.9 Shear studs: to CSA W59.

2.2 FABRICATION

.1 For rehabilitation and remediation projects, verify dimensions prior to commencing fabrication.

.2 Fabricate structural steel in accordance with CAN/CSA-S16 and/or CAN/CSA-S136.

.3 Weld to CSA W59.

.4 Joint surfaces to be free from fins and tears.

.5 Install shear studs in accordance with CSA W59.

.6 Continuously seal members by continuous welds where indicated. Grind smooth.

.7 Seal all hollow structural sections with suitable cap plates or by welding all around to adjoining members.

.8 Splice members are not allowed unless noted otherwise or with a written consent of the Contract Administrator. Where spliced, reliable non-destructive inspection such as X-ray is mandatory to ensure the splice workmanship and at the contractor’s expense.

.9 Weld threaded studs to top flanges for attachment of wood nailers.

.10 Clean, prepare surfaces in accordance with SSPC and prime structural steel in accordance with MPI except where members to be encased in concrete.

Part 3 Execution

3.1 GENERAL

.1 Structural steel work: to CAN/CSA-S16 and/or CAN/CSA-S136.

.2 Welding: in accordance with CSA W59.

.3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 CONNECTION TO EXISTING WORK

.1 Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Contract Administrator for direction before commencing fabrication.

3.3 MARKING

.1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.

.2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.4 ERECTION

.1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and/or CAN/CSA-S136 and in accordance with approved reviewed erection drawings.

.2 Field cutting or altering structural members: to approval of Contract Administrator.

.3 Provide all temporary bracings.

.4 Fix and attach all members and bracing by means of field welding.

.5 Continuously seal members by continuous welds where indicated. Grind smooth.

.6 Level, plumb and align all members to CAN/CSA S16.

.7 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.

.8 Galvanize all exterior structural steel components and all noted or specified components to ASTM A123/A123M.

.9 Weld all anchors required to restrain concrete masonry walls.

.10 Correct to acceptance all errors in member fit and erection.

.11 Do not place holes or openings in structural members without the approval of Contract Administrator. Provide reinforcing plates around all openings to maintain design strength where approval is granted.

.12 Frame all openings in steel deck exceeding 400 mm across the flutes.

.13 Provide steel plates, shelf angles, including anchors, required to support steel deck on masonry walls.

3.5 FIELD QUALITY CONTROL

.1 The Contract Administrator, and/or the City's representative will periodically visits the site.

.2 Field services by the Contract Administrator, and/or the City's representative do not in any way relieve the Contractor's responsibility to carry out work as shown in the Contract Documents.

.3 Inspection of materials and workmanship to be carried out by an independent inspection and testing firm certified in accordance with CAN/CSA W178.1 retained and paid for by the Contractor and approved by the Contract Administrator, and/or the City's representative.

.4 An independent inspection shall include:

- .1 Visual inspection of all welds and workmanship that are readily accessible.
- .2 Random check of structural steel member sizes and steel deck gauge.
- .3 Other non-destructive tests, if required.
- .4 Review welder's certificates and welding procedure.
- .5 Inspect all puddle welds and side lap crimping of accessible steel decking.
- .6 Confirm acceptable coatings.
- .7 Tracking all noted deficiencies and providing report to all relevant parties.
- .8 A final report sealed and signed by a Professional Engineer registered in the province where the work is located certifying that all welds and connections, including confirmation that required repairs have been completed.

.5 Provide safe access and working areas for testing and inspection on Site, as required by testing agency and/or the Contract Administrator.

.6 Submit mill test reports to Contract Administrator, and/or the City's representative upon request.

.7 The Contractor will pay costs of inspection and testing, re-inspection as a result of defective workmanship, and repairs to correct defective work.

.8 Additional inspection or test may be requested by the Contract Administrator, with the approval of the City. The cost associating with approved additional inspections or tests to be paid for by the City.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

.1 ASTM A53/A53M-18, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269/A269M-15a, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.4 ASTM A108-18, Standard Specification for Steel Bar, Carbon and Alloy, Cold-finished

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.

.2 CAN/CSA-G164-18, Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA-S16-14, Design of Steel Structures.

.4 CAN/CSA S167-17, Strength Design in Aluminum.

.5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.

.6 CSA W59-18, Welded Steel Construction (Metal Arc Welding).

1.2 SUBMITTALS

.1 Qualification:

.1 Submit qualifications of the manufacturer, welder, mil certificates.

.2 Shop Drawings

.1 Submit Shop Drawings signed and sealed by a Professional Engineer practicing in the Province of Manitoba.

.2 Indicate erection detail, materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.

1.3 QUALITY ASSURANCE

.1 Fabricator and welders must be certified in accordance with CSA and the Canadian Welding Bureau.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job Site.

.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

.3 Store materials off ground in a dry, well-ventilated area.

.4 Replace defective or damaged materials with new.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 350W/300W.

.2 Steel pipe: to ASTM A53/A53M galvanized finished.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Studs Anchors: to ASTM A108 Gr 1020.

.7 Aluminum: to CSA S157 and the Aluminum Association Specifications for Aluminum Structures.

.8 Aluminum plates: type 6061-T651. Aluminium plate shall have an approved raised multi-grip pattern.

.9 Aluminum welding: CAN W59.2.

.10 Hot Dipped Galvanized Steel Repair: Galvalloy, Gal-Viz.

.11 Grout: non-shrink, non-metallic, flowable, 15 MPa at twenty-four (24) hours.

2.2 FABRICATION

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

.2 Confirm measurements for all fabrications before fabricating

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

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

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

.6 Remove and grind smooth burrs, filings, sharp protrusions and projections from metal fabrications to prevent possible injury.

2.3 ACCESS COVERS

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

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

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

2.4 PIPE BOLLARDS

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

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

2.5 RAILS

.1 Steel pipe: diameter as indicated, hot-dip galvanized after fabrication.

.2 Fabricate and install pipe rails to be removable as indicated on Drawings. Sleeve to be secured in concrete slab.

2.6 STAIRS

.1 Stairs sizes and framings as indicated.

.2 Galvanized after fabrication.

.3 Alternating Tread as per Section 05 51 33.23 – Alternate Tread Stairs.

2.7 HOIST BEAMS

.1 Steel beams to be pocketed on masonry wall as per Drawings.

.2 Finish: galvanize

2.8 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 700 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. Color schedule will be provided by the Contract Administrator.

.3 Zinc primer: zinc rich, ready mix.

Part 3 Execution

3.1 ERECTION

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

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

.3 Provide components for building by other sections in accordance with Shop Drawings and schedule.

.4 Make field connections with bolts to CAN/CSA-S16, or weld.

.5 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Aluminum Alternating Tread Stairs.

1.2 REFERENCES

.1 OSHA 1910.25: Stairways.

.2 ASTM B 211-14, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles, and Tubes

1.3 SUBMITTALS

.1 Submit under provisions of Section 01 30 00 – Submittal Procedures.

.2 Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Shop Drawings for Stairs:

.1 Plan and section of stair installation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

.2 Store stair until installation inside under cover. If stored outside, under a tarp or suitable cover.

1.5 WARRANTY

.1 Limited Warranty: One (1) year inclusive. Five (5) years against defective material and workmanship – parts.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturer: Precision Ladders, LLC (www.PrecisionLadders.com), Lapeyre Stair Inc. (www.lapeyrestair.com), or approved equivalent in accordance with B7.

2.2 ALUMINUM ALTERNATING TREAD STAIR

.1 All components shall be aluminum alloy 6005-T5.

.2 Aluminum Alternating Tread Stair and Components: Stair, mounting brackets and handrails on both sides.

.3 Design requirements:

.1 Treads to be capable of withstanding a single concentrated 4.5 kN (1,000 lb) load without failure or permanent deformation.

.2 Handrails to be capable of withstanding a single concentrated load of 1 kN (225 lbs) or a uniform load of 725 N/m (50 lb/ft.) in any direction at any point on the rail.

.3 Degree of Incline: 68 degrees.

.4 Performance Standard: Units designed and manufactured to meet or exceed OSHA 1910.25.

.4 Components:

.1 Stair Side Stringers: 76 mm x 51 mm x 3 mm (3 in x 2 in x 1/8 in) extruded 6005-T5 aluminum tubing or as per manufacturer.

.2 Pitch: 68 degrees.

.3 Stair Center Stringer: 254 mm x 6 mm (10 in x ¼ in) extruded 6005-T5 aluminum flat bar or as per manufacturer. Neoprene trim adhered to front edge of center stringer to protect climber.

.4 Stair Treads: 25 mm (1 in) aluminum Bar Grating, 249 mm (9 13/16 in) deep x 302 mm (11 7/8 in) wide or as per manufacturer, skid resistant surfaces.

.5 Riser spacing: equal spacing within 5 mm (3/16 in) for adjacent and to within 9 mm (3/8 in) for any two (2) non-adjacent risers on a stair.

.6 Stair Mounting Brackets: 153 mm x 6 mm (6” x ¼ in) aluminum flat bar or as per manufacturer.

.7 Handrails: 32 mm (1-1/4 in) Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.

.8 Finishes:

.1 Standard: Mill finish on aluminum stair components.

.2 Powder Coated.

2.3 FABRICATION

.1 Completely fabricate stair ready for installation before shipment to the Site.

Part 3 Execution

3.1 EXAMINATION

.1 If substrate preparation is the responsibility of another installer, notify Contractor of unsatisfactory preparation before proceeding.

.2 Examine materials upon arrival at Site. Notify the carrier and manufacturer of any damage.

3.2 INSTALLATION

.1 Install in accordance with approved submittals.

3.3 PROTECTION

.1 Protect installed products until completion of Work.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section describes the requirements for blanket insulation applied to inside walls and attic space.

1.2 REFERENCES

.1 National Building Code of Canada (NBC).

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

.1 ASTM C553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C665-01e1, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

1.3 SUBMITTALS

.1 Product Data:

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

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-Site for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 INSULATION

.1 Batt and blanket mineral fibre: to ASTM C665 and CAN/ULC S702.

.1 Type: Owens Corning Pink Fibre glass or approved equal in accordance with B7.

.2 Thickness: 140 mm providing total insulation value RSI 3.52 (R20), or to fill cavities as indicated on Drawings.

.3 Thickness: providing total insulation value RSI 7.04 (R40) to attic space.

2.2 ACCESSORIES

.1 Type: as recommended by manufacturer.

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 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of chimneys and Type B vents.

.5 Do not enclose insulation until it has been inspected and approved by Contract Administrator.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 45 00 – Quality Control.

.3 Section 01 61 00 – Common Product Requirements.

.4 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

1.3 REFERENCES

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

.1 ASTM C919-02, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No.1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB-19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound, Type 2, Class B.

.3 Department of Justice Canada (Jus)

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

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

.1 FS-SS-S-200-E (2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

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

.1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

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

.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 samples in accordance with Section 01 33 00 – Submittal Procedures.

.4 Submit duplicate samples of each type of material and colour.

.5 Cured samples of exposed sealants for each color where required to match adjacent material.

.6 Submit manufacturer's instructions in accordance with Section 01 33 00 – Submittal Procedures.

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

1.5 QUALITY ASSURANCE

.1 Carry out the supply and installation of sealants and caulking work by recognized Specialist Applicators having at least five (5) years of proven satisfactory experience and having skilled workmen thoroughly trained and competent in all phases of caulking work.

1.6 DELIVERY, STORAGE, AND HANDLING

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

.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.

.3 Store materials in dry location in such manner that no damage will be done to materials or building.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

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

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

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to an approved, official hazardous material collections site.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

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

1.8 PROJECT 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 4.4 degrees Celsius.

.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.

1.9 ENVIRONMENTAL REQUIREMENTS

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

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

1.10 WARRANTY

.1 Provide written warranty covering the work of this Section for a period of two (2) years from the date of Substantial Completion as per the Contract.

.2 Defective work shall include but not be restricted to leakage, cracking, crumbling, melting, running, loss of adhesion, loss of cohesion, staining of adjoining or adjacent surfaces or work.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Sealants - Type A

.1 Multi-component sealants to meet CGSB Specification CAN/CGSB-19.24, (Two (2) -part urethane) or single component sealant to meet CGSB Specification CAN/CGSB-19.13, (silicone) to be used for:

.1 Exterior joints around perimeters of metal door frames including thresholds and sills.

.2 Exterior joints around perimeters of louvre frames and duct penetrations.

.3 Exterior perimeter of conduit, wire and pipe penetrations.

.4 Exterior control joints.

.5 Roof flashings.

.2 Use one of the following sealants:

.1 Dymeric by Tremco (Canada) Limited.

.2 1200 Sealant by CGE Canada Ltd.

.3 795 Sealant by Dow Corning Canada.

.2 Sealants – Type B

.1 Acrylic solvent release, one (1) part sealant, to meet CGSB Specification 19-GP-5M, to be used for all other locations where caulking beads remain exposed:

.1 Interior perimeters of door and window frames, louvre openings, service penetrations and ducts.

.2 Interior movement joints in exterior masonry walls.

.2 Use one of the following sealants:

.1 Mono by Tremco (Canada) Limited.

.2 Acryflex by Sternson Ltd.

.3 Parr-Crylic by Parr Sealants of Canada Ltd.

.4 PR12-100 Vinyl Acrylic by PRC Canada Ltd.

.3 Silicone Sealant – Type C

.1 Apply clear, mildew resistant silicone sealant at perimeter of backsplashes, at millwork mounted against walls, at washroom vanities, and around plumbing fixtures at floor and wall surfaces.

.2 Use one of the following sealants:

.1 Tremsil 200 by Tremco (Canada) Ltd.

.2 DAP 3.0.

.4 Primers

.1 To be of a type recommended by sealant manufacturer for the appropriate sealant and corresponding substrate.

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

.1 Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open closed cell foam backer rod.

.2 Size: oversize thirty percent (30%) to fifty percent (50%).

.2 Neoprene or Butyl Rubber.

.1 Round solid rod, Shore A hardness 70.

.3 High Density Foam.

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m^3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond Breaker Tape.

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 COLOURS

.1 Colours of sealant, shall match the predominant material to which sealant is applied.

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 thirty percent (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 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 61 00 – Common Product Requirements.

.3 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.4 Section 07 92 10 – Joint Sealing: Caulking of joints between frames and other building components.

.5 Section 08 71 10 – Door Hardware: Supply of finish hardware, including weather-stripping and mounting heights.

.6 Section 09 91 00 – Painting and Protective Coatings.

1.2 REFERENCES

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

.1 ASTM A653/A653M-03, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.ASTM B29-92 (1997), Specification for Refined LeadASTM B749-97, Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)

.1 G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-M1989 (R2001), Welded Steel Construction (Metal Arc Welding) (Metric Version).

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

.1 CSDMA, Specifications for Commercial Steel Doors and Frames, 1990.

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-99, Standard for Fire Doors and Fire Windows.NFPA 252-99, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN4-S104-M80, Fire Tests of Door Assemblies.

.2 CAN4-S105-M85, Fire Door Frames Meeting the Performance Required by CAN4-S104.

.3 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.4 CAN/ULC-S702-97, Mineral Fibre Thermal Insulation for Buildings.

.5 CAN/ULC-S704-03, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 DESIGN REQUIREMENTS

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

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

1.4 SHOP DRAWINGS

.1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed louvred, arrangement of hardware and fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing fire rating finishes.

.4 Indicate details of construction and installation of all components of the Work.

.5 Include schedule identifying each unit, with door marks and numbers relating to numbering on Drawings and door schedule.

.6 Submit test and engineering data, and installation instructions.

1.5 REQUIREMENTS

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M, CAN4-S105M and NFPA 252 for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104, ASTM E152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.6 WARRANTY

.1 Materials and workmanship shall be warranted by manufacturer in accordance with Canadian Steel Door Manufacturers' Association, (CSDMA) Standard Warranty for Steel Doors and Frames.

1.7 DELIVERY, STORAGE, AND HANDLING

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

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

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from Site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

.4 Divert unused paint and sealant materials from landfill to an approved, official hazardous material collections site.

.5 Do not dispose of unused paint and sealant materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

.6 Divert unused metal materials from landfill to an approved metal recycling facility.

.7 Divert unused wood materials from landfill to an approved recycling facility.

.8 Damaged or broken glazing materials are not recyclable. These materials must not be disposed of with materials destined for recycling.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 Only steel frame products manufactured by Canadian Steel Door Manufacturers' Association, (CSDMA) members are eligible for use on this project.

2.2 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, hot dipped galvanized.

.3 Fire-rated doors and frames: Material and construction in accordance with listing requirements. Doors to be flush type with no face seams.

2.3 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m^3 minimum sanded to required thickness.

.2 Insulated:

.1 Expanded polystyrene: CAN/ULC-S701, density 16 to 32 kg/m^3.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250ºC at 30 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.4 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Polystyrene cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.5 PRIMER

.1 Touch-up prime CAN/CGSB-1.181.

2.6 PAINT

.1 Field paint steel doors and frames in accordance with 09 91 00 – Painting and Protective Coatings. Protect weather-strips from paint. Provide final finish shall be free of scratches or other blemishes.

2.7 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma steel.

.3 Door bottom seal: to Section 08 71 10 – Door Hardware.

.4 Metallic paste filler: to manufacturer's standard.

.5 Accessories (doors and frames) and minimum base steel thickness:

.1	Lock/strike reinforcements:	1.6 mm
.2	Hinge reinforcements:	2.7 mm
.3	Flush bolt reinforcements:	1.6 mm
.4	Reinforcements for surface applied hardware:	1.2 mm
.5	Top or bottom channels:	1.2 mm

.6	Glass trim, screw fixed or snap-in types:	0.9 mm
.7	Mortar guard boxes:	0.8 mm
.8	Floor anchors:	1.6 mm
.9	Jamb spreaders:	0.9 mm

.6 Sealant: to Section 07 92 10 – Joint Sealing.

2.8 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications, reviewed Shop Drawings and listing requirements.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Finish: hot dipped galvanized after fabrication.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cutouts with steel guard boxes welded to frame.

.6 Prepare frame for door silencers, three (3) for single door, and two (2) at head for double door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Insulate exterior frame components with mineral wool insulation.

2.9 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb, minimum three (3) anchors per jamb.

.3 Provide two (2) anchors for rebate opening heights up to 1,520 mm and one (1) additional anchor for each additional 760 mm of height or fraction thereof.

2.10 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane; fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in two (2) temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.11 DOOR FABRICATION GENERAL

.1 Fabricate doors in accordance with CSDMA specifications, reviewed Shop Drawings and listing requirements.

.2 Doors: swing type, flush, with provision for single, sealed insulated glass units, and louvre openings as indicated.

.3 Interior doors: honeycomb hollow steel construction.

.4 Exterior doors: insulated polystyrene core construction.

.5 Fabricate doors with longitudinal edges mechanically interlocked with visible seams.

.6 Bevel hinge and lock edges of doors, 3 mm in 50 mm.

.7 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.8 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on-Site, at time of hardware installation.

.9 Reinforce doors where required, for surface mounted hardware.

.10 Provide flush PVC steel top caps to exterior doors.

.11 Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.12 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.13 Provide 127 mm backset for all locksets and latchsets where indicated in the Door Schedule.

2.12 HOLLOW STEEL CONSTRUCTION

.1 Form each face sheet for exterior doors from 1.6 mm (sixteen (16) gauge) galvanized sheet steel with polystyrene core laminated under pressure to face sheets.

.2 Form each face sheet for interior doors from 1.3 mm (eighteen (18) gauge) galvanized sheet steel with honeycomb or temperature rise rated core laminated under pressure to face sheets.

.3 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.

2.13 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.

.4 Welding of thermally broken frames must not cause thermal transfers between exterior and interior surfaces of frame sections.

.5 Fill voids in frame with mineral wool insulation prior to insulation.

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 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 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 1,200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

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

.6 Maintain continuity of air barrier and vapour retarder.

.7 Install door silencers after finish painting of frame has been completed.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 10 – Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

.5 Install vinyl top caps in out swinging exterior doors for weather protection.

3.4 FINISH REPAIRS

.1 Touch up with primer 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 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 08 11 14 - Metal Doors and Frames.

1.2 REFERENCES

.1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA)

.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-69.17-M86 (R1993), Bored and Preassembled Locks and Latches.

.2 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.

.3 CAN/CGSB-69.19-93/ANSI/BHMA A156.3-1984, Exit Devices.

.4 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).

.5 CAN/CGSB-69.21-M90/ANSI/BHMA A156.5 1984, Auxiliary Locks and Associated Products.

.6 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.

.7 CAN/CGSB 69.24-M90/ANSI/BHMA A156.8-1982, Door Controls - Overhead Holders.

.8 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-1987, Mortise Locks and Latches.

.9 CAN/CGSB-69.31-M89/ANSI/BHMA A156.15-1981, Closer/Holder Release Device.

.10 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981, Auxiliary Hardware.

.11 CAN/CGSB-69.34-93/ANSI/BHMA A156.18-1987, Materials and Finishes.

1.3 SUBMITTALS

.1 Product Data

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

.2 Samples:

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

.2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.3 After approval samples will be returned for incorporation in the Work.

.3 Hardware List

.1 Submit contract hardware list in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.5 Closeout Submittals

.1 Provide operation and maintenance data for door closers, locksets, door holders.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

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

1.5 DELIVERY STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

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

.2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.2 Storage and Protection:

.1 Store finishing hardware in locked, clean and dry area.

1.6 WASTE DISPOSAL AND MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard, polystyrene and plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Supply two (2) sets of wrenches for door closers, locksets and exit hardware.

PART 2 Products

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Butts and hinges: to CAN/CGSB-69.18, (Three (3) per door for doors up to 2135 and four (4) per door for doors up to 2440 in height or over 914 in width), NRP, ball bearing type, stainless steel.

.1 Acceptable products:

.1 Hagar AB850 x 114 x 114.

.2 Stanley CB199 x 114 x 114.

.3 Contract Administrator approved equal in accordance with B7.

.2 Exit devices: to CAN/CGSB-69.19, rim exit device, ULC rated, with cylinder core, exterior lever handle trim and vinyl touch bar.

.1 Acceptable products:

.1 Von Duprin 98 series.

.2 Sargent 8800 series.

.3 Contract Administrator approved equal in accordance with B7.

.2 Locksets:

.1 Locksets to CAN/CGSB-69.17 –M86, Grade 1 lever handle.

.2 Provide construction cylinder cores and final cores with keying to City’s BEST master key system.

.3 Acceptable products for interior locksets:

.1 Schlage “A” series.

.2 Stanley 9K series.

.3 Contract Administrator approved equal in accordance with B7.

.4 Acceptable products for exterior locksets:
.1 Schlage “D” series.
.2 Stanley 9K series.
.3 Contract Administrator approved equal in accordance with B7.

.3 Door Closers and Accessories:
.1 Door controls (closers): to CAN/CGSB-69.20, one (1) per door. All door closers shall be through bolted. Finish aluminum lacquer.
.1 Acceptable products:
.1 LCN 4040 Super Smoothee by LCN closers.
.2 Contract Administrator approved equal in accordance with B7.
.2 Door controls - overhead holders: to CAN/CGSB-69.24, extruded bronze, 110 degree hold-open and stop, one (1) per door.
.1 Acceptable products:
.1 Sargent 598H.
.2 Contract Administrator approved equal in accordance with B7.

.4 Architectural door trim: to CAN/CGSB-69.22, as listed below.
.1 Door protection plates: kick plate type, 1.27 mm thick stainless steel.
.1 Acceptable products:
.1 Canadian Builders Hardware.
.2 Contract Administrator approved equal in accordance with B7.

.5 Auxiliary hardware: to CAN/CGSB-69.32, as listed below.
.1 Surface bolt: (200 mm), heavy duty top and bottom.
.1 Acceptable products:
.1 Canadian Builders Hardware F67.
.2 Ives SB1630TBL 1289.
.3 Contract Administrator approved equal in accordance with B7.

.6 Thresholds: 150 mm, extruded aluminum with thermal break.
.1 Acceptable products:
.1 K. N. Crowder CT-46.
.2 Contract Administrator approved equal in accordance with B7.

.7 Weatherstripping:
.1 Head and jamb seal: Adjustable spring loaded, vinyl in extruded aluminum trim.
.1 Acceptable products:
.1 K. N. Crowder W44.
.2 Contract Administrator approved equal in accordance with B7.
.2 Door bottom seal: Neoprene rubber in extruded aluminum trim.
.1 Acceptable products:

.1 K. N. Crowder Type CT-54 Automatic door bottom.

.2 Contract Administrator approved equal in accordance with B7.

.8 Astragal: full height mounted, interior magnetic in extruded aluminum trim and pile strip in extruded aluminum trim on exterior.

.1 Acceptable products:

.1 Zero International, No.40 Interior and No.41 Exterior.

.2 Contract Administrator approved equal in accordance with B7.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

.6 All fasteners to be non-corroding.

2.4 KEYING

.1 Lay out keying system in consultation with the City. Keying system shall include keying alike, keying differently, keying in groups, submaster keying and grand master keying locks as necessary to meet the requirements of the City.

.2 Keying chart and related explanatory data shall be prepared and submitted to the City for approval, and lock work shall not be commenced until written confirmation of keying arrangements is received from the City.

.3 Provide keys in duplicate for every lock.

.4 Stamp keying code numbers on keys and cylinders.

.5 Provide cabinet for key control with two tag security system complete with key loan register, three(3)-way cross reference index, and cabinet door locking device.

.6 All locks shall be operated by a construction master key in construction cylinder cores while the building is under construction, but shall not operate when the temporary construction cores are replaced with permanent master keyed cylinders at completion of the building.

.7 Provide all permanent cores and keys to City.

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.

.2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

.1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.

.2 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.3 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.4 Remove construction cores when directed by Contract Administrator; install permanent cores and check operation of locks.

3.3 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

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

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer’s instructions.

.3 Remove protective material from hardware items where present.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Moisture testing of substrates.

.2 Surface preparation of substrates as required for acceptance of paint, including cleaning, small crack repair, patching, caulking, and making good surfaces and areas to limits defined under Master Painters Institute (MPI) Repainting Maintenance Manual requirements.

.3 Specific pre-treatments noted herein or specified in the MPI Repainting Maintenance Manual.

.4 Sealing/touch-up, spot priming, and/or full priming surfaces for repainting in accordance with MPI Repainting Maintenance Manual requirements.

.5 Provision of safe and adequate ventilation as required where toxic and/or volatile/flammable materials are being used over and above temporary ventilation supplied by others.

1.2 REFERENCES

.1 Maintenance Repainting Manual by the MPI, including Identifiers, Evaluation, Systems, Preparation and Approved Product List.

.2 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.3 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five (5) years proven satisfactory experience. Provide a list of last three (3) comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they Work under the direct supervision of a qualified journeyman in accordance with applicable trade regulations.

.3 Conform to latest MPI requirements for interior painting work including cleaning, preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with the latest edition of the MPI Approved Product List and shall be from a single manufacturer for each system used.

.5 Paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Maintenance Repainting Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Contract Administrator.

.7 Standard of Acceptance: When viewed using final lighting source surfaces shall indicate the following:

.1 Walls: No defects visible from a distance of 1,000 mm at 90 degrees to surface.

.2 Ceilings: No defects visible from floor at 45 degrees to surface.

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

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide indoor paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

1.5 INSPECTION REQUIREMENTS

.1 Interior surfaces requiring repainting shall be inspected by both painting contractor who will notify Contract Administrator and Contractor in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.2 Where an assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered shall be rectified by others, as mutually agreed, before repainting is started.

1.6 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with the requirements of Section 01 30 00 – Submittal Procedures.

.2 Submit full range colour sample chips for review and selection. Indicate where colour availability is restricted.

.3 Submit Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) for paint and coating materials in accordance with section.

.4 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use (i.e., materials and location).

.2 Manufacturer's product number.

.3 Colour code numbers.

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's MSDS.

1.7 QUALITY CONTROL

.1 Provide a mock-up in accordance with requirements of Section 01 33 00 – Submittal Procedures.

.2 Prepare and repaint mock-up designated interior room, surface or item to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Maintenance Repainting Manual standards for review and approval.

.3 When approved, repainted room, surface and/or item shall become acceptable standard of finish quality and workmanship for similar on-Site interior repainting work.

1.8 DELIVERY, HANDLING AND STORAGE

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

.2 Deliver and store materials in original containers, sealed, with labels intact.

.3 Labels shall clearly indicate:

.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.

.4 Remove damaged, opened and rejected materials from Site.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and equipment in a secure, dry, well-ventilated area with temperature range between 7 degrees Celsius to 30 degrees Celsius. Store materials and supplies away from heat generating devices and sensitive products above minimum temperature as recommended by manufacturer.

.7 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Contract Administrator. After completion of operations, return areas to clean condition to approval of Contract Administrator.

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

.9 Comply with requirements of WHMIS regarding use, handling storage, and disposal of hazardous materials.

.10 Fire Safety Requirements:

.1 Provide one (1) 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from Site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:

.1 Perform no repainting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees Celsius for twenty-four (24) hours before, during and after paint application and until paint has cured sufficiently.

.2 Ventilate enclosed spaces. Where required, provide continuous ventilation for seven (7) days after completion of application of paint.

.3 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements. The use of gas-fired appliances is not permitted.

.4 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no repainting work when:

.1 Ambient air and substrate temperatures are below 10 degrees Celsius.

.2 Substrate temperature is over 32 degrees Celsius unless paint is specifically formulated for application at high temperatures.

.3 Relative humidity within area to be repainted is above eighty-five percent (85%).

.2 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except use a simple "cover patch test" on concrete floors to be repainted.

.3 Perform no repainting work when maximum moisture content of substrate exceeds:

.1 Twelve percent (12%) for concrete and masonry (clay and concrete brick/block).

.2 Fifteen percent (15%) for wood.

.3 Twelve percent (12%) for plaster and gypsum board.

.4 Test painted concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured, unless otherwise pre-approved by the specific coating manufacturer.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.2 Materials that cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

.5 Where paint recycling is available, collect waste materials by type and provide for delivery to recycling or collection facility.

.6 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by employees, individuals, or organizations for verifiable re-use or re-manufacturing.

1.11 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Special Provisions of the Contract.

.2 Submit one (1), 4 litre can of each type and colour of finish coating. Identify type and colour in relation to established colour schedule and finish system.

.3 Deliver to City and store where directed.

Part 2 Products

2.1 MATERIALS

.1 Paint materials listed in the latest edition of the MPI Approved Product List (APL) as supplied by one (1) of following manufacturers are acceptable for use on this project:

.1 ICI Devoe.
.2 Pittsburgh Paints.
.3 Colour Your World.
.4 Pratt and Lambert.
.5 Benjamin Moore.
.6 Para Paints.

.2 Where required by authorities having jurisdiction, paints and coatings shall provide a fire resistant rating.

.3 Paint materials for repaint systems shall be products of a single manufacturer.

.4 Paints and coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.5 Paints and coatings must not be formulated or manufactured with formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

2.2 COLOURS

.1 Contract Administrator will provide Colour Schedule after Contract award.

.2 Colour schedule will be based upon selection of five (5) base colours and three (3) accent colours. No more than eight (8) colours will be selected for the entire project and no more than three (3) colours will be selected in each area.

.3 Selection of colours will be from manufacturer’s full range of colours.

.4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.5 First coat in a two (2) coat (Premium) repaint system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to Site.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following MPI gloss/sheen standard values:

GLOSS LEVEL CATEGORY	UNITS @ 60^{O}	UNITS @ 85^{O}
G1 - Matte Finish	0 to 5	maximum 10
G2 - Velvet Finish	0 to 10	10 to 35
G3 - Eggshell Finish	10 to 25	10 to 35
G4 - Satin Finish	20 to 35	minimum 35
G5 - Semi-Gloss Finish	35 to 70	
G6 - Gloss Finish	70 to 85	
G7 - High Gloss Finish	> 85	

.2 Gloss level ratings of repainted surfaces shall be as specified herein and as noted on Finish Schedule.**INTERIOR PAINTING SYSTEMS**

.1 Applies to new finishes over previously unpainted surfaces or new shop primed surfaces to be field painted.

.2 Refer to Finish Schedule on architectural Drawings for locations.

.3 Galvanized and non-galvanized metal: doors, frames, railings, structural and miscellaneous metals (within floor to underside of ceilings).

.1 Alkyd primer/sealer – One (1) coat.

.2 Alkyd - G5 finish – Two (2) coats.

.4 Gypsum board and exposed plywood: gypsum wallboard, drywall, "sheet rock type material", plywood and wood:

.1 Latex primer/sealer – One (1) coat.

.2 Latex G3 finish – Two (2) coats.

.5 Canvas and cotton coverings.

.1 Latex G1 finish – Two (2) coats.

2.6 INTERIOR RE-PAINTING SYSTEMS

.1 Applies to previously painted surfaces, not new or shop primed.

.2 Galvanized and non-galvanized metal: doors, frames, railings, misc. steel, pipes and ducts.

.1 Prepare by mechanical means or shot blasting.

.2 Alkyd primer – 1 Alkyd - G5 – Two (2) coats.

.3 Concrete and masonry surfaces:

.1 Latex block filler – One (1) thick coat to fill pores.

.2 Latex G3 finish – Two (2) coats.

.4 Canvas and cotton coverings.

.1 Latex G1 finish – Two (2) coats.

2.7 EXTERIOR PAINTING AND RE-PAINTING SYSTEMS

.1 Galvanized Metal:

.1 Galv, metal primer – One (1) coat.

.2 Alkyd G5 level finish – Two (2) coats.

2.8 ANTI-GRAFFITI COATING:

.1 Applied to exterior masonry and exposed concrete surfaces:

.1 Sherwin Williams Anti-Graffiti Coating (or Contract Administrator approved alternate) siloxane, non-stick transparent coating with non-glossy finish applied following suppliers instructions on sand blasted and clean surfaces.

Part 3 Execution

3.1 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Maintenance Repainting Manual requirements except where otherwise specified.

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

3.2 EXISTING CONDITIONS

.1 Prior to commencing Work, thoroughly examine Site conditions and existing interior substrates to be repainted. Report in writing to Contract Administrator damages, defects, or unsatisfactory or unfavourable conditions or surfaces that will adversely affect this work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Contract Administrator. Maximum moisture content shall not exceed limits specified herein.

.3 No repainting work shall commence until such adverse conditions and defects have been corrected and surfaces and conditions are acceptable to the Painting Subcontractor and Inspection Agency. Commencement of Work shall not be held to imply acceptance of surfaces except as qualified herein.

.4 Degree of surface deterioration (DSD) shall be assessed using MPI Identifiers and Assessment criteria indicated in the MPI Maintenance Repainting Manual. MPI DSD ratings and descriptions are as follows:

CONDITION	DESCRIPTION
DSD-0	Sound Surface (includes visual (aesthetic) defects that do not affect film's protective properties).
DSD-1	Slightly Deteriorated Surface (indicating fading; gloss reduction, slight surface contamination, minor pin holes scratches, etc.).
DSD-2	Moderately Deteriorated Surface (small areas of peeling, flaking, slight cracking, staining, etc.).
DSD-3	Severely Deteriorated Surface (heavy peeling, flaking, cracking, checking, scratches, scuffs, abrasion, small holes and gouges).
DSD-4	Substrate Damage (repair or replacement of surface required by others).

3.3 PROTECTION

.1 Protect existing surfaces and adjacent fixtures and furnishings from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Contract Administrator.

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

.3 Protect factory finished products and equipment.

.4 Protect general public and building occupants in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and surface mounted equipment, fittings and fastenings shall be done prior to undertaking re-painting operations by Contractor. Items shall be securely stored and re-installed by Contractor after painting is completed.

.6 Move and cover furniture and portable equipment as necessary to carry out repainting operations. Replace as painting operations progress.

.7 As repainting operations progress, place "WET PAINT" signs in occupied areas to approval of Contract Administrator.

3.4 CLEANING AND PREPARATION

.1 Clean and prepare interior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

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

.2 Remove chipped, loose, scaling, sealants and caulking materials, fasteners, adhesive residues etc. or other surface blemishes which would impair the final results.

.3 Patch small holes and depressions in drywall finishes with appropriate patching compound and sand flush with adjacent finish.

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

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

.6 Allow surfaces to drain completely and to dry thoroughly. Allow sufficient drying time and test surfaces using an electronic moisture meter before commencing Work.

.7 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.

.8 Many water-based paints cannot be removed with water once dried. Minimize the use of kerosene or such organic solvents to clean up water-based paints.

.2 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

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

.4 Do not apply paint until prepared surfaces have been accepted by Contract Administrator.

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1,000 mm.

3.5 APPLICATION

.1 Apply paint by method that is best suited for substrate being repainted using brush roller air sprayer and/or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise. Methods of application shall be as pre-approved by Contract Administrator before commencing the Work.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application by continuous mechanical agitation intermittent agitation frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Back roll spray applications and brush out runs and sags immediately.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Contract Administrator.

.5 Apply paint coats in a continuous manner and allow surfaces to dry and properly cure between coats for minimum time period as recommended by manufacturer. Minimum dry film thickness of coats shall not be less than that recommended by the manufacturer. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Sand and dust between coats to remove visible defects.

.7 Repaint surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.8 Repaint top, bottom, and vertical edges of doors to be repainted.

.9 Repaint closets and alcoves to match existing, unless otherwise scheduled or noted.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise noted, repainting shall also include exposed to view/previously painted mechanical and electrical equipment and components (panels, conduits, piping, hangers, ductwork, ventilation fan enclosures, etc.).

.2 Touch up scratches and marks and repaint such mechanical and electrical equipment and components with colour, and sheen finish to match existing unless otherwise noted or scheduled.

.3 Do not paint over name plates or instruction labels.

.4 Leave unfinished exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish.

.5 Keep sprinkler heads free of paint.

.6 Do not paint interior transformers and substation equipment.

3.7 CLEAN-UP

.1 Remove paint where spilled, splashed, splattered or sprayed as Work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep Work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water used for water borne materials, solvents used for oil based materials as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinners, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction and as noted herein.

.5 Painting equipment shall be cleaned in leak-proof containers that will permit particulate matter to settle out and be collected. Sediment remaining from cleaning operations shall be recycled or disposed of in a manner acceptable to authorities having jurisdiction.

.6 Paint and coatings in excess of repainting requirements shall be recycled as noted herein.

3.8 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 splashings on affected exposed surfaces. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of 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 Contract Administrator.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

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

.1 Material Safety Data Sheets (MSDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 10-2006, Standard for Portable Fire Extinguishers.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide Shop Drawings.

.4 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into O&M Manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

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

.1 Size 10-B.

2.2 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.3 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of CAN/ULC-S508 and NFPA 10.

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets in accordance with NFPA 10.

3.3 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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 61 00 - Common Product Requirements

.3 Section 01 78 00 - Closeout Submittals

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

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop Drawings:

.1 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada when indicated.

.2 Indicate on Shop Drawings:

.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 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 – Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data:

.1 O&M Manual approved by, and final copies deposited with, the Contract Administrator before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit two (2) copies of draft O&M Manual to the Contract Administrator for approval. Submission of individual data will not be accepted unless directed by the Contract Administrator.

.2 Make changes as required and re-submit as directed by the Contract Administrator.

.6 Additional data:

.1 Prepare and insert into O&M Manuals additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 The Contract Administrator will provide one (1) set of reproducible mechanical drawings. Provide sets of prints as required for each phase of Work. Mark changes as Work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Make available for reference purposes and inspection.

.8 As-built drawings:

.1 Prior to start of testing, adjusting and balancing for HVAC, finalize production of As-Built Drawings.

.2 Identify each As-Built Drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to the Contract Administrator for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using As-Built Drawings.

.5 Submit completed reproducible As-Built Drawings with O&M Manuals.

.9 Submit copies of As-Built Drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide one (1) set of special tools required to service equipment as recommended by manufacturers.

.3 Furnish one (1) commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other sections or contracts are acceptable.

.1 Visually inspect substrate in presence of the Contract Administrator.

.2 Inform the Contractor Administrator of unacceptable conditions immediately upon discovery.

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

3.2 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 DEMONSTRATION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.3 Instruction duration time requirements as specified in appropriate sections.

3.5 CLEANING

.1 Progress Cleaning:

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

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

3.6 PROTECTION

.1 Protect equipment and systems openings from dirt, dust and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA)

.1 ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.

.3 CSA Group (CSA)

.1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.

.4 National Research Council Canada (NRC)

.1 National Plumbing Code of Canada 2015.

1.2 SUBMITTALS

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

.2 Shop Drawings:

.1 Indicate on Shop Drawings to indicate method of anchorage, dimensions, materials, accessories, construction and assembly details.

.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 Manufacturers' Field Reports: manufacturers' field reports specified.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into O&M Manual.

.1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect plumbing materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 BACK FLOW PREVENTERS

.1 Preventers: to CSA-B64 Series, reduced pressure principle type.

.2 Acceptable Manufacturers: Watts

2.2 WATER METERS

.1 Turbine type to AWWA C701 and as per City requirements.

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 provincial codes and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 BACK FLOW PREVENTERS

.1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest existing drain as indicated.

3.4 WATER METERS

.1 Install water metre provided by local water authority.

.2 Install water meter as indicated.

3.5 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.
.4 Water treatment systems operational.

3.6 TESTING AND ADJUSTING

.1 Timing:

.1 After start-up deficiencies rectified.
.2 After certificate of completion has been issued by authority having jurisdiction.

.2 Application tolerances:

.1 Pressure at fixtures: ±70 kPa.
.2 Flow rate at fixtures: ±20%.

.3 Vacuum breakers, backflow preventers:

.1 Test tightness, accessibility for O&M Manuals 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.

.4 Access doors:

.1 Verify size and location relative to items to be accessed.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for plumbing pumps.

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.

.3 Shop Drawings.

.1 Submit Shop Drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

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

.5 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 SUMP PUMP SUBMERSIBLE

.1 Capacity: as indicated.

.2 Construction: simplex CSA approved, housing epoxy coated cast iron, stainless steel stainless steel shaft, non-clog bronze impeller, mechanical shaft seal.

.3 Motor: as indicated hermetically sealed, with automatic overload protection.

.4 Control: integral diaphragm type level control.

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 Make piping and electrical connections to pump and motor assembly and controls as indicated.

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

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

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust flow from water-cooled bearings.

.5 Adjust impeller shaft stuffing boxes, packing glands.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

.1 Polyvinyl chloride (PVC) domestic cold water services inside building.

.2 High Density Polyethylene (HDPE) piping outside building.

1.2 REFERENCE STANDARDS

.1 American Society of Mechanical Engineers International (ASME)

.1 ANSI/ASME B16.15-[13], Cast Cooper Alloy Threaded Fittings, Classes 125 and 250.

.2 ANSI/ASME B16.18-[12], Cast Copper Alloy Solder Joint Pressure Fittings.

.3 ANSI/ASME B16.22-[13], Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.4 ANSI/ASME B16.24-[11], Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.

.5 ASME B16.26-[13], Cast Copper Alloy Fittings for Flared Copper Tubes.

.6 ASME B31.9-[14], Building Services Piping.

.7 ASME B36.19M-[04], Stainless Steel Pipe.

.2 ASTM International (ASTM)

.1 ASTM A182/A 182M-[16], Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

.2 ASTM A269-[15a], Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-[14], Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.4 ASTM A312/A312M-[16], Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.5 ASTM A351/A351M-[16], Castings, Austenitic, for Pressure Containing Parts.

.6 ASTM A403/A403M-[16], Wrought Austenitic Stainless Steel Piping Fittings.

.7 ASTM A536-[84(2014)], Standard Specification for Ductile Iron Castings.

.8 ASTM B32-[08(2014)], Standard Specification for Solder Metal.

.9 ASTM B42-[15a], Seamless Copper Tube, Standard Sizes.

.10 ASTM B88M-[14], Standard Specification for Seamless Copper Water Tube (Metric).

.11 ASTM F876-[15], Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

.12 ASTM F877-[11], Standard Specification for Crosslinked Polyethylene (PEX) Hot and Cold Water Distribution System.

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

.1 ANSI/AWWA C111/A21.11-[12], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 ANSI/AWWA C151/A21.51-[09], Ductile Iron Pipe, Centrifugally Cast, for Water.

.3 AWWA C904-[06] , Crosslinked Polyethylene (PEX) Pressure Pipe, ½ In. (12 mm) through 3 In. (76 mm), for Water Service.

.4 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum [2007]).

.2 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide for Commercial Interiors.

.5 CSA Group (CSA)

.1 CSA B137.5-[13], Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.2 CSA B242-[05], Groove and Shoulder Type Mechanical Pipe Couplings.

.6 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S101-[07], Fire Endurance Tests of Buildings Construction and Materials.

.2 CAN/ULC S102.2-[10], Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

.3 CAN/ULC S115-[11], Standard Method of Fire Tests of Firestop.

.7 Department of Justice Canada (Jus)

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

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

.1 Material Safety Data Sheets (MSDS).

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

.1 MSS-SP-67-[02a], Butterfly Valves.

.2 MSS-SP-70-[06], Grey Iron Gate Valves, Flanged and Threaded Ends.

.3 MSS-SP-71-[05], Grey Iron Swing Check Valves, Flanged and Threaded Ends.

.4 MSS-SP-80-[03], Bronze Gate, Globe, Angle and Check Valves.

.10 National Research Council (NRC)

.1 National Plumbing Code of Canada (NPC) [2015].

.11 Transport Canada (TC)

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

1.3 SUBMITTALS

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

.2 Product Data

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

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

Part 2 Products

2.1 PIPING

.1 Domestic cold piping within building.

.1 Above ground: PVC: to CAN/CSA-B181.2.

.2 Buried or embedded: HDPE in long lengths and with no buried joints.

2.2 FITTINGS

.1 PVC: to CAN/CSA-B181.2.

2.3 JOINTS

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

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

.3 Teflon tape: for threaded joints.

2.4 SWING CHECK VALVES

.1 NPS 2 and under, threaded or socket:

.1 PVC body, EPDM O-Ring Seals, PVC coil to guide piston to positive seat, screw in cap.

2.5 BALL VALVES

.1 NPS 2 and under, threaded or solvent ends:

.1 PVC body, PVC and ABS ball, PTFE seat, EPDM O-Ring, ABS handle.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

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

.2 Install pipe work in accordance with Section 23 05 15 – Common Installation Requirements for HVAC Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI and Standard Council of Canada (SCC) standards.

.4 Install CWS piping below and away from heat sources so as to maintain temperature of cold water as low as possible.

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

.6 Buried tubing:

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

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

.7 Valves

.1 Isolate equipment, fixtures and branches with ball valves.

3.3 PRESSURE TESTS

.1 Test pressure: greater of 1.5 times maximum system operating pressure or 860 kPa.

3.4 PRE-START-UP INSPECTIONS

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

.2 Verify that system can be completely drained.

3.5 START-UP

.1 Timing: start up after:

.1 Pressure tests have been completed.

.2 Certificate of static completion has been issued.

.2 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 Rectify start-up deficiencies.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM D2235- [04], Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564- [04e1], Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 CSA Group (CSA)

.1 CAN/CSA-Series B1800- [06], Thermoplastic Nonpressure Pipe Compendium - B1800 Series.

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 piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Store at temperatures and conditions recommended by manufacturer.

Part 2 Products

2.1 PIPING AND FITTINGS

.1 For above piping to:

.1 CAN/CSA B1800.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code.

3.3 TESTING

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

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and datasheets.

.3 Shop Drawings:

.1 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada as indicated.

.2 Indicate on Shop Drawings:

.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 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00 – Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data:

.1 O&M Manual approved by, and final copies deposited with, the Contract Administrator before final inspection.

.2 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Colour coding chart.

.3 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

.5 Approvals:

.1 Submit two (2) copies of draft O&M Manual to the Contract Administrator for approval. Submission of individual data will not be accepted unless directed by the Contract Administrator.

.2 Make changes as required and re-submit as directed by the Contract Administrator.

.6 Additional data:

.1 Prepare and insert into O&M Manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.7 Site records:

.1 The Contract Administrator will provide one (1) set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Make available for reference purposes and inspection.

.8 As-built Drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of As-Built Drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to the Contract Administrator for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using As-Built Drawings.

.5 Submit completed reproducible As-Built Drawings with O&M Manuals.

.9 Submit copies of As-Built Drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Provide one (1) set of special tools required to service equipment as recommended by manufacturers.

.3 Furnish one (1) commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other sections or contracts are acceptable.

.1 Visually inspect substrate in presence of the Contract Administrator.

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

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

3.2 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 DEMONSTRATION

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.3 Instruction duration time requirements as specified in appropriate sections.

3.5 CLEANING

.1 Progress Cleaning:

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

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

3.6 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 SECTION INCLUDES

.1 Vibration isolation materials and components and their installation.

1.2 SUBMITTALS

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

.1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.

.2 Submit Shop Drawings.

1.3 DELIVERY, STORAGE, AND HANDLING

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

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as indicated.

2.2 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

2.3 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.

.2 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.3 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

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 vibration isolation equipment in accordance with manufacturer’s instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.

.2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCE STANDARDS

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3, Identification of Piping Systems.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

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

.2 Packing, shipping, handling and unloading:

.1 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 twenty-five (25) letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

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.

2.4 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

2.5 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.

2.6 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.

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 has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one (1) is visible from any one viewpoint in operating areas and walking aisles.

.1 Adjacent to each change in direction.

.2 At least once in each small room through which piping or ductwork passes.

.3 On either sides of visual obstruction, or where run is difficult to follow.

.4 On both sides of separations such as walls, floors, partitions.

.5 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.6 At beginning and end points of each run and at each piece of equipment in run.

.2 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.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.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Contact Administrator within ninety (90) days of award of Contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.

.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 Work and completion schedule to ensure completion before acceptance of Work.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review Contract Documents before project construction is started confirm in writing to Contact Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report Contact Administrator in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23 - Heating, Ventilating and Air Conditioning (HVAC).

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Contact Administrator for verification of TAB reports.

1.9 START OF TAB

.1 Notify Contact Administrator seven (7) days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather-stripping, sealing, and caulking.

.3 Pressure, leakage, other tests specified elsewhere Division 23 - Heating, Ventilating and Air Conditioning (HVAC).

.4 Provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus or minus five percent (5%).

1.11 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus two percent (2%) of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Contract Administrator list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within three (3) months of TAB. Provide certificate of calibration to Contract Administrator.

1.13 SUBMITTALS

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

.2 Submit, prior to commencement of TAB:

.1 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 TAB Report to Contract Administrator for verification and approval, 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 thirty percent (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 Contract Administrator.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of SMACNA, AABC, ASHRAE, or NEBB.

.2 Do TAB of systems, equipment, components, controls specified Division 23 - Heating, Ventilating and Air Conditioning (HVAC).

.3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.

.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.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

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 Submit in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and datasheets for electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.

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

1.2 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect electric and electronic control systems from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 THERMOSTAT (LOW VOLTAGE)

.1 Low voltage wall thermostat:

.1 For use on 24 V circuit at 1.5 A capacity.

.2 Temperature setting range: 10 degrees C to 40 degrees Celsius.

.3 With sub-base.

2.2 CONTROLLER

.1 The ventilation system consists of the following components:

.1 Supply fan SF-1.

.2 Outside air damper MD-1.

.3 Recirculation air damper MD-2.

.2 The ventilation system shall operate as follows:

.1 Interlock dampers MD-1 and MD- 2 with Main Floor light switch. The supply fan SF-1 operates continuously during occupied and unoccupied mode.

.2 When the light switch is turned ON (occupied mode), damper MD-1 is fully open and damper MD-2 is fully closed.

.3 When the electrical room light switch is turned OFF (unoccupied mode), dampers MD-1 and MD-2 will be positioned to provide seventy-five percent (75%) recirculated air and twenty-five percent (25%) outside air. The position of the dampers is to be determined during air balancing to provide the required outside air and recirculated air flows.

.4 Controls contractor shall be responsible for specifying all control wiring and controls to meet the sequence of operation.

Part 3 Execution

3.1 INSTALLATION

.1 Install control devices.

.2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

.2 ASTM International (ASTM)

.1 ASTM A480/A480M-[12], Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-[09b], Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

.3 ASTM A653/A653M-[11], Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 National Fire Protection Association (NFPA)

.1 NFPA 90A-[12], Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-[12], Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-[11], Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, [2005].

.2 SMACNA HVAC Air Duct Leakage Test Manual, [2012].

.3 IAQ Guideline for Occupied Buildings Under Construction [2007].

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect metal ducts from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

.2 Seal classification:

.1 Class 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, sealant or combination thereof.

.3 Class C: transverse joints and connections made air tight with gaskets, tape, sealant or combination thereof. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.2 SEALANT

.1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees Celsius to plus 93 degrees Celsius.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:

.1 Rectangular: standard radius, centreline radius: 1.5 times width of duct.

.2 Round: five] piece, centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with single thickness turning vanes.

.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: with 45 degree entry on branch, radius on branch 1.5 times width of duct.

.2 Round main and branch: enter main duct at 45 degrees with conical connection.

.3 Provide volume control damper in branch duct near connection to main duct.

.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.

.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Full radiused elbows.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.7 ALUMINUM

.1 To SMACNA. Aluminum type: 3003-H-14.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports:

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.2 Hanger configuration: to SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps.

Part 3 Execution

3.1 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.

.4 Install breakaway joints in ductwork on sides of fire separation.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

.2 Form bottom of horizontal duct without longitudinal seams.

.1 Weld joints of bottom and side sheets.

.2 Seal other joints with duct sealer.

3.4 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA.

.2 Bed tape in sealant and recoat with minimum of one (1) coat of sealant to manufacturers recommendations.

3.5 LEAKAGE TESTS

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.2 Do leakage tests in sections.

.3 Make trial leakage tests as instructed to demonstrate workmanship.

.4 Do not install additional ductwork until trial test has been passed.

.5 Complete test before performance insulation or concealment Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air duct accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect air duct accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame.

.2 Material:

.1 Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees Celsius, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one (1) 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 (1) 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 (2) sash locks.

.2 301 to 450 mm: four (4) sash locks.

.3 Hold open devices.

2.4 TURNING VANES

.1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

Part 3 Execution

3.1 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 As indicated.

.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:

.1 450 x 450 mm for servicing entry

.2 150 x 150 mm for viewing

.3 As indicated.

.2 Locations:

.1 Devices requiring maintenance.

.2 Required by code.

.3 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 indicated.

.3 At inlet and outlet of coils.

.4 Downstream of junctions of two (2) converging air streams of different temperatures.

.5 And as indicated.

.4 Turning Vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-[11], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for dampers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for dampers for incorporation into O&M Manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect dampers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed blade type as indicated.

.2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: equal to Belimo EF Series MFT.

.6 Performance:

.1 Leakage: in closed position less than ten percent (10%) of rated air flow at 1 kPa differential across damper.

.2 Pressure drop: at full open position less than 25 Pa differential across damper at 5 m/s.

.7 Insulated aluminum dampers:

.1 Frames: insulated with extruded polystyrene foam with RSI 0.44.

.2 Blades: constructed from aluminum extrusions thermally broken with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.44.

.8 Acceptable Manufacturers: Greenheck, Price, Ruskin, Ventex, Alumavent

2.2 RELIEF DAMPERS

.1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open at as indicated.

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.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)

.1 ANSI/AMCA Standard 99, Standards Handbook.

.2 ANSI/ASHRAE 51 (ANSI/AMCA 210), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.

.4 ANSI/AMCA Stadard 30, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for HVAC fans and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide:

.1 Fan performance curves showing point of operation, kW and efficiency.

.2 Sound rating data at point of operation.

1.3 MAINTENANCE MATERIAL

.1 Extra Materials:

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.1 Provide:

.1 Furnish list of individual manufacturer's recommended spare parts for equipment, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing or replacing.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect HVAC fans from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, static pressure, W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with ANSI/AMCA Standard 99.

.4 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210.

2.2 FANS GENERAL

.1 Motors:

.1 Sizes as specified.

.2 Two (2) speed with two (2) windings and speeds as indicated.

.2 Factory primed before assembly in colour standard to manufacturer.

.3 Flexible connections: to Section 23 33 00 – Air Duct Accessories.

2.3 INLINE CENTRIFUGAL FANS

.1 Fan wheels:

.1 Welded aluminum construction.

.2 Maximum operating speed of centrifugal fans not more than fifty percetn (50%) of first critical speed.

.3 Backward inclined blades, as indicated.

.2 Bearings: flange mounted grease lubricated ball or roller self-aligning type with oil retaining, dust excluding seals.

.3 Housings:

.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, steel for smaller wheels, braced, and with welded supports.

.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.

.3 Provide bolted airtight access doors with handles.

Part 3 Execution

3.1 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with Section 23 33 00- Air Duct Accessories.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

1.2 MAINTENANCE MATERIAL

.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.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect diffuser, registers and grilles from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Concealed manual volume control damper operators.

.3 Colour: as indicated.

2.3 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one (1) manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

.1 General: as indicated on mechanical drawings.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 General: as indicated on mechanical drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer’s instructions.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)

.1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and datasheets for louvers and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Indicate following:

.1 Pressure drop.

.2 Face area.

.3 Free area.

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

.4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth.

.2 Material: extruded aluminum alloy 6063-T5.

.3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.

.5 Mullions: at 1500 mm maximum centres.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, stainless steel washer and aluminum body.

.7 Screen: 19mm intake mesh, 2mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: anodized.

.9 Colour: to the Contract Administrator’s approval.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other sections or contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

.1 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

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

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No. 155 – Electric Duct Heaters.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and datasheets for duct heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit product data and include:

.1 Element support details.

.2 Heater: total kW rating, voltage, phase.

.3 Number of stages.

.4 Rating of stage: rating, voltage, phase.

.5 Heater element watt/density and maximum sheath temperature.

.6 Maximum discharge temperature.

.7 Unit support.

.8 Clearance from combustible materials.

.9 Internal components wiring diagrams.

.10 Minimum operating airflow.

.11 Pressure drop at operating and minimum airflow.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect duct heaters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DUCT HEATERS

.1 Duct heaters: flange type.

.2 Elements:

.1 Helical coils of nickel chrome alloy resistance wire.

.3 Staging:

.1 Staged heaters: balanced line current at each stage.

.2 Each stage: uniform face distribution.

.4 Maximum temperature at discharge: 40 degrees Celsius.

.5 Controls:

.1 Factory mounted and wired in control box. Use terminal blocks for power and control wiring to thermostat and sail switch.

.2 Controls mounted in a CSA type enclosure and to include:

.1 Magnetic contactors.

.2 Pneumatic electric relays.

.3 Control transformers.

.4 SCR controller.

.3 Where controls are mounted in heater, exercise care in mounting contactors to minimize switching noise transmission through ductwork.

.4 High temperature cutout and air proving switch.

.6 Electrical:

.1 Duct heater rating:

.1 As indicated on mechanical drawings

.7 Main isolation disconnect switch.

.8 Acceptable Manufacturers: Greenheck, EH Price, Thermolec, Stelpro Ideeco.

Part 3 Execution

3.1 INSTALLATION

.1 Make power and control connections to CSA C22.2 No.155.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

.6 Provide test report and include copy with O&M Manuals.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)

.1 ANSI/ASHRAE 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particulate Size.

.2 ASTM International (ASTM)

.1 ASTM C547, Specification for Mineral Fiber Pipe Insulation.

.3 CSA Group (CSA)

.1 CSA B52, Mechanical Refrigeration Code.

.2 CAN/CSA-C656, Performance Standard for Single Package Central Air-Conditioners and Heat Pumps.

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for air conditioning components and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.

.2 Indicate on Shop Drawings:

.1 Major components and accessories including sound power levels of units.

.2 Type of refrigerant used.

.3 Indicate major components and accessories including sound power levels of units.

.4 Type of refrigerant used, R-410A.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into O&M Manual specified in Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for air conditioning components for incorporation into O&M Manual.

□

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect air conditioning components from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 Provide five(5)-year warranty including material and labour on compressors.

Part 2 Products

2.1 INDOOR UNIT (AC-L60)

.1 Refer to schedule.

2.2 OUTDOOR UNIT (CU-L60)

.1 Refer to schedule.

2.3 ACCEPTABLE MANUFACTURERS

.1 LG

.2 Daikin

.3 Samsung

Part 3 Execution

3.1 GENERAL

.1 Install as indicated, to manufacturer's recommendations, and in accordance with EPS 1/RA/2.

.2 Manufacturer to certify installation.

.3 Run drain line from cooling coil condensate drain pan to terminate over nearest floor drain.

□

3.2 EQUIPMENT PREPARATION

.1 Provide services of manufacturer's field engineer to set and adjust equipment for operation as specified.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 PROTECTION

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

END OF SECTION

□

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.46-M1988 (R2006), Electric Air-Heaters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-08, Enclosures for Electrical Equipment (1,000 V Maximum).

1.2 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and datasheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 – Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into O&M Manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

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

.2 Store and protect unit heaters from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 UNIT HEATERS

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet.

.2 Fan type: unit heaters with built-in high-heat limit protection, fan-delay switches.

.3 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount.

.1 Built-in fan motor thermal overload protection.

.4 Hangers: as indicated.

.5 Manufacturers: Ouellette, Ruffneck, Stelpro.

2.2 CONTROLS

.1 Wall mounted thermostats: type electronic, low voltage.

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 00 – Common Work Results for Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by unit heaters installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 General requirements that are common to NMS sections found in Division 26 – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.

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

.1 Material Safety Data Sheets (MSDS).

.4 City of Winnipeg Water and Waste Department – Electrical Design Guide, Rev 01

.5 City of Winnipeg Water and Waste Department – Automation Design Guide, Rev 00

.6 City of Winnipeg Water and Waste Department – Identification Standard, Rev 00

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

1.4 SUBMITTALS

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

.2 Quality Control:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to Site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with the General Conditions for Construction of Contract.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to the Contract Administrator.

.3 Manufacturer's Field Reports: submit to the Contract Administrator manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in Part 3 - Field Quality Control.

1.5 QUALITY ASSURANCE

.1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.6 SYSTEM STARTUP

.1 Instruct City's personnel in operation, care and maintenance of systems, system equipment and components.

.2 Assist City's personnel and the Contract Administrator in the start-up of equipment.

.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 will aspects of its care and operation.

1.7 SITE

.1 Classification of Pumping Station Areas

.1 Dry Well Building Superstructure: Ordinary.

.2 Dry Well Building Substructure: Ordinary.

.3 Wet Well Building Superstructure: Class 1 – Zone 1, Category 2.

.4 Wet Well Building Substructure: Class 1 – Zone 1, Category 2.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to Site and submit such approval as described in Part 1 – Submittals.

.2 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Division 29 – Instrumentation and Control.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of inspection authorities.

.2 Lamacoid signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, white with black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping stainless steel screws.

.2 Lamacoids as follows:

Application	**Text Size**	**Text**
Electrical Equipment - General	5 mm	Line 1: Identifier
Circuit Breaker - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Disconnect Switch - Separate	5 mm	Line 1: Identifier Line 2: Load Identifier Line 3: Load Description
Fire Alarm Devices	8 mm	Line 1: Identifier
Light Switches	3 mm	Source Panel and Circuit Number
Motor Control Centre	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Motor Starter or MCC Bucket	5 mm	Line 1: Load Identifier Line 2: Load Description
Panelboards	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Receptacles	3 mm	Source Panel and Circuit Number

Application	Text Size	Text
Switchgear	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Switchgear Breaker	8 mm	Line 1: Identifier Line 2: Description Line 3: System Voltage Line 4: Fed By
Transformer – Indoor	8 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By
Transformer – Outdoor	10 mm	Line 1: Identifier Line 2: Rating, System Voltage Line 3: Fed By

.2 Wording on nameplates to be approved the Contract Administrator prior to manufacture.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

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

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes, and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

.4 Colour Codes

	Prime	Auxiliary
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White
Up to 250 V	Yellow	

	Prime	Auxiliary
Up to 600 V	Yellow	Green
Other Communication Systems	Green	Blue

.5 Cable Colour Codes

	Prime	Auxiliary
Power, 120/208/240 VAC	Black	
UPS Power, 120/208/240 VAC	Black	Green
Control Wiring, 120VAC	Black	Orange
Fire Alarm	Red	
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring, <50 V	Blue	Orange
Intrinsically Safe	Blue	White
up to 600 V	Yellow	Green
Other Communication Systems	Green	Blue

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

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

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 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 Local switches: 1,400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 In mechanical rooms: 1,400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Control panels: as indicated.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays, and fuses are installed to required values and settings.

3.5 FIELD QUALITY CONTROL

.1 Conduct following tests:

.1 Circuits originating from branch distribution panels.

.2 Lighting and its control.

.3 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350 to 600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.2 Carry out tests in presence of the Contract Administrator.

.3 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of the Work.

3.6 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1,200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

□

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 20 – Wire and Box Connectors – 0 to 1,000 V.

1.2 REFERENCES

.1 CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No.131, Type TECK 90 Cable.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RWU90 XLPE or RW90 XLPE.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No.131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type XLPE, 1,000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One (1)-hole stainless steel straps to secure surface cables 50 mm and smaller. Two (2)-hole stainless steel straps for cables larger than 50 mm.

.2 Channel type supports for two (2) or more cables at 900 mm centers.

.3 Stainless steel threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors

□

2.3 VFD DRIVE CABLE

.1 Cable: to CAN/CSA- C22.2 No. 123, 174.

.2 Conductors:

.1 Sectored Grounding conductors: three (3) bare copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: heavy wall, continuously corrugated aluminum.

.6 Nexan DriveRx or approved equal in accordance with B7.

2.4 CONTROL CABLES

.1 Type LVT: soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 600 V type: stranded annealed copper conductors, sizes as indicated with PVC insulation type TW, or cross-linked polyethylene type RW90 (x-link with shielding of metallized tapes over each pair of conductors and overall covering of thermoplastic jacket interlocked armour and jacket over sheath of PVC.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install building wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastening and Conduit Fittings.

3.2 INSTALLATION OF TECK CABLE 0 to 1000 V

.1 Teck cable to be only used for pump power or as approved by Contract Administrator.

.2 Install cables.

.1 Group cables wherever possible on channels.

.3 Lay cable in cabletroughs/cable tray in accordance with Section 26 05 36 – Cable Trays for Electrical Systems.

.4 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors – 0-1000 V.

□

3.3 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield at one (1) end only.

3.4 INSTALLATION OF VFD DRIVE CABLE

.1 Install drive cable between VFD output and motor load.

.2 Install cables.

.1 Group cables wherever possible on channels.

.3 Lay cable in cable troughs in accordance with Section 26 05 34 – Conduits, Conduit Fastening and Conduit Fittings.

.4 Use approved connectors

.5 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors – 0 to 1000 V.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 - Common Work - Electrical.

1.2 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 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Rod electrodes: copper clad steel 19 mm dia. by 3 m long.

.3 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.4 Insulated grounding conductors: green, type RW90.

.5 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.

.6 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 complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

□

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

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.10 Ground secondary service pedestals.

3.2 ELECTRODES

.1 Install rod electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Use size 1/0AWG copper conductors for connections to electrodes.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall.

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections sized in accordance with the Canadian Electrical Code.

□

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work - Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to Site conditions and to approval of the Contract Administrator.

.3 Perform tests before energizing electrical system.

END OF SECTION

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Part 1 General

1.1 NOT USED

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape aluminum, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead 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 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One (1)-hole stainless steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two (2)-hole stainless steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia. threaded rods and spring clips.
- .2 Support two (2) or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two (2) or more conduits use channels at 1 m on center spacing.

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

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

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

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

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

END OF SECTION

□

Part 1 General

1.1 SUBMITTALS

.1 Submit Shop Drawings and product data for cabinets in accordance with Section 01 33 00 – Submittal Procedures.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three (3) spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Cast aluminium construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, two (2) keys, containing sheet steel backboard for surface mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

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.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work – Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one (1) system are grouped.

2.2 CAST ALUMINIUM OUTLET BOXES

.1 Cast aluminium single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one (1) conduit enters one side with extension and plaster rings as required.

.2 Cast aluminium utility boxes for outlets connected to surface-mounted rigid aluminum conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

□

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit. Reducing washers are not allowed.

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. 83, Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2 Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, aluminum threaded.

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One (1)-hole aluminum or stainless steel straps to secure surface conduits 50 mm and smaller. Two (2)-hole aluminum or stainless steel straps for conduits larger than 50 mm.

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

.3 Channel type supports for two (2) or more conduits at 1 m on center (oc).

.4 Stainless steel threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 X-ray cast walls and floors before coring to confirm location of embedded items.

.3 Existing structure may contain asbestos. Confirm materials are free of asbestos before drilling or coring.

.4 Use rigid aluminum threaded conduit in all areas.

.5 Use epoxy coated conduit underground and in cast concrete.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.

.7 Minimum conduit size for lighting and power circuits: 19 mm.

.8 Bend conduit cold. Replace conduit if kinked or flattened more than $1/10^{th}$ of its original diameter.

.9 Mechanically bend steel conduit over 19 mm dia.

.10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.11 Install fish cord in empty conduits.

.12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Paint walls before installation of electrical equipment including conduits.

.2 Run parallel or perpendicular to building lines.

.3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.4 Run conduits in flanged portion of structural steel.

.5 Group conduits wherever possible on suspended or surface channels.

.6 Do not pass conduits through structural members except as indicated.

.7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than four (4) times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2No.126, Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA) standards

.1 NEMA VE 1, Metal Cable Tray Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit Shop Drawings and product data in accordance with section 01 33 00 – Submittal Procedures.

.2 Identify types of cable troughs used.

.3 Show actual cable trough installation details and suspension system.

Part 2 Products

2.1 CABLETROUGH

.1 Cable troughs and fittings: to NEMA VE 1.

.2 Ladder type, Class D1 to CAN/CSA C22.2No.126.

.3 Trays: extruded aluminum, wide as required with depth of 100 mm.

.4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable trough supplied.

.1 Radii on fittings: 600 mm minimum.

.5 Barriers where different voltage systems are in same cable trough.

.6 De-rate power cables according to the Manitoba Electrical Code.

2.2 SUPPORTS

.1 Provide supports as required.

□

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cable trough system.

.2 Cable trough systems are not fully indicated on the plans. Provide cable trough, indicated or not, to fully support cables.

.3 Support cable trough on both sides.

.4 Install green insulated 1/0 copper bonding conductor to run full length of cable troughs.

.5 Bonding conductors to be fastened with electrically conducting metal clamps at 6 m centres and at each end of terminated cable trough.

.6 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Lay cables into cable trough. Use rollers when necessary to pull cables.

.3 Secure cables in cable trough at 3 m centres, with nylon ties in horizontal applications

.4 Secure cables in cable trough at 3 m centres, with cable clips in vertical applications

.5 Identify cables every 30 m with size 2 nameplates.

END OF SECTION

□

Part 1 General

1.1 DESCRIPTION

.1 Provide a coordination/protective study, short circuit, and arc flash study of all equipment specified herein and submit for review.

.2 Include the following:

.1 600 V cable thermal damage curves.

.2 600 V circuit breaker overcurrent, overload, ground fault devices, and zone interlocking.

.3 347/600 and 120/208 V panelboards, MCCs, and switchgear, and connecting feeder cables.

.4 600 V transformer damage curves, magnetizing currents for all transformers 150 kVA and larger.

.5 Locked rotor currents, acceleration times and damage curves for motors 75 kW and larger.

.6 Any additional data necessary for successful completion of the coordination and short circuit study.

.3 Data shall clearly state the operating time in cycles of each breaker and indicate whether the time current curves for relays are inclusive of breaker trippings time or otherwise.

.4 Prepare a summation chart showing all ratings and settings with easy reference to the appropriate curve.

.5 Symmetrical and asymmetrical fault current calculations shall be submitted to verify the correct choice of the protective elements of the system.

.6 Prepare a systems single line diagram on which the resultant short circuit values, device numbers and equipment ratings are shown.

.7 Include a list of recommended settings for each relay.

1.2 QUALIFICATIONS

.1 This study shall be provided by the supplier of the motor control centre.

.2 This study shall be performed by and bear the stamp of a professional engineer registered in the Province of Manitoba.

1.3 SUBMITTALS

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

.2 Submit the complete study for review prior to carrying out calibration and verification.

.3 Submit typed results of coordination and short circuit study in maintenance manuals.

Part 2 Products

2.1 TRIPPING DEVICES

.1 Relay style, CT ratios and fuse sizes have been selected on a preliminary basis for design purposes. Final selection shall be based on the results of this study and shall be included at no extra cost.

Part 3 Execution

3.1 DATA

.1 Provide the main switchboard supplier with all relevant data for equipment not provided by that supplier.

.2 Provide Arc Flash Hazard Level labels for all electrical equipment.

END OF SECTION

Part 1. General

1.1. REFERENCES

.1 CAN3-C17, Alternating - Current Electricity Metering.

.2 ANSI/IEEE C37.90A surge withstand and fast transient tests.

1.2. SUBMITTALS

.1 Submit product data in accordance with Section 26 05 00 – Common Work - For Electrical.

.2 Indicate meter, instrument, outline dimensions, panel drilling dimensions and include cut out template.

Part 2. Products

2.1. DIGITAL METERING INSTRUMENT

.1 Microprocessor-based data collection and storage meter to monitor power conditions on main service as shown on the plans.

.2 Meter to display true RMS value of:

.1	Amps	3-phase current
.2	Volts	Line-to-line or line-to-neutral 3-phase voltage
.3	kW	kilowatts
.4	kVA	kilovoltamperes
.5	Pf	power factor
.6	F	frequency
.7	kWd	kilowatt demand
.8	Ad	amperes demand
.9	kWh	kilowatt hours

.10 Total kWH as an accumulating total, providing bi-directional (import/export) indication.

.11 Total kVARH as an accumulating total, providing bi-directional (import/export) indication.

.12 kW Demand, user-programmable length of each demand period and the number of periods averaged to match local utility billing method.

.13 Amps Demand.

.14 kVA Demand, user-programmable length of each demand period and the number of periods averaged to match local utility billing method.

.15 Total harmonic current and voltage.

.16 Individual harmonic true rms current and voltage to the 63rd harmonic.

.3 Each power meter to have:

.1 True RMS measurement.

.2 Direct connection to 600 V, 3-phase, 4-wire system.

.3 Fourth current input for measurement of ground or neutral current.

.4 Eight (8) digital inputs for status/counter inputs, self-excited dry contact sensing, to remotely monitor breaker status, ground fault relay status, or any other dry contact input.

.5 Storage in non-volatile memory for the following:

.1 A time-stamped alarm and event log of up to eight hundred (800) events which records event date, time (to 0.001 sec), event type, and value for all over/under limit conditions, all status input activity, and all relay operations.

.2 A time-stamped minimum/maximum log, which records the value of any parameter exceeding the previous highest or lowest value recorded. Log to be read from the front panel display or via the communications port.

.3 All setup data.

.6 Waveform capture capability allowing any of the eight (8) voltage and current input channels to be digitally sampled at two hundred and fifty-six (256) samples/60 Hz cycle. Waveform capture to be initiated using commands made via the communications port or event triggered. Waveform capture data is to be made accessible via the communications port.

.7 Liquid crystal display, 320 x 240 pixels resolution, backlight.

.8 Serial communications ports:

.1 One (1) RS-232C/RS-485, and one (1) RS-485.

.2 Protocols: Modbus RTU.

.3 Baud rate: RS-232, 300 bps to 115,200 bps.

.4 Baud rate: RS-485, 300 bps to 57,600 bps.

.9 Ethernet port:

.1 Protocols: Modbus TCP.

.2 10BaseT.

.10 Field programmability as follows:

.1 Volts scale, volts mode (wye, delta, single phase), amps scale, Vaux scale, baud rate, TCP/IP address and the relay operation are programmable from the front panel.

.2 All parameters in 1.1.3.10.1 above, plus additional alarm/event parameters may be programmed via the communications port using a portable terminal or a computer.

.3 Ensure programming is password protected.

.11 Compliance with the following standards:

.1 ULC certified.

.2 CSA approved.

.3 Voltage, current, status, relay and power inputs pass the ANSI/IEEE C37.90A surge withstand and fast transient tests.

.4 Certified to comply with FCC Part 15 Subpart J for Class A computing devices.

.12 300 amps for one (1) second surge protection on all four (4) current inputs.

.13 The following accuracy, resolution, range, and power supply ratings specifications:

Parameter	Accuracy	Resolution	Range
Volts (V1, V2, V3)	0.1%	0.1%	0 - 1,000,000[1]
Amps (I1, I2, I3)	0.1%	0.1%	0 - 30,000
Neutral Current (I4)	0.4%	0.1%	0 - 9,999
kW	class 0.2	0.1%	0 - 1,000,000[2]
kVAR	class 0.2	0.1%	0 - 1,000,000[2]
kVA	class 0.2	0.1%	0 - 1,000,000[2]
Power Factor	0.2%	1.0%	1.0 to ±0.6
Frequency	0.005 Hz	0.1 Hz[3]	40 to 450 Hz
kW Demand	class 0.2	0.1%	0 - 1,000,000
Amps Demand	class 0.2	0.1%	0 - 30,000
kWH (-F, -R)	class 0.2	1 kWH	0 - 1,000,000,000
kVARH (-F, -R)	class 0.2	1 kVARH	0 - 1,000,000,000

.1 Reads in kV for voltages over 9,999.

.2 Reads in MVA, MW, MVAR for readings over 9,999 K.

.3 1 Hz resolution at 400 Hz range.

.4 Power Supply

.1 85 to 250 VAC or 110 to 300 VDC.

.2 Burden: 15 VA typical, 35 VA maximum.

.3 Record and store the following information in meter memory. Recall and reset stored data via meter controls and meter indicator.

.1 Volts max/min at one (1) second interval

.2 Amps max/min at one (1) second interval

.3 F max/min at one (1) second interval

.4 kW max/min at one (1) second interval

.5 Pf max/min (or kVA max/min) at one (1) second interval

.6 kWd at field programmable intervals of one (1) minute to thirty (30) minutes; set at 1 minute

.7 Ad per kWd

.5 10-Base-T communications port for connection to Ethernet network.

.6 Field programmable for set-up and system variables.

.7 Test terminal blocks as required.

.8 Relay output signalling loss of phase. Relay to open on phase loss.

.9 CSA approved.

.10 Approved Product: Schneider Electric PowerLogic ION7400, Eaton Power Xpert Meter 4000.

2.2. CURRENT TRANSFORMERS

.1 Provide shorting switches or test blocks for all meter CT inputs.

2.3. EQUIPMENT IDENTIFICATION

.1 Provide equipment identification.

Part 3. EXECUTION

3.1. METERING INSTALLATION

.1 Install meters in panels as indicated.

.2 Make connections in accordance with diagrams.

.3 Connect phase loss relay to RTU control panel.

3.2. FIELD QUALITY CONTROL

.1 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.2 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

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 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 – Common Work – Electrical.

1.3 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)

1.4 SUBMITTALS

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

Part 2 Products

2.1 TRANSFORMERS

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

.2 Design.

.1 Type: ANN.
.2 Windings: Copper.
.3 Rating as specified.
.4 Voltage taps: standard.
.5 Insulation: 180 degrees Celsius temperature rise.
.6 Basic Impulse Level (BIL): standard.
.7 Hipot: standard.
.8 Average sound level: standard.
.9 Impedance at 17 degrees C: standard.
.10 Enclosure: CSA 1, removable metal front panel c/w sprinkler shield.
.11 Finish: in accordance with Section 26 05 01 – Common Work – Electrical.
.12 Acceptable manufactures: Schneider Electric, Eaton, Rex Manufacturing.

□

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work – Electrical.

.2 Nameplate wording example:

.1 T-2
.2 15kVA
.3 600V – 120/208V

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry type transformers in MCC section.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

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

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

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

.7 Energize transformers after installation is complete.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 – Common Work – Electrical.

.3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity, and enclosure dimension.

Part 2 Products

2.1 120/208V PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one (1) manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250 V panelboards: bus and breakers rated for 10kA (symmetrical) interrupting capacity or as indicated.

.3 Panelboard width to be less than 230 mm.

.4 Integral SPD.

.5 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.6 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated on plans.

□

.7 Two (2) keys for each panelboard and key panelboards alike.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Mains: suitable for bolt-on breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked grey enamel.

.12 Approved manufacture: Schneider Electric.

2.2 600V PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one (1) manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.3 Panelboard to be service entrance rated.

.2 600 V panelboards: bus and breakers rated for 18kA (symmetrical) interrupting capacity or as indicated.

.3 Panelboard width to be less than 1120 mm.

.4 Panelboard height to be less than 2190 mm.

.5 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.6 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated on plans.

.7 Two (2) keys for each panelboard and key panelboards alike.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Mains: suitable for bolt-on breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked grey enamel.

.12 Approved manufacture: Schneider Electric I-Line.

2.3 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

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.3 Lock-on devices for fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.4 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work – Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

.1 Mount 120/208V panelboard in MCC.

.2 Mount 600V panelboard floor standing as indicated.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus with respective neutral identified.

.5 Measure load current on each phase and adjust phase loading for a balanced system.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 Section 26 05 00 – Common Work – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-Q9000, Quality Management and Quality Assurance Standards – Guidelines for Selection and Use.

1.3 SUBMITTALS

.1 Submit product data and Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit product datasheets for sills, busbars and compartments. Include product characteristics, physical size and finish.

.2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

.3 Shop Drawings to Indicate:

.1 Outline dimensions.

.2 Configuration of identified compartments.

.3 Floor 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.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor control centre for incorporation into O&M Manual in accordance with Section 01 78 00 – Closeout Submittals.

.2 Include data for each type and style of starter.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 – Closeout Submittals.

.2 Include: five (5) control fuses, control transformer, H-O-A selector switch and contact blocks, five (5) lamps.

Part 2 Products

2.1 SUPPLY CHARACTERISTICS

.1 600 V, 60Hz, amperage as indicated on plans, wye connected, 3-phase, 4-wire, grounded neutral.

.2 Fault current: 18kAIC

2.2 GENERAL DESCRIPTION

.1 Compartmentalized vertical sections with common power busbars.

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

.3 Indoor CSA 12 gasketted enclosure.

.4 Class I Type B.

2.3 VERTICAL SECTION CONSTRUCTION

.1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.

.2 Each vertical section divided into compartment units, minimum 305 mm high, as indicated.

.3 Each unit to have complete top and bottom steel plate for isolation between units.

.4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.

.5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.

.6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.

.7 Incoming cables to enter at side with terminals.

.8 Provision for outgoing cables to exit via top or bottom with terminals.

.9 Removable lifting means.

.10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.

.11 Divide assembly for shipment to Site, complete with hardware and instructions for re-assembly.

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 self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:

.1 Main horizontal busbars: 600 A.

.2 Branch vertical busbars: 300 A.

.2 Branch vertical busbars for distribution of power to units in vertical sections.

.3 No other cables, wires, equipment in main and branch busbar compartments.

.4 Brace buswork to withstand effects of short-circuit current of 42kA rms symmetrical.

.5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

2.6 GROUND BUS

.1 Copper ground bus extending entire width of motor control centre.

2.7 MOTOR STARTERS AND DEVICES

.1 Rated 18kAIC.

.2 See Section 26 29 10 – Motor Starters to 600 V.

2.8 STARTER UNIT COMPARTMENTS

.1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type.

.2 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for three (3) padlocks to lock operating handle in "off" position and lock door closed.

.3 Hinge unit doors on same side.

.4 Overload relays manually reset from front with door closed.

.5 Pushbuttons and indicating lights mounted on door front.

.6 Devices and components by one (1) manufacturer to facilitate maintenance.

.7 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

2.9 WIRING IDENTIFICATION

.1 Provide wiring identification in accordance with Section 26 05 00 – Common Work – Electrical.

2.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work – Electrical.

.1 Motor control centre main nameplate: size No. 7, engraved as indicated.

.2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.11 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 – Common Work – Electrical.

.2 Paint motor control centre exterior light gray and interiors white.

2.12 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 The Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

.3 Manufacturer to provide proof of quality control program in accordance with CAN/CSA-Q9000.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Make field power and control connections as indicated.

.2 Ensure correct overload heater elements are installed.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work – Electrical.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 – Common Work – Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55, Special Use Switches.

.4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SUBMITTALS

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

Part 2 Products

2.1 SWITCHES

.1 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Ivory toggle.

.3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to eighty percent (80%) of rated capacity of motor loads.

.4 Switches of one (1) manufacturer throughout the Work.

.5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

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2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

- .1 Ivory urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight (8) back wired entrances, four (4) side wiring screws.
- .5 Triple wipe contacts and riveted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

- .1 Ivory urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Four (4) back wired entrances, two (2)-side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one (1) manufacturer throughout the Work.

.5 Acceptable materials: Leviton specification grade, Hubbell specification grade.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one (1) manufacturer throughout the Work.

.3 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.4 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

- .1 Install single throw switches with handle in "UP" position when switch closed.
- .2 Install switches in gang type outlet box when more than one (1) switch is required in one (1) location.
- .3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work – Electrical.

.2 Receptacles:

- .1 Install receptacles in gang type outlet box when more than one (1) receptacle is required in one (1) location.

□

.2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work – Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.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.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-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.

.2 Include time-current characteristic curves for breakers with ampacity of 90 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees Celsius ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from three (3) to eight (8) times current rating.

.5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating matching panel board or switchboard containing breaker.

2.2 THERMAL MAGNETIC BREAKERS [DESIGN A]

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS [DESIGN B]

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS [DESIGN D]

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Set adjustable trip settings according to coordination study.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fused and non-fused disconnect switches.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work – For Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 SUBMITTALS

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

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Heavy duty non-fusible, horsepower rated disconnect switch to CAN/CSA C22.2 No.4.

.2 Provision for padlocking in OFF position.

.3 Quick-make, quick-break action.

.4 ON-OFF switch position indication on switch enclosure cover.

.5 Category 1 locations: NEMA 4.

.6 Category 2 locations: NEMA 4x.

.7 Ordinary locations: NEMA 12.

.8 Outdoor: NEMA 3.

.9 Acceptable Manufacturer: Square D, Eaton, Hubbell, Pass & Seymour, Leviton.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work – For Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches as indicated and as required by CSA C22.1.

END OF SECTION

□

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for industrial control devices including pushbutton stations, control and relay panels.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 26 05 00 – Common Work – Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Include schematic, wiring, interconnection diagrams.

1.5 QUALITY ASSURANCE

.1 Submit to the Contract Administrator copy of test results.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14.

.2 Fixed contact plug-in type: general purpose heavy duty with two (2) poles. Coil rating: 120 V. Contact rating: 240V, 2 A.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open – convertible to normally-closed in field.

2.3 OILTIGHT LIMIT SWITCHES

.1 Snap action type: roller, rod, fork, lever, top, side, push, wobble stick actuator, CSA type 4 enclosure. Contact rating 240VAC, 2A.

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2.4 SOLID STATE TIMING RELAYS

.1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact.

.2 Operation: on-delay or off-delay.

.3 Potentiometer: self contained to provide time interval adjustment.

.4 Supply voltage: 120 V, AC, 60 Hz.

.5 Temperature range: minus 20 to 60 degrees Celsius.

.6 Output contact rating: maximum voltage 300 V AC or DC. Current: 2A

.7 Timing ranges: field adjustable, minimum 0.1s, maximum sixty (60) hours.

2.5 OPERATOR CONTROL STATIONS

.1 Enclosure: CSA Type 4, surface mounting.

2.6 PUSHBUTTONS

.1 Illuminated, Heavy duty Oil tight. Operator extend type, as indicated. Black, with 2-NO and 2-NC contacts rated at 10 A, AC, labels as indicated. Stop pushbuttons coloured red. Start pushbuttons coloured green.

2.7 EMERGENCY STOP PUSHBUTTONS

.1 Illuminated, Heavy duty oil tight. mushroom head, 2-position, Push-Pull operator, Red, with 2-NO and 2-NC contacts rated at 10 A, AC/DC, labels as indicated.

2.8 SELECTOR SWITCHES

.1 Maintained three (3) position labelled as indicated heavy duty oil tight, operators wing lever contact arrangement as indicated, rated 120 V, 10A, AC.

2.9 INDICATING LIGHTS

.1 Heavy duty Oil tight, full voltage, LED type, push-to-test, lens colour: as indicated, supply voltage: 120 V, lamp voltage: 120 V, labels as indicated.

2.10 CONTROL AND RELAY PANELS

.1 CSA Type 12 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.11 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 600 V, 60 Hz ac.

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.3 Secondary: 120 V, AC.

.4 Rating: 150 VA, or larger as required.

.5 Secondary fuse: ampacity as required.

.6 Close voltage regulation as required by magnet coils and solenoid valves.

2.12 THERMOSTAT LINE VOLTAGE

.1 Wall mounted, for exhaust fan control.

.2 Full load rating: 8A at 120 V.

.3 Temperature setting range: 0 to 30 degrees Celsius.

.4 Thermometer Range: 0 to 30 degrees Celsius.

.5 Markings in 5 degree increments.

.6 Differential temperature fixed at 1 degree Celsius.

Part 3 Execution

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work – Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

END OF SECTION

□

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 – Common Work – Electrical.

1.2 REFERENCES

.1 NEMA contactors and motor starters.

1.3 SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 01 33 00 – Submittal Procedures.

.2 Indicate:

.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout of identified internal and front panel components.
.4 Enclosure types.
.5 Wiring diagram for each type of starter.
.6 Interconnection diagrams.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into O&M Manual in accordance with 01 78 00 – Closeout Submittals.

.2 Include operation and maintenance data for each type and style of starter.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with 01 78 00 – Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 Three (3) contacts, stationary.
.2 Three (3) contacts, movable.
.3 One (1) contacts, auxiliary.
.4 One (1) control transformer.
.5 One (1) operating coil.
.6 Two (2) fuses.
.7 Ten percent (10%) indicating lamp bulbs used.

Part 2 Products

2.1 MATERIALS

.1 Starters: NEMA standards, IEC rated equipment not allowed.

2.2 MANUAL MOTOR STARTERS

.1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:

- .1 Switching mechanism, quick make and break.
- .2 One overload heater, manual reset, trip indicating handle.

.2 Accessories:

- .1 Toggle switch, heavy duty oil tight labelled as indicated.
- .2 Indicating light: heavy duty oil tight, LED type and colour as indicated.
- .3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Provide control signal interface to new PLC Control panel.

.2 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

- .1 Contactor solenoid operated, rapid action type.
- .2 Motor overload protective device in each phase, manually reset from outside enclosure.
- .3 Wiring and schematic diagram inside starter enclosure in visible location.
- .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .5 Hand-Off-Auto selector switch mounted on starter door.
- .6 Red running light.
- .7 Green stopped light.
- .8 Amber alarm light.

.3 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control disconnect motor circuit interrupter, and provision for:

- .1 Locking in "OFF" position with up to three (3) padlocks.
- .2 Independent locking of enclosure door.
- .3 Provision for preventing switching to "ON" position while enclosure door open.
- .4 Shut trip or under voltage trip protection not allowed.

.4 Accessories:

- .1 Pushbuttons and selector switches: heavy duty, oil tight labelled as indicated.
- .2 Indicating lights: heavy duty, oil tight, LED type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus twenty percent (20%) spare capacity.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 – Common Work – Electrical.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work – Electrical.

.2 Manual starter designation label, black plate, white letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, black plate, white letters, size 4 engraved as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

.3 Confirm operation of motor starters from level controller and PLC Control System.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work – Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 The Contractor shall supply, install, wire and connect and program all VFD controllers and indicated on the Drawings.

1.2 STANDARD MOTOR

.1 All VFDs supplied under this Contract shall meet or exceed the following Specifications.

.2 Provide a complete inventory (as specified) of spare cooling fans, and fuses, for each VFD supplied.

.3 The adjustable frequency controller shall be designed to operate standard squirrel cage induction motor with a 1.15 S.F. or definite purpose motors meeting National Electric Manufacturers Association (NEMA) MG1 Part 31.

.4 Harmonic loading will not exceed a motor service factor of 1.0.

.5 VFD unit shall be Underwriters Laboratories (UL) listed and Canadian Standards Association (CSA) certified.

.6 VFD unit shall comply with applicable requirements of the latest standards of CSA, American National Standards Institute (ANSI), IEEE and the Canadian Electrical Code.

1.3 TESTS

.1 Factory testing

.1 VFD units are to be factory tested prior to shipment. Provide confirmation from factory of actual tests completed and results.

.2 Provide certified copies of production test results required by CSA and Electrical and Electronic Manufacturer's Association of Canada (EEMAC), prior to acceptance of the equipment.

.2 Field testing

.1 The VFD supplier shall provide on-site start-up, fine-tuning, commissioning, operator training and instruction.

.2 The VFD supplier shall provide site functionality test reports indicating loading/current levels during testing as well as control point proving results.

.3 The VFD supplier shall ensure shaft to ground voltages do not exceed 1.5 V at any speed or load requirement.

.4 Allow for all costs and labour for as many trips as necessary to complete requirements.

.5 It is the intent of this specification to provide a VFD installation that does not adversely affect the electrical system. Included in the Contract Documents is information on the electrical system including:

.1 Single line drawing.

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.2 Additional information on electrical system layout and load profile.

.3 The VFD supplier can use this information to evaluate the predicted effect of the VFD installation on the electrical system and advise the Engineer of these effects. For the purposes of analysis, the point of common coupling (PCC) will be taken as the secondary of the main distribution transformers.

.3 Provide certified copies of all production test results required by CSA and NEMA.

1.4 SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Mounting method and dimensions.

.2 Starter size and type.

.3 Layout of identified internal and front panel components.

.4 Enclosure types.

.5 Wiring diagram for each type of starter.

.6 Interconnection diagrams.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for motor starters for incorporation into O&M Manual specified in Section 01 78 00 - Closeout Submittals.

.2 Include operation and maintenance data for each type and style of VFD.

.3 Provide parameter settings for each VFD.

1.6 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide listed spare parts for each different size and type of starter:

.1 Three (3) contacts, stationary.

.2 Three (3) contacts, movable.

.3 One (1) contacts, auxiliary.

.4 One (1) control transformers.

.5 One (1) operating coil.

.6 Two (2) fuses.

.7 Ten percent (10%) indicating lamp bulbs used.

Part 2 Products

2.1 VARIABLE FREQUENCY DRIVES

.1 Variable Frequency Drives as supplied by one of the following acceptable manufacturers:

.1 Schneider Electric – AltiVar ATV630.

.2 Variable speed controller shall be electronic adjustable frequency and voltage output unit.

.3 The VFD shall employ a minimum 6-pulse pulse width modulated (PWM) inverter system utilizing Insulated Gate Bipolar Transistors (IGBT) power switching devices and come complete with line reactors or DC link filters.

.4 The drive shall be rated for continuous duty while operating a NEMA design induction motor of the sizes and operating voltages as shown in the following schedules and indicated on the Drawings. Drive output shall be sized for a 1.0 motor service factor. The VFD shall have a current rating at least ten percent (10%) in excess of the motor full load amp rating.

.5 Input voltage shall be as indicated on motor schedules and drawings (line voltage variation ±10%) Based on 347/600 volt systems (Not 575V). Line frequency variation ±5%. Output voltage shall vary with motor speed to nominal motor voltage. Speed stability shall be ±1%. Drive shall match torque characteristic of load.

.6 Input frequency setting signal will be selective between 4-20 mA or 0-10v DC. Output speed monitoring signal shall be selective between 4-20 mA or 0-10 v DC.

.7 Enclosure:

.1 Drive shall be installed in the MCC as indicated on the Drawings. Filters to be provided for any forced air-cooled enclosures as required by the supplier. VFD(s) shall be suitable for mounting in a typical building electrical room and shall be able to operate under these conditions with no special cleaning requirements. VFD cabinets shall be mounted in such a way that there is adequate room for ventilation and no build-up of heat.

.8 Protective devices to be incorporated are:

.1 Fast acting electronic circuit board protective devices for protection of electronic components.

.2 Three percent (3%) Line reactor.

.3 Drive output filter.

.4 Integral electronic motor overload protection adjustable up to one hundred and ten percent (110%) of motor rating for sixty (60) seconds.

.5 Overcurrent instantaneous trip two hundred and fifty percent (250%).

.6 Programmable short-circuit protection.

.7 Programmable ground fault protection.

.8 Overvoltage/overcurrent DC bus monitor/protection.

.9 Undervoltage protection.

.10 Loss of phase and phase unbalance protection.

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.11 Inverter over-temperature protection.

.12 Capable of running without motor for start-up.

.13 Maximum acceptable noise level is 80 dBA at 1 m.

.9 Operation features:

.1 Integral flush mounted display in VFD cover with keypad for programming, monitoring and operating of drive, accessible through password or other acceptable security measure only. Remote keypads, completely duplicating functions of integral keypads, shall also be provided for all VFD(s) that are not normally accessible such as located inside MCCs, fan plenums, etc. The remote keypads in these cases shall be located adjacent to the door entering the plenum.

.2 Fault shutdown and indication.

.3 Automatic restart following power outage.

.4 Ability to disconnect motor load for setup or trouble.

.5 Manual speed control potentiometer mounted on MCC door.

.6 Adjustable maximum and minimum speed.

.7 Acceleration and deceleration time adjustment.

.8 Controller “stop” interlock from a NC dry contact.

.9 Drive fault contact.

.10 Stop/start forward/start revers push buttons on keypad and MCC door.

.11 Transient voltage protection.

.12 Provide three (3) dry “C” type contacts programmable for any combination of the following:

.1 Running (output frequency being generated).

.2 Fault lockout.

.3 Stopped.

.4 At speed.

.5 Under speed.

.6 Forward/Reverse.

.7 Low reference.

.8 Manual/Auto Mode.

.9 Local/Remote Mode.

.13 Soft start sequence.

.14 Minimum of three (3) skip frequencies.

.15 Provide Hand/Off/Auto selector switch. Keypad HOA is not an acceptable replacement.

.16 Password protection of parameter programming or some method to prevent unauthorized changes.

.17 Output speed monitoring signal to be selective between 4-20 mA. or 0 to 10 V.

.18 Data communication link.

.1 Data communication links shall be provided with various components in the electrical distribution system as defined in

various section of this division and as shown on the Drawings. The data communication link shall be Modbus Ethernet.

.2 Motor control data communication link.

.3 Each variable frequency drive shall be provided with Ethernet data communication link capable of communicating with the Plant SCADA System.

.10 Environmental Capabilities: The drive shall operate without mechanical or electrical damage under any combination of conditions as follows:

.1 Ambient temperature: 0 degrees to 40 degrees Celsius.

.2 Humidity: zero (0) to ninety percent (90%) (non-condensing).

.3 Vibration up to 0.5 g.

.4 Altitude 0 to 1,250 m.

.11 Diagnostic and indicating features:

.1 Power On indication.

.2 Percentage speed indicator.

.3 Overload indication.

.4 Short circuit indication.

.5 Ground fault indication.

.6 Overvoltage indication.

.7 Undervoltage indication.

.8 High temperature (controller).

.9 AC voltmeter (output).

.10 AC ammeter (output).

.11 Inverter ready.

.12 Inverter fault.

.13 External fault.

.12 Cooling System:

.1 VFD supplier to provide adequate proven cooling devices for VFD equipment.

.2 VFD supplier to ensure any enclosure utilized will not allow a build-up of heat. This can be accomplished by use of fans and / or sufficient guarded, filtered openings.

.13 Control wiring shall be TEW 105 degrees Celcius rise.

.14 Terminal blocks in separate control enclosures for remote interface shall be Weidmueller SAK6N or approved equivalent.

.15 Provide wire markers at both ends of all control wires, Electrovert Type Z or approved equivalent in accordance with B7.

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Part 3 Execution

3.1 INSTALLATION

.1 Identify mounting requirements and include all materials and labour, including concrete pads for all floor-mounted equipment.

.2 Install VFD(s) in locations as indicated on drawings, and connect up all necessary wiring. All VFD(s) are to be mounted in the electrical room. Follow manufacturer's recommendations for maximum distance between the VFD and the motor. The minimum clearance in front of VFDs is 1 m.

.3 Connect VFD output to motor using drive rated cable.

.4 The Contractor shall connect all interlocks including (but not limited to) vibration switch, freeze stats, and fire alarms to the VFD. These interlocks will be active in both the Hand (local) and Auto (remote) configurations.

.5 The Contractor shall program all VFD parameters to provide operation as indicated in the plans and Specifications.

.6 The Contractor shall ensure that all control and stop commands shut down the drive as per manufacture's recommended procedure (example, ramp to stop, ramp and hold, or coast to stop). The Contactors on the line or load side of the drive are not an approved method of control.

.7 MCC disconnect switch, VFD and motor isolation switch are to be labelled with proper shutdown procedures as follows:

.1 "Caution".

.2 "Ensure VFD is stopped before operating this switch".

.3 "Record all faults before resetting".

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work – For Electrical and Manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.5 Contractor shall be responsible to bring factory representative back to reset, repair, and re-commission the VFD during the two (2) year warranty period if problems arise with the normal operation of the VFD. This includes prevention of any motor shaft voltages exceeding 1.5 V when referenced to ground.

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INSTALLED VFD TEST

VFD EQUIPMENT NO. _____ DATE OF TEST_____

DRIVEN MOTOR EQUIPMENT NO. _____

DRIVEN LOAD CHARACTERISTIC: CONSTANT TORQUE _____

_____

VARIABLE TORQUE _____

SETPOINTS:

MINIMUM FREQUENCY _____Hz MAXIMUM FREQUENCY _____Hz

ACCELERATION TIME _____Sec DECELERATION TIME _____Sec

SPEED RANGE: MANUAL _____to _____RPM

CDACS _____to _____RPM

VFD CURRENT AT FULL LOAD: PH.A. _____Amp

PH.B _____Amp

PH.C _____Amp

MOTOR CURRENT: PH.A. _____Amp

PH.B _____Amp

PH.C _____Amp

MOTOR NAMEPLATE DATA:

MFR.: _____MFR. TYPE _____FRAME _____ hp_____

VOLTS: _____PHASE _____RPM _____SERVICE FACTOR_____

FLA:_____FREQ._____(Hz) AMBIENT TEMP. RATING _____°C

TIME RATING _____ DESIGN LETTER_____

kVA CODE LETTER _____ INSULATION CLASS _____

CERTIFIED _____ DATE _____

Contractor's Representative

WITNESSED _____ DATE _____

END OF SECTION

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Part 1 General

1.1 REQUIREMENTS OF WORK

.1 Supply, install and commissioning a complete instrumentation and control (I&C) system for the pumping station as shown on the Drawings and as specified herein.

.2 Component subsystems of the I&C system will include, but are not limited to, the following:

.1 Primary elements and transmitters.

.2 Final control elements.

.3 RTU control panels.

.4 Instrumentation cabling.

.5 Instrumentation power supplies.

.6 Conduit and cable tray.

.3 Where packaged, stand-alone control systems are supplied by others provide cabling to connect to the required remote monitoring and/or control functions. Provide end-to-end commissioning of all required remote monitoring and/or control functions. Assist in ensuring the correct functionality of any equipment supplied by others.

.4 Documentation referred to in 1.1.1 to include as a minimum:

.1 Records of as-built information for the complete instrumentation system.

.5 Documentation provided is formatted as follows:

.1 Location Drawings – indicate in plan and/or elevation views where the instrument elements are physically located. These Drawings are provided to assist the Contractor in estimating the amount of cable and ducting required.

.2 Standard Details – provide a reference for installation, operation and other instructions pertinent to a particular device.

.3 Detailed Specification – lists qualifications, quality of materials and workmanship, and supplementary information.

.6 Definitions

.1 Interpret specialized terms not explicitly defined herein in accordance with ISA-S51.1, NEMA-ICS-1, ANSI/IEEE-Std-100, and The Communications Standard Dictionary, by Martin H. Weik.

.7 References

.1 This Specification contains references to the following Documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed Documents, the requirements of this section prevail.

Reference	**Title**
API RP550	Manual on Installation of Refinery Instruments and Control Systems, Part I – Process Instrumentation and Control Sections 1 Through 13
ASME Section VII	Rules for Construction of Pressure Vessels
ASTM B68	Seamless Copper Tube
ASTM D883	Terms Relating to Plastics
IEEE 100	Dictionary of Electrical and Electronic Terms
ISA RP7.1	Pneumatic Control Circuit Pressure Test
ISA RP12.6	Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations
ISA S5.4	Instrument Loop Diagrams
ISA S18.1	Annunciator Sequences and Specifications
ISA S51.1	Process Instrumentation Terminology
NEMA 250	Enclosures for Industrial Controls and Systems
NEMA ICS 1	General Standards for Industrial Control and Systems
NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
NFPA 70	National Electrical Code (NEC)
SAMA PMC 17-10	Bushings and Wells for Temperature Sensing Elements
UBC	Uniform Building Code
UL 1012	Power Supplies
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Weik, Martin H. Communications Standard Dictionary, Van Nostrand Reinhold Co.

.8 Related Work:

.1 Mechanical

.2 Electrical

.9 Qualifications

.1 The instrumentation Subcontractor shall be a firm normally engaged and fully competent in the type of Work described in this section of the Specification. The firm shall have been continuously and successfully engaged in this business for at least five (5) years.

.2 Qualified journeyman instrument mechanics that are familiar with the devices being installed shall perform all instrument hook-ups, calibrations, and checkouts.

.3 Qualified journeyman electricians shall perform all control wiring installation and connections.

.10 Codes, Rules, Permits and Fees

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

.2 Comply with all rules of the Electrical Safety Act of the Province, CSA Standards, the ULC and the applicable building codes, whether specifically shown on Drawings or not.

.3 Give all required notices, submit Drawings, obtain all permits, licenses and certificates and pay all fees required for this Work.

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.4 Furnish a certificate of final inspection and approvals from an inspection authority to the Contract Administrator.

.11 Standards of Workmanship

.1 Execute all Work in a manner, which will result in the completed installation presenting an acceptable appearance, to a level of quality defined in the general conditions of this Specification.

.2 Employ a competent supervisor and all necessary licensed tradesmen to complete the Work in the required time.

.3 Arrange and install products to fit properly into designated building spaces.

.4 Install products in accordance with the recommendations and ratings of the product manufacturers.

.12 Contract Drawings and Specifications

.1 Refer to Division 1 – General Requirements.

.2 Provide all items and accessories required to install City supplied equipment.

.3 Perform all operations as designated by the Specification according to the methods prescribed, complete with all necessary labour and incidentals.

.4 Treat any item or subject omitted from this division's Specifications or Drawings, but which is mentioned or reasonably specified in other divisions' Specifications or Drawings and pertains to the instrumentation and control system, as being integral to the overall system. Provide such specified items or subjects.

.5 Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.

.6 If discrepancies or omissions in the Drawings or Specifications are found, or if intent or meaning is not clear, consult the Contract Administrator for clarification before submitting bid.

1.2 EQUIPMENT

.1 Receiving, Storing, and Protection of Components during Construction

.1 Examine each component upon delivery to Site. Report all damage noted to the Contract Administrator prior to accepting or rejecting delivery. All instrumentation primary elements, control components, panels, etc. shall be placed in a secure, dry, heated storage building. Maintain the space temperature above 10 degrees Celsius and the space relative humidity below fifty percent (50%).

.2 Perform a preliminary examination upon delivery to ensure that:

.1 All instrumentation and control components supplied for the Work under this section of the Specification comply with the requirements stated in the instrument Specification sheets.

.2 All instrumentation and control components supplied by others, to be connected to instrumentation and control components comply with the requirements stated in the Contract Documents.

.3 Itemize all non-conformities noted above and forward them to the Contract Administrator.

.4 Do not install primary elements or other sensitive equipment until construction is sufficiently completed to provide an "operating condition" environment. Notify the Contract Administrator prior to installing any equipment of this type.

.5 Ensure that covers where required are properly installed on all equipment. Provide all covers, padding, guards, etc. as required to guard any equipment against damage.

.6 Return all damaged equipment to the supplier for total corrective repairs. If deemed necessary by the Contract Administrator, the damaged equipment shall be replaced with new product.

1.3 SITE

.1 Classification of Plant Areas

.1 Building Superstructure: Ordinary.

.2 Building Substructure: Ordinary.

1.4 DOCUMENTATION

.1 Submittals

.1 Submit Shop Drawings for all products supplied by this division.

.2 Shop Drawings for City supplied equipment will be provided to the Contractor

.2 Construction Record Drawings

.1 Maintain on-site a complete set of construction record drawings as listed in Division 1 – General Requirements.

.2 In addition to the requirements as stated in Division 1 – General Requirements, record the following information on the Drawings:

.1 All changes, alterations or additions.

.2 All instrumentation cable and control tubing.

.3 All changes to the numbers and location of outlets, motors, panels and end devices that may occur during the course of the Work.

.3 Before requesting the certificate of Total Performance, make any necessary final corrections to the Drawings, sign each print as a certification of accuracy and deliver all sets to the Contract Administrator for approval.

Part 2 Products

2.1 GENERAL

.1 Refer to the requirements of Division 1 – General Requirements.

.2 Selected Products:

.1 Provide products and materials that are new and free from all defects.

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.2 The design has been based on the use of the first named product where multiple products have been listed.

.3 Quality of Products

.1 All products provided to be CSA and ULC approved where applicable.

.2 If products specified are not CSA approved, obtain approval of the relevant provincial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Refer to Division 1 – General Requirements for further information.

.4 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the Specification, uniformity of manufacture to be maintained for similar products throughout the Work.

.5 Use of Products during Construction

.1 Any equipment used for temporary or construction purposes is to be approved by the Contract Administrator. Clean and restore to "as new" condition all equipment prior to the time of Substantial Performance.

2.2 INSTRUMENTATION

.1 General

.1 Instruments and installation methods to be suitable for the environmental conditions in which they are to be installed.

.2 Determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation.

2.3 IDENTIFICATION

.1 Refer to City of Winnipeg Water and Waste Department – Identification Standard, Rev 00 for general identification requirements.

.2 Provide 3 mm thick lamacoid nameplates with 6 mm black lettering on white background. Identify the loop tag number (where applicable) and the device name, function, and instrument range or setpoint value on the nameplate.

.3 Where it is not possible to attach a lamacoid nameplate to a field instrument component, provide the component with a stainless steel metal tag firmly wired to the device and identified with the loop tag number.

.4 Identify all wires where they terminate at the marshalling panels, junction boxes and field devices with a heat shrink sleeve with machine printed labelling.

.5 Clearly mark all panels, pull boxes, junction boxes, etc. to indicate the nature of service.

.6 Provide neatly typed circuit directories for panel power distribution systems to indicate loops or devices powered by the circuit and the fuse size.

.7 Identify all exposed control conduits at all pull box locations, where the conduits enter or leave a room, and 13 m on centre throughout the room. This shall apply to conduits above removable ceilings. Use Thomas & Betts TY-RAP 5532-M labels conduit identification.

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.8 For direct current wiring use black for positive and white for negative.

.9 For thermistor wiring to motors use red and blue coloured, insulated wire.

Part 3 Execution

3.1 SITE EXAMINATION

.1 Refer to the requirements of Division 1 – General Requirements.

.2 No additional compensation will be given for extra Work due to existing conditions that a Site examination prior to Bid should have disclosed.

3.2 COORDINATION WITH OTHER DIVISIONS

.1 Examine the Drawings and Specifications of all Divisions and become fully familiar the Work. Before commencing Work, obtain a ruling from the Contract Administrator on any conflicting issues between Divisions. No compensation will be made for any costs arising from conflict not identified before Work has commenced.

.2 Coordinate the Work to be performed under this section of the Specification with all divisions installing equipment to ensure that there are no conflicts.

.3 Install anchors, bolts, pipe sleeves, hanger inserts, etc. required in ample time to prevent delays to other division's installation Work.

.4 Lay out the Work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural Drawings take precedence over electrical Drawings regarding locations of walls, doors, and equipment.

.5 Structural members shall not be cut without prior approval of the Contract Administrator.

.6 Examine previously constructed Work and notify the Contract Administrator of any conditions, which prejudice the proper completion of this Work.

3.3 PRODUCT HANDLING

.1 Use all means necessary to protect the products included in this division before, during and after installation, and to protect products and installed Work of all other trades.

.2 Any damage to the products and/or installed Work shall be repaired or replaced by the Contractor at no additional cost to the City and to the approval of the Contract Administrator.

.3 Remove advertising labels from all products installed that have such labels attached. Identification or CSA labels are not to be removed.

.4 Remove dirt, rubbish, grease, etc. resulting from Work performed under this division of the Contract from all surfaces.

3.4 SEPARATION OF SERVICES

.1 Maintain separation between the electrical wiring system, piping, ductwork, and the instrumentation cables so that each system is isolated (except at approved

connections to such systems) to prevent galvanic corrosion. In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is unacceptable.

.2 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings are not to be used for the support of wiring.

.3 Classifications of Circuits

.1 The circuit categorization shall of first priority follow Canadian Electrical Code with respect to separation for electrical safety and the following shall apply with respect to electro-magnetic compatibility:

Very Noisy	High voltage circuits and their associated grounding
	High current (>200 A) LV circuits.
	Harmonic-rich LV circuits
	DC circuits: un-suppressed or above 50 V
Noisy	Low current class two (2) circuits
	Medium power pulsed or radio frequency circuits
Indifferent	ELV digital status circuits
	Intrinsically safe circuits
	Telecommunications circuits
	Fire alarm and emergency lighting circuits (note that some fire alarm circuits may fall into the category of signal circuits).
	Any other emergency, shutdown, or high integrity circuit (e.g. toxic gas alarm).
Sensitive	Analogue signal circuits
	Data communication circuits
Very Sensitive	Low level voltage and current signals (e.g. from instrument sensors).

.4 Separation of Circuits

.1 This section relates to the running of cables carrying differing types of circuit in close proximity to one another and to other services. Sensitive circuits shall normally be run in overall shielded cable. Very sensitive circuits shall normally be run in individually twisted pair shielded cable.

.2 For cables sharing the same support/containment system, the following shall provide guidance to minimize extraneous interference:

Segregation between Circuits	**Very Noisy**	**Noisy**	**Indifferent**	**Sensitive**	**Very Sensitive**
Very Noisy	Thermal grouping as per CE Code	150 mm	300 mm	300 mm	300 mm

□

Segregation between Circuits	Very Noisy	Noisy	Indifferent	Sensitive	Very Sensitive
Noisy	150 mm	Thermal grouping as per CE Code	150 mm	150 mm	150 mm
Indifferent	300 mm	150 mm	Separation of Circuit types	100 mm	100 mm
Sensitive	300 mm	150 mm	100 mm	Touching	50 mm
Very Sensitive	300 mm	150 mm	100 mm	50 mm	Touching

3.5 WIRE AND CABLE

.1 Refer Division 26 - Electrical.

3.6 CONTROL WIRING COLOUR IDENTIFICATION

.1 Colour Codes

Conductor Purpose	Colour
Power, 120/208/240 VAC Supply	Black
Power, 120/208/240 VAC Neutral	White
Power, 24 VDC Supply (+)	Blue
Power, 24 VDC Common (-, or 0VDC)	Brown
Discrete Control AC	Red
Discrete Control DC	Blue
Intrinsically Safe	IS (light) Blue
Protective Earth (PE)	Green
Signal Ground/Instrumentation Earth (IE)	Green/Yellow

3.7 NETWORK CABLE – JACKET COLOUR

.1 Colour Codes

Cable Purpose	Colour
Ethernet, CAT5E or CAT6	Blue
Profibus DP	Purple
Profibus PA, Non-Intrinsically Safe	Black
Profibus PA, Intrinsically Safe	Light Blue
Modbus/RTU (serial)	Grey

3.8 EQUIPMENT CONNECTIONS

.1 Prior to the connection of signal wiring to process I&C devices, check the device voltage rating and polarity for compatibility with the corresponding loop and/or schematic diagram. Where device and circuit characteristics are found to be

incompatible, the connections are not to be made. Report the condition immediately to the Contract Administrator.

.2 All control wiring diagrams illustrate typical control circuits applicable to the type of equipment specified. Control circuits may vary with different manufacturer's equipment. Verify all control circuits with the manufacturers of the equipment and make any corrections to the control wiring diagrams that may be required.

3.9 WIRING TO EQUIPMENT SUPPLIED BY OTHER DIVISIONS

.1 Equipment supplied by the City or by other divisions, that have external or field mounted control devices, are to be installed, wired and commissioned by this division.

3.10 INSTRUMENT MOUNTING STANDS

.1 Supply and install instrumentation mounting stands as required. Stands are to be either floor or wall mounted. The mounting stands are to be fabricated from aluminum.

.2 Supply and install protective drip shields for any exterior stand-mounted instrumentation equipment. Drip shields are to extend 50 mm past the front and side faces of the equipment. Drip shields are to be fabricated from aluminum.

3.11 SEALING OF WALL AND FLOOR OPENINGS

.1 Seal all conduit and cable entries passing through walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade.

.2 Seal openings after all wiring entries have been completed.

.3 Sealing material shall be fire resistant and shall not contain any compounds that could chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations, if required, are to be sealed. Submit Shop Drawing for rated assembly prior to installation of fire stop.

3.12 TAGGING STANDARDS FOR DEVICES AND WIRING

.1 Tag all devices, wires, and I/O using the assigned loop, equipment, or device tag name. Where tag naming and numbering is not specified, the Contract Administrator will provide naming and numbering that is consistent with the plant naming conventions.

3.13 TESTING OF INSTRUMENTATION LOOPS

.1 After all devices within a loop have been connected, check the loop for correct functioning and interaction with other loops, where applicable. Provide written notice to the Contract Administrator when the loops are going to be tested so that the tests may be witnessed at the Contract Administrator’s discretion.

.2 Check the operation of final control elements such as solenoid valves, actuators, etc. by manual control before checking with automatic control.

.3 Check and simulate all alarms and shutdown functions.

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.4 Test all tubing for leaks in compliance with ISA RP7.1. Isolate all instruments when tubing is being tested to protect against over pressure.

.5 Perform tests and record results on the test data forms that are included in this section. Develop additional and/or more detailed test forms as necessary to suit more complex instrumentation.

.6 Sign and date all test reports. Submit the test reports to the Contract Administrator within five (5) Business Days of testing.

.7 Coordinate and cooperate with City's staff while they verify the instrument loop I/O in the programmable logic controller (PLC) and on the supervisory control and data acquisition (SCADA) system.

3.14 CALIBRATION

.1 Instruments are to be factory pre-calibrated. Verify calibration after installation for all instruments installed under these Specifications. Provide a printed record of the factory calibration parameters for "smart" devices.

.2 Prior to calibration, completely program all "smart" transmitters including entries of the appropriate range and tag number. Provide a printed record of smart device serial numbers against their assigned tag number with all programmed parameters.

.3 Calibrate all instruments to an accuracy of 0.5% of full range, or to the manufacturer's stated accuracy of the instrument whenever an accuracy of 0.5% is not achievable.

.4 Prior to instrument installation perform the following applicable calibration for each instrument and its associated signal conditioning equipment:

.1 Calibrate online analyzers with known samples.

3.15 COMMISSIONING

.1 Refer to the requirements of Division 1 – General Requirements for additional requirements.

.2 Inspections

.1 Provide two (2) weeks' written notice to the Contract Administrator prior to energizing any system to allow for inspection by the Contract Administrator of the following:

.1 Proper mounting.

.2 Proper connections.

.2 During commissioning, demonstrate to the Contract Administrator proper calibration and correct operation of instruments and gauges

.3 Commissioning of the I&C system to include but not be limited to the following.

.1 Verify installation of components, wiring connections and piping connections.

.2 Supervise wiring continuity and pipe leak tests.

.3 Verify instrument calibration and provide written report.

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.4 Function check and adjust the instruments and control equipment under operational conditions.

.5 Coordinate manufacturer's service personnel as required for complete system testing.

.6 Instruct plant personnel in correct method of instruments equipment operation.

.7 Direct plant personnel at hand-over as to final adjustment of the system for correct plant operation.

.8 Ensure that the manufacturer's representatives cooperate to complete the Work of this section.

.9 Verify signal levels and wiring connections to all instrumentation and control equipment.

.10 Work with control system programmer to verify all field devices, wiring, calibration and operation.

3.16 TEST FORMS

Form No.	**Title**
.1 ITR	Instrument Test Report
.2 LCR	Loop Check Report

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LOOP CHECK REPORT

☐ CHECKED OUT OK

☐ NOT APPLICABLE

☐ FURTHER ACTION REQUIRED

	INSTRUMENT TAG NO.								
LOOP NO. _____ SHEET NO. _____ P & I DWG. NO.									
INSTALLATION COMPLETE									
Primary Element									
Impulse Lines									
Block and Drain Valves									
Air Supply/Filter/Reg.									
Wiring									
Tracing/Insulation/Housing									
Mounting and Location									
PLC/SCADA I/O & Status									
CALIBRATED									
Impulse Lines Press. Tested									
LOOP CHECKED									
Element To Receiver									
X Mtr. to Receiver									
X Mtr./Trans. to Receiver									
X Mtr./Trans. to Switches									
Switches to Annunciator									
Interlocking Circuit									
Controller to Valve									
Controller Action D or R									

REMARKS:

READY FOR START-UP

DATE: _____

Installed by: _____

Checked by: _____

INSTRUMENT TEST REPORT

SYSTEM: _____

SERVICE: _____ TAG NO._____

LOCATION: _____ _____

MAKE: _____ MODEL: _____

SERIAL NO.: _____ CSA: _____

ELEMENT: _____ RANGE: _____

DESIGN SETTING/RANGE: _____ CONTACT TO: _____ ON: _____

SIGNAL IN:_____ OUT:_____ ASSOCIATED INSTRUMENT: _____

INSTRUMENT CONDITION: _____ CONFORM TO SPEC: _____

PROJECT NO.:_____ DATA SHEET: _____

	TEST 1				**TEST 2**			
TEST METHOD								
	INPUT		**OUTPUT**		**INPUT**		**OUTPUT**	
PROCESS	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**
TEST POINT 1								
TEST POINT 2								
TEST POINT 3								
TEST POINT 4								
TEST POINT 5								
COMMENTS								
GRAPHS								

TESTED BY: _____ CHECKED BY: _____

DATE: _____ DATE: _____

END OF SECTION

□

Part 1 General

1.1 REFERENCES – GENERAL

.1 Suppliers, equipment, products, and execution must meet all requirements detailed in Section 29 05 00 – Common Work Instrumentation.

.2 Local control stations shall be supplied to house local control switches, push buttons and indictor lights associated with field devices (valves, drives etc.). The control stations shall be located in close proximity to their associated devices. Where a group of devices are located within close proximity to each other, the local controls may be combined into a single common local control panel. Line of site must be maintained between all devices and the respective local controls.

Part 2 Products

2.1 GENERAL

.1 Unless otherwise specified, provide outside finishes on all enclosures in ANSI 61 Grey.

.2 The enclosures must be suitable for carrying the weight of the equipment mounted inside the panel and on the doors without any warpage.

2.2 ENCLOSURES

.1 Provide Electrical EEMAC Type 12 enclosures for ordinary locations.

.2 Provide Electrical EEMA Type 4x enclosures for Category 1 and 2 locations

2.3 WIRING AND ACCESSORIES

.1 Provide wiring inside the enclosures according to the following Specifications:

.1 Control wiring to be a minimum of #16 AWG tinned stranded copper; insulation rated at 600 V.

.2 Wiring for power distribution shall be a minimum of #14 AWG tinned stranded copper; insulation rated at 600 V.

.3 Install cables in accordance with the requirements of Division 26 - Electrical.

.2 Tag each wire at both ends with a heat shrink sleeve that is machine printed. Allow approximately 20 mm of wire insulation between the tag and the bare wire.

.3 Wiring systems with different voltage levels or types shall be suitably segregated within the panel, according to relevant electrical codes.

.4 Run all wiring in enclosed plastic wireways such as panduit. Size all wireways so that the total cross sectional area of the insulated wire and cable does not exceed forty percent (40%) of the cross sectional area of the wire way.

.5 Provide a minimum clearance of 50 mm between wire ways and any point of wire termination.

.6 Terminate all wiring, incoming and outgoing, at terminal strips mounted inside the enclosure. Identify each terminal strip with a terminal strip number, defined as follows:

.1 Wire identification to use the connected field device tag name with the wire's corresponding end device terminal number appended to it.

.2 Identify every joint and/or terminal of the above wire run with the same identifier until the wire meets another tagged device, at which point the wire identifier will change to use the new device name and terminal number.

.3 For example, pressure transmitter FIT-740 located in the field has a 1 PR-TPSH cable connected to it. The cable runs through a junction box to a marshaling panel. The wire identifiers for the pair of wires would be FIT-740 all the way to the marshaling panel.

.4 Identify spare wires by using the cable tag, wire number and an “-SP” suffix.

.5 Arrange wiring on terminal blocks such that all internal panel wiring terminates on the inboard side of the terminal blocks and all external wiring terminates on the outboard side.

.7 Provide sufficient terminals so that not more than two (2) wires are connected under the same terminal. Provide twenty percent (20%) spare terminal capacity at each terminal block assembly.

.8 Terminals shall be Weidmuller W Series color coded as follows:

.1 Red = positive 24 VDC

.2 Black = analog signal plus

.3 White = analog signal common and VAC neutral

.4 Grey = 120 VAC

.5 Green = ground

.9 Provide nameplates for each device on or within the panels and enclosures. Nameplates shall be white lamacoid with black lettering, a minimum of 25 mm x 75 mm in size with up to three (3) lines of 5 mm lettering. Securely fasten nameplates in and situate them in a visible location.

2.4 PANEL GROUNDING

.1 Provide a ground system for the instrumentation circuits.

.2 Provide grounding lugs for each panel, suitable for termination of up to #2 AWG copper grounding conductor.

.3 Firmly bond all panel-mounted devices on or within the panels to ground. Provide supplementary bonding conductors for backpanels 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.

Part 3 Execution

3.1 MOUNTING HEIGHTS

.1 Unless otherwise specified or a conflict exists, mount all panels, starters and disconnects 2000 mm to top of cover.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 Refer to Division 26 - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 214, Communications Cables (Bi-National standard with UL 444).

.2 CSA-C22.2 No. 232, Optical Fiber Cables.

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.

.2 TIA/EIA-568-B.2, Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.

.3 TIA/EIA-568-B.3, Optical Fiber Cabling Components Standard.

.4 TIA/EIA-606-A, Administration Standard for the Commercial Telecommunications Infrastructure.

.5 TIA TSB-140, Telecommunications Systems Bulletin – Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

.6 TIA-598-C, Optical Fiber Cable Color Coding.

1.3 DEFINITIONS

.1 Refer to TIA/EIA-598-C, Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.4 SUBMITTALS

.1 Submit product data in accordance with Division 26 - Electrical.

1.5 INSPECTION

.1 Provide adequate notice to the Contract Administrator so that all cable installations can be inspected prior to energizing equipment.

1.6 STANDARDS

.1 All wire and cable shall be CSA approved.

Part 2 Products

2.1 TWISTED PAIR SHIELDED CABLES (TPSH)

.1 TPSH shall be constructed as follows:

.1 Two (2) copper conductors, stranded, minimum #18 AWG, PVC insulated, twisted in nominal intervals of 50 mm.

.2 Insulated for 600 V, 90 degrees Celsius.

.3 One hundred percent (100%) coverage aluminum foil or tape shield.

.4 Separate bare stranded copper drain wire, minimum #18 AWG.

.5 Overall flame retardant PVC jacket to CSA-C22.2.

.6 The entire cable assembly to be suitable for pulling in conduit or laying in cable tray.

.7 Interlocked aluminum armour and outer PVC jacket.

.8 Shaw Type 1751-CSA or Belden equivalent.

.2 Where multi-conductor TPSH cables are called for, each pair shall be individually shielded, continuous number coded, and the cable assembly shall have an overall shield and overall flame retardant PVC jacket.

2.2 RTD AND MULTI CONDUCTOR SHIELDED CABLE

.1 RTD cables shall be CSA approved and shall be constructed as follows:

.1 Three (3) or more copper conductors, stranded, minimum # 18 AWG.

.2 PVC insulated for 600 V.

.3 One hundred percent (100%) coverage aluminum foil or tape shield.

.4 Separate bare stranded copper drain wire.

.5 Interlocked aluminum armour and outer PVC jacket.

.6 Overall flame retardant PVC jacket to CSA-C22.2.

2.3 TECK CABLES

.1 As per Division 26 - Electrical.

2.4 WIRE

.1 As per Division 26 - Electrical.

2.5 100 BASE TX CATEGORY 6 COMMUNICATION CABLE

.1 Category 6 cable shall be CSA approved and constructed as follows:

.1 Four (4) bonded pairs, solid stranded, #24 AWG.

.2 Interlocked aluminum armour.

.3 Rip cord.

.4 PVC inner and outer jackets.

.5 UL verified to Category 6.

.6 Insulated for 300 V.

.7 Shielded.

Part 3 Execution

3.1 ANALOG SIGNALS

.1 Use TPSH cable for all low level analog signals such as 4-20 mA, pulse type circuits 24 VDC and under, and other signals of a similar nature.

.2 Use RTD cable for connections between RTDs and transmitters or control system RTD inputs.

3.2 DIGITAL SIGNALS

.1 Use TPSH cable for all low level input (24 V and below) and output signals to the control system.

3.3 INSTRUMENT POWER

.1 Use wire and conduit for power to instruments, for 120 V signals other than those mentioned above and as otherwise indicated on the Drawings. Use stranded wire and cable to supply power to instruments.

3.4 INSTALLATION

.1 Install instrumentation cables in conduits. Use a minimum of 300 mm and a maximum of 1,000 mm length of liquid tight flexible conduit to connect the field sensors to the conduit.

.2 At each end of the run leave sufficient cable length for termination.

.3 Do not make splices in any of the instrumentation cable runs.

.4 Cable shields shall be terminated on insulated terminals and carried through to the extent of the cable.

.5 Ground cable shields at one end only. Unless otherwise specified, ground the shields at the PLC control panel.

.6 Protect all conductors against moisture during and after installation.

3.5 CATEGORY 6 INSTALLATION

.1 Always follow the manufacturer's guidelines for minimum bend radius and tension.

.2 All installations and terminations shall be performed by personnel experienced in Category 6 cable installation.

.3 Perform cable testing with time domain reflectometer instrument and provide complete detailed test report. Test all runs upon completion of permanent terminations, using instrumentation acceptable to the Contract Administrator. Before commencing testing, submit sample test datasheets and information with respect to test instrumentation to be used.

.1 Test for the following:

.1 Continuity.

.2 Pair placement and polarity.

.3 DC resistance.

.4 Characteristics at highest contemplated frequency:

.1 Attenuation – data cable.

.2 Mutual Capacitance – data cable.

.3 Near-end crosstalk (NEXT) – data cable.

.5 Run length.

.2 Category 6 using certified level III tester to: TIA/EIA-568-B.2.

.3 Reconnect or re-install and retest as necessary to correct excessive variations.

3.6 FIELD QUALITY CONTROL

.1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as hard copy.

.1 Perform tests for Permanent Link on installed cables, including spares:

.1 Category 6 using certified level IIi tester to: TIA/EIA-568-B.2.

.2 Perform tests for Channel on one hundred percent (100%) of cross-connected data horizontal cabling installed from each telecommunications room, including shortest and longest drops from each telecommunications room.

.1 Category 6 using certified level III tester to: TIA/EIA-568-B.

3.7 CONDUCTOR TERMINATIONS

.1 All equipment supplied shall be equipped with terminal blocks to accept conductor connections.

.2 Instrumentation conductors, where terminated at equipment terminals other than clamping type terminal blocks, shall be equipped with Burndy-YAE-2 or STA-KON, self-insulated, locking type terminators, sized as required to fit conductors and screw terminals.

3.8 TESTING

.1 Test all conductors for opens, shorts, or grounds. Resistance values shall not be less than those recommended by the cable manufacturer.

3.9 IDENTIFICATION

.1 Identify all instrumentation cables.

.2 Identify each conductor with wire numbers using a machine printed Raychem TMS heat shrink wire marker or approved equal in accordance with B7.

END OF SECTION

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Part 1 General

1.1 REFERENCES – GENERAL

.1 Equipment, Products and Execution must meet all requirements detailed in Section 29 05 00 – Common Work Instrumentation.

Part 2 Products

2.1 MISCELLANEOUS PANEL DEVICES

.1 Ethernet Switch

- .1 Install Ethernet switch in RTU control panel.
- .2 Eight (8) port unmanaged Ethernet switch.
- .3 Power Supply: 24 VDC.
- .4 Mounting: DIN rail.
- .5 Approved Product: Schneider Electric Connexium TCSEU083FN0.

.2 Cellular Modem/Router

- .1 Industrial 4G LTE cellular router.
- .2 Power Supply: 24 VDC.
- .3 Mounting: DIN rail.
- .4 Supplied by the City.
- .5 Contractor shall install in MCC-L70 control bucket.

.3 Dialup Modem

- .1 Industrial modem.
- .2 Power Supply: 24 VDC.
- .3 Mounting: DIN rail.
- .4 RS-232.
- .5 PSTN-port.
- .6 Phoenix Contact.

.4 Pilot Lights

- .1 Provide LED transformer type pilot lights for extended lamp life, oil tight, push to test, complete with appropriate colour lenses. Normal colours used are run = red, stop = green, fault = amber. Refer to Division 26 - Electrical for additional information.

.5 Terminals

- .1 Provide strap screw type terminal blocks rated for 600 V.
- .2 Identify each terminal block within an enclosure with a unique machine printed terminal block number. Cabinet chassis grounding terminal blocks to be identified by the electrical ground symbol.
- .3 Connections to screw terminals to be locking fork tongue insulated crimp type wire connectors.

.4 Terminals to be Weidmuller or approved equal in accordance with B7.

.5 Provide a group of terminals for each of 120 VAC hot and neutral and 24 VDC positive and negative power. Distribution wiring to have a thermal magnetic circuit breaker upstream of all major blocks of loads, adequately sized to protect the connected load while not causing nuisance tripping.

.6 Provide Weidmuller disconnect type terminal blocks for each load or loop powered from the marshalling panels.

.6 Nameplates

.1 Refer to Section 29 05 00 – Common Work Instrumentation.

Part 3 Execution

3.1 REFERENCES - GENERAL

.1 Refer to Section 29 05 00 – Common Work Instrumentation.

END OF SECTION

Part 1 General

1.1 REFERENCES – GENERAL

.1 Refer to Section 29 05 00 – Common Work – Instrumentation and Controls.

Part 2 Products

2.1 POWER SUPPLY AND CONDITIONING EQUIPMENT

.1 General

.1 Provide all DC power supplies as required for all instrument circuits. All circuits are to be powered from the PLC control panels. Power supplies to be Hammond, G.F.C., Weidmuller or approved equal in accordance with B7, complete with an over-voltage protection module.

.2 DC power supplies shall be fully redundant. Individual fault signals from each power supply shall be monitored by the PLC for alarming.

.3 Unless otherwise required, all DC power supplies to be rated 28 VDC, adjustable plus or minus five percent (5%), and set to provide 26.4 V on the panel direct current bus. Size the power supply for two (2) times the connected load, minimum size is 2 amps.

.4 24 VDC UPS system cable of six (6) hours operation during power supply failure

2.2 NOISE SUPPRESSION

.1 Provide SPD units in each panel to power AC instrumentation and control (I&C) loads. Power conditioners are to be SquareD, Cutler Hammer, Leviton.

Part 3 Execution

3.1 REFERENCES – GENERAL

.1 Refer to Section 29 05 00 – Common Work – Instrumentation and Controls, Part 3.

END OF SECTION

Part 1 General

1.1 REFERENCES – GENERAL

.1 Equipment, products, and execution must meet all requirements detailed in Section 29 05 00 – Common Work – Instrumentation and Controls.

1.2 GENERAL REQUIREMENTS

.1 Pumping station control system for facility

.1 The control system shall consist of the Programmable Logic Controller (PLC), Remote Terminal Unit (RTU) and Operator Graphic Interface (OGI).

.2 The control system shall utilize an Ethernet backbone for communications between the PLC, RTU and OGI. The Ethernet backbone shall be Category 6 cabling.

.3 Contractor shall supply all software, hardware, and labour to provide a fully functional and commissioned control system.

1.3 SUBMITTALS

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

.2 Submit Shop Drawings for all hardware and software components.

.3 Submit graphic layout screens and variable declarations.

Part 2 Products

2.1 OPERATOR GRAPHIC INTERFACE (OGI)

.1 Provide 2 OGIs.

.2 The OGI shall be a 12.1”, 65536 colours, 1024 x 600, TFT multi-touch resistive screen.

.3 Communications shall be Ethernet Modbus TCP/IP.

.4 OGIs to be mounted in control panels CP-L80 and CP-L81.

.5 Operating System to be “Magelis”.

.6 Provide 1 GB SD memory card.

.7 Power: 24 VDC.

.8 Approved product: Schneider Electric Magelis GTU series.

2.2 CONFIGURATION

.1 Provide detailed graphic screens for the pumping station including:

.1 Wet well level.

.2 Plant effluent flow rate and totalized flow.

□

.3 Individual pump status, running forward, running reverse, fault, in-auto, in-hand, ready, motor speed setpoint and actual, motor current.

.4 Building security.

.5 600 VAC power phase voltage, phase current, and power failure.

.6 Building temperature.

.7 Building flood.

.2 Provide secured access screens for calibration of analog input and output signals including, but not limited to, level sensors, building temperature, pump speed, and pump current.

.3 Provide trend screens for all input signals.

.4 Display all operational variables and equipment status.

.5 Configure alarm variables.

.6 Configure historical logging of all process variables onto SD memory card.

Part 3 Execution

3.1 INSTALLATION

.1 Configure IP address provided by the City.

.2 Verify all communications.

.3 Provide startup and commissioning services.

.4 Coordinate verification checks with others.

.5 Provide training to City's personnel.

END OF SECTION

□

Part 1 General

1.1 REFERENCES

.1 Refer to Section 29 05 00 – Common Work Instrumentation.

1.2 RTU I/O INDEX

.1 The following spreadsheet gives an itemized list of the new Remote Terminal Unit (RUT) System inputs and outputs. It is intended to serve as an aid for determining the cabling requirements for the Work specified in this division.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

□

PLC I/O INDEX

			DESCRIPTION			I/O SPECIFICATION											
RECORD NO.	REV. N0.	TAG NAME	FUNCTION	SERVICE	P&ID DRAWING	ENG. UNITS	SCALE LOW	SCALE HIGH	ALARMS LOW	ALARMS HIGH	RTU CABINET	I/O TYPE	I/O ADDRESS	I/O RACK	I/O SLOT	I/O POINT	ACTIVE STATE
0000	0	DC-L531	DOOR OPEN STATUS - EAST DOOR							OFF	RTU	DI	10001	1	5	0	-
0001	0	DC-L532	DOOR OPEN STATUS - NORTH DOOR							OFF	RTU	DI	10002	1	5	1	-
0002	0	DC-L533	DOOR OPEN STATUS - WET WELL							OFF	RTU	DI	10003	1	5	2	1
0003	0	FS-L60	AIR FLOW PROVING SWITCH	HVAC	P-05					OFF	RTU	DI	10004	1	5	3	1
0004	0		24 VDC POWER FAILURE	POWER SUPPLY 1						OFF	RTU	DI	10005	1	5	4	1
0005	0		24 VDC POWER FAILURE	POWER SUPPLY 2						OFF	RTU	DI	10006	1	5	5	1
0006	0		POWER OK	120VAC POWER						OFF	RTU	DI	10007	1	5	6	1
0007	0		POWER OK	600VAC POWER						OFF	RTU	DI	10008	1	5	7	1
0008	0	LSH-L511	STATION FLOOD	PUMP ROOM	P-05					OFF	RTU	DI	10009	1	5	8	1
0009	0	KS-L543	STATION OCCUPIED		P-05						RTU	DI	10010	1	5	9	1
0010	0		UPS ALARM							OFF	RTU	DI	10011	1	5	10	1
0011	0		UPS BATTERY MODE							OFF	RTU	DI	10012	1	5	11	1
0012	0		UPS BATTERY CHARGING							OFF	RTU	DI	10013	1	5	12	1
0013	0	LIT-L560	RAIN GAUGE COUNTER	RAIN GAUGE							RTU	DI	10014	1	5	13	1
0014	0		SPARE								RTU	DI	10015	1	5	14	1
0015	0		SPARE								RTU	DI	10016	1	5	15	1
0016	0	HS-L01A	MANUAL MODE	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10017	1	6	0	1
0017	0	HS-L01B	AUTO MODE	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10018	1	6	1	1
0018	0	YI-L01A	READY	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10019	1	6	2	1
0019	0	YI-L01B	RUNNING FWD	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10020	1	6	3	1
0020	0	YI-L01B	RUNNING REV	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10021	1	6	4	1
0021	0	YA-L01	VFD FAULT	P-L01 DISCHARGE PUMP	P-05					OFF	RTU	DI	10022	1	6	5	0
0022	0	FS-L011	SEAL WATER FLOW SWITCH	P-L01 DISCHARGE PUMP	P-05					OFF	RTU	DI	10023	1	6	6	1
0023	0		SPARE								RTU	DI	10024	1	6	7	-
0024	0	HS-L02A	MANUAL MODE	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10025	1	6	8	1
0025	0	HS-L02B	AUTO MODE	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10026	1	6	9	1
0026	0	YI-L02A	READY	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10027	1	6	10	1
0027	0	YI-L02B	RUNNING FWD	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10028	1	6	11	1
0028	0	YI-L02B	RUNNING REV	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10029	1	6	12	1
0029	0	YA-L02	VFD FAULT	P-L02 DISCHARGE PUMP	P-05					OFF	RTU	DI	10030	1	6	13	0
0030	0	FS-L021	SEAL WATER FLOW SWITCH	P-L02 DISCHARGE PUMP	P-05					OFF	RTU	DI	10031	1	6	14	1
0031	0		SPARE								RTU	DI	10032	1	6	15	-
0032	0	HS-L03A	MANUAL MODE	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10033	1	7	0	1
0033	0	HS-L03B	AUTO MODE	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10034	1	7	1	1
0034	0	YI-L03A	READY	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10035	1	7	2	1
0035	0	YI-L03B	RUNNING FWD	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10036	1	7	3	1
0036	0	YI-L03B	RUNNING REV	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10037	1	7	4	1
0037	0	YA-L03	VFD FAULT	P-L03 DISCHARGE PUMP	P-05					OFF	RTU	DI	10038	1	7	5	0
0038	0	FS-L031	SEAL WATER FLOW SWITCH	P-L03 DISCHARGE PUMP	P-05					OFF	RTU	DI	10039	1	7	6	1
0039	0		SPARE								RTU	DI	10040	1	7	7	-
0040	0	FA-L201	FLOW METER FAULT	FORCE MAIN 1	P-05					OFF	RTU	DI	10041	1	7	8	0
0041	0	FQ-L201	FLOW METER TOTALIZER PULSE	FORCE MAIN 1	P-05						RTU	DI	10042	1	7	9	1
0042	0	FA-L202	FLOW METER FAULT	FORCE MAIN 2	P-05					OFF	RTU	DI	10043	1	7	10	0
0043	0	FQ-L202	FLOW METER TOTALIZER PULSE	FORCE MAIN 2	P-05						RTU	DI	10044	1	7	11	1
0044	0		SPARE								RTU	DI	10045	1	7	12	-
0045	0		SPARE								RTU	DI	10046	1	7	13	-
0046	0		SPARE								RTU	DI	10047	1	7	14	-
0047	0		SPARE								RTU	DI	10048	1	7	15	-
0048	0	YI-L04A	GAS ENGINE READY	P-L04 STORM PUMP	P-05						RTU	DI	10049	1	8	0	1
0049	0	YI-L04B	GAS ENGINE RUN	P-L04 STORM PUMP	P-05						RTU	DI	10050	1	8	1	1
0050	0	YA-L04A	GAS ENGINE FAIL	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10051	1	8	2	0
0051	0	YI-L04C	GAS ENGINE IDLE	P-L04 STORM PUMP	P-05						RTU	DI	10052	1	8	3	1
0052	0	YA-L04C	GAS ENGINE BATTERY FAULT	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10053	1	8	4	0
0053	0	YA-L04D	GAS ENGINE CHARGER FAIL	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10054	1	8	5	0
0054	0	YI-L04D	GAS ENGINE MANUAL HI SPEED	P-L04 STORM PUMP	P-05						RTU	DI	10055	1	8	6	1
0055	0	FS-L041	SEAL WATER FLOW SWITCH	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10056	1	8	7	1
0056	0	GDC-L550	GAS DETECTOR FAULT	STATION	P-05					OFF	RTU	DI	10057	1	8	8	0
0057	0	GDC-L550	GAS DETECTOR LEVEL HIGH	STATION	P-05					ON	RTU	DI	10058	1	8	9	1
0058	0	GDC-L550	GAS DETECTOR LEVEL HIGH HIGH	STATION	P-05					ON	RTU	DI	10059	1	8	10	1

PLC I/O INDEX

			DESCRIPTION			I/O SPECIFICATION											
RECORD NO.	REV. N0.	TAG NAME	FUNCTION	SERVICE	P&ID DRAWING	ENG. UNITS	SCALE LOW	SCALE HIGH	ALARMS LOW	ALARMS HIGH	RTU CABINET	I/O TYPE	I/O ADDRESS	I/O RACK	I/O SLOT	I/O POINT	ACTIVE STATE
0059	0		SPARE								RTU	DI	10060	1	8	11	-
0060	0		SPARE								RTU	DI	10061	1	8	12	-
0061	0		SPARE								RTU	DI	10062	1	8	13	-
0062	0		SPARE								RTU	DI	10063	1	8	14	-
0063	0		SPARE								RTU	DI	10064	1	8	15	-
0064	0	LIT-L111	LEVEL TRANSMITTER	WETWELL	P-05	m	0	5			RTU	AI	30001	2	1	0	
0065	0	LIT-L112	LEVEL TRANSMITTER	WETWELL	P-05	m	0	5			RTU	AI	30002	2	1	1	
0066	0	TIT-L501	MAIN FLOOR TEMPERATURE	STATION	P-05	C	-10	40	10	35	RTU	AI	30003	2	1	2	
0067	0		SPARE								RTU	AI	30004	2	1	3	
0068	0	FIT-L201	DISCHARGE FLOW	P-L01 DISCHARGE PUMP	P-05	L/SEC	0	400	100		RTU	AI	30005	2	1	4	
0069	0	FIT-L202	DISCHARGE FLOW	P-L02 DISCHARGE PUMP	P-05	L/SEC	0	400	100		RTU	AI	30006	2	1	5	
0070	0	GDC-L550-1	GAS DETECTION LEVEL - CO	STATION	P-05	ppm	0	250		100	RTU	AI	30007	2	1	6	
0071	0	GDC-L550-2	GAS DETECTION LEVEL - CH4	STATION	P-05	%LEL	0	100	10	25	RTU	AI	30008	2	1	7	
0072	0	VFD-L01	MOTOR SPEED	P-L01 DISCHARGE PUMP	P-05	%	0	100			RTU	AI	30009	2	2	0	
0073	0	VFD-L01	MOTOR CURRENT	P-L01 DISCHARGE PUMP	P-05	AMP	0	50		45	RTU	AI	30010	2	2	1	
0074	0	VFD-L02	MOTOR SPEED	P-L02 DISCHARGE PUMP	P-05	%	0	100			RTU	AI	30011	2	2	2	
0075	0	VFD-L02	MOTOR CURRENT	P-L02 DISCHARGE PUMP	P-05	AMP	0	50		45	RTU	AI	30012	2	2	3	
0076	0	VFD-L03	MOTOR SPEED	P-L02 DISCHARGE PUMP	P-05	%	0	100			RTU	AI	30013	2	2	4	
0077	0	VFD-L03	MOTOR CURRENT	P-L03 DISCHARGE PUMP	P-05	AMP	0	50		45	RTU	AI	30014	2	2	5	
0078	0		SPARE								RTU	AI	30015	2	2	6	
0079	0		SPARE								RTU	AI	30016	2	2	7	
0080	0		SPARE								RTU	AI	30017	2	3	0	
0081	0		SPARE								RTU	AI	30018	2	3	1	
0082	0		SPARE								RTU	AI	30019	2	3	2	
0083	0		SPARE								RTU	AI	30020	2	3	3	
0084	0		SPARE								RTU	AI	30021	2	3	4	
0085	0		SPARE								RTU	AI	30022	2	3	5	
0086	0		SPARE								RTU	AI	30023	2	3	6	
0087	0		SPARE								RTU	AI	30024	2	3	7	
0088	0	VFD-L01	RUN FWD COMMAND	P-L01 DISCHARGE PUMP	P-05						RTU	DO	10001	2	4	0	1
0089	0	VFD-L01	RUN REV COMMAND	P-L01 DISCHARGE PUMP	P-05						RTU	DO	10002	2	4	1	1
0090	0	VFD-L02	RUN FWD COMMAND	P-L02 DISCHARGE PUMP	P-05						RTU	DO	10003	2	4	2	1
0091	0	VFD-L02	RUN REV COMMAND	P-L02 DISCHARGE PUMP	P-05						RTU	DO	10004	2	4	3	1
0092	0	VFD-L03	RUN FWD COMMAND	P-L03 DISCHARGE PUMP	P-05						RTU	DO	10005	2	4	4	1
0093	0	VFD-L03	RUN REV COMMAND	P-L03 DISCHARGE PUMP	P-05						RTU	DO	10006	2	4	5	1
0094	0	ENG-L04	ENGINE RUN COMMAND	P-L04 STORM PUMP	P-05						RTU	DO	10007	2	4	6	1
0095	0	YC-L111	PLC MODE	P-L01, P-L02, P-L03 DISCHARGE PUMPS							RTU	DO	10008	2	4	7	1
0096	0	LT-L543	SECURITY SYSTEM ON LIGHT	BUILDING SECURITY							RTU	DO	10009	2	4	8	1
0097	0	KS-L543	LIGHT	SECURITY DOOR ON							RTU	DO	10010	2	4	9	1
0098	0	KS-L543	LIGHT	SECURITY DOOR OFF							RTU	DO	10011	2	4	10	1
0099	0		SPARE								RTU	DO	10012	2	4	11	-
0100	0		SPARE								RTU	DO	10013	2	4	12	-
0101	0		SPARE								RTU	DO	10014	2	4	13	-
0102	0		SPARE								RTU	DO	10015	2	4	14	-
0103	0		SPARE								RTU	DO	10016	2	4	15	-
0104	0	VFD-L01	VFD SPEED COMMAND	P-L01 DISCHARGE PUMP	P-05	%	0	100			RTU	AO	40001	2	5	0	
0105	0	VFD-L02	VFD SPEED COMMAND	P-L02 DISCHARGE PUMP	P-05	%	0	100			RTU	AO	40002	2	5	1	
0106	0	VFD-L03	VFD SPEED COMMAND	P-L03 DISCHARGE PUMP	P-05	%	0	100			RTU	AO	40003	2	5	2	
0107	0		SPARE								RTU	AO	40004	2	5	3	
0108	0		SPARE								RTU	AO	40005	2	5	4	
0109	0		SPARE								RTU	AO	40006	2	5	5	
0110	0		SPARE								RTU	AO	40007	2	5	6	
0111	0		SPARE								RTU	AO	40008	2	5	7	

Part 1 General

1.1 REFERENCES – GENERAL

.1 Refer to Section 29 05 00 – Common Work – Instrumentation and Control.

1.2 INSTRUMENT INDEX

.1 The following spreadsheet gives an itemized list of the instrumentation included as part of this Work.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 NOT USED.

END OF SECTION

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INSTRUMENTATION INDEX

RECORD NO.	REV. No.	LOOP NUM.	TAG NAME	DESCRIPTION		POWER SUPPLY	CALIBRATED RANGE	MOUNTING	SUPPLIED BY	INSTALLED BY	COMMENTS	SPEC. DATA SHEET	P&ID DRAWING
				INSTRUMENT TYPE	SERVICE								
0001	0	111	LIT-L111	PRESSURE TRANSMITTER	WET WELL LEVEL	LOOP	0 to 5000 mm	INTEGRATED	CONTRACTOR	CONTRACTOR			P-05
0002	0	112	LIT-L112	PRESSURE TRANSMITTER	WET WELL LEVEL	LOOP	0 to 5000 mm	INTEGRATED	CONTRACTOR	CONTRACTOR			P-05
0003	0	201	FE/FIT-L201	FLOW TRANSMITTER	PUMP L01 DISCHARGE	LOOP	0 to 200 L/sec	WALL-MOUNT	CONTRACTOR	CONTRACTOR			P-05
0004	0	202	FE/FIT-L202	FLOW TRANSMITTER	PUMP L02 DISCHARGE	LOOP	0 to 200 L/sec	WALL-MOUNT	CONTRACTOR	CONTRACTOR			P-05
0005	0	501	TIT-L501	TEMPERATURE TRANSMITTER	MAIN FLOOR TEMP	LOOP	-10 to 40 C	INTEGRATED	CONTRACTOR	CONTRACTOR			P-05
0006	0	511	LSH-L511	LEVEL SWITCH	STATION FLOOD SWITCH	24 VDC		SUSPENDED	CONTRACTOR	CONTRACTOR			P-05
0007	0	512	LSH-L512	LEVEL SWITCH	SUMP PUMP P-L04 HIGH LEVEL	24 VDC		SUSPENDED	CONTRACTOR	CONTRACTOR			P-05
0008	0	531	DC-L531	DOOR CONTACTOR	STATION OCCUPANCY	24 VDC		DOOR-FRAME	CONTRACTOR	CONTRACTOR			P-05
0009	0	532	DC-L532	DOOR CONTACTOR	STATION OCCUPANCY	24 VDC		DOOR-FRAME	CONTRACTOR	CONTRACTOR			P-05
0010	0	533	DC-L533	DOOR CONTACTOR	STATION OCCUPANCY	24 VDC		DOOR-FRAME	CONTRACTOR	CONTRACTOR			P-05
0011	0	543	KS-L543	KEY SWITCH	BUILDING SECURITY	24 VDC		WALL-MOUNT	CONTRACTOR	CONTRACTOR			P-05
0012	0	543	LT-L543	LIGHT	BUILDING SECURITY	24 VDC		WALL-MOUNT	CONTRACTOR	CONTRACTOR			P-05
0013	0	550	GDC-L550	GAS DETECTOR	STATION COMBUSTIBLE GAS LEVEL	24VDC		WALL-MOUNT	CONTRACTOR	CONTRACTOR			P-05

Part 1 General

1.1 REFERENCES

.1 Refer to Section 29 05 00 – Common Work – Instrumentation and Control.

1.2 DNP3 MAPPING LIST

.1 The following spreadsheet gives a list of the new DNP3 communication inputs and outputs to the City of Winnipeg SCADA. It is intended to serve as an aid for programming the Work specified in this Division.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

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DNP3 MAPPING TABLE

			Description				I/O SPECIFICATION				RTU			DNP3			
RECORD	REV.	TAG	FUNCTION	SERVICE	P&ID	ENG.	SCALE		ALARMS		RTU	I/O	I/O	DNP3	DNP3 POINT	USAGE	ACTIVE
NO.	N0.	NAME			DRAWING	UNITS	LOW	HIGH	LOW	HIGH	CABINET	TYPE	ADDRESS	TABLE	ADDRESS	DESCRIPTION	STATE
0000	0	DC-L531	DOOR OPEN STATUS - EAST DOOR							OFF	RTU	DI	10001	DISCRETE INPUT	0	RTU INPUT	1
0001	0	DC-L532	DOOR OPEN STATUS - NORTH DOOR							OFF	RTU	DI	10002	DISCRETE INPUT	1	RTU INPUT	1
0002	0	DC-L533	DOOR OPEN STATUS - WET WELL							OFF	RTU	DI	10003	DISCRETE INPUT	2	RTU INPUT	1
0003	0	FS-L60	AIR FLOW PROVING SWITCH	HVAC	P-05					OFF	RTU	DI	10004	DISCRETE INPUT	3	RTU INPUT	1
0004	0		24 VDC POWER FAILURE	POWER SUPPLY 1						OFF	RTU	DI	10005	DISCRETE INPUT	4	RTU INPUT	1
0005	0		24 VDC POWER FAILURE	POWER SUPPLY 2						OFF	RTU	DI	10006	DISCRETE INPUT	5	RTU INPUT	1
0006	0		POWER OK	120VAC POWER						OFF	RTU	DI	10007	DISCRETE INPUT	6	RTU INPUT	1
0007	0		POWER OK	600VAC POWER						OFF	RTU	DI	10008	DISCRETE INPUT	7	RTU INPUT	1
0008	0	LSH-L511	STATION FLOOD	PUMP ROOM	P-05					OFF	RTU	DI	10009	DISCRETE INPUT	8	RTU INPUT	1
0009	0	KS-L543	STATION OCCUPIED		P-05						RTU	DI	10010	DISCRETE INPUT	9	RTU INPUT	1
0010	0		UPS ALARM							OFF	RTU	DI	10011	DISCRETE INPUT	10	RTU INPUT	1
0011	0		UPS BATTERY MODE							OFF	RTU	DI	10012	DISCRETE INPUT	11	RTU INPUT	1
0012	0		UPS BATTERY CHARGING							OFF	RTU	DI	10013	DISCRETE INPUT	12	RTU INPUT	1
0013	0	LIT-L560	RAIN GAUGE COUNTER	RAIN GAUGE							RTU	DI	10014	COUNTER INPUT	0	RTU INPUT	1
0014	0		SPARE								RTU	DI	10015	DISCRETE INPUT	13	RTU INPUT	1
0015	0		SPARE								RTU	DI	10016	DISCRETE INPUT	14	RTU INPUT	1
0016	0	HS-L01A	MANUAL MODE	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10017	DISCRETE INPUT	15	RTU INPUT	1
0017	0	HS-L01B	AUTO MODE	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10018	DISCRETE INPUT	16	RTU INPUT	1
0018	0	YI-L01A	READY	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10019	DISCRETE INPUT	17	RTU INPUT	1
0019	0	YI-L01B	RUNNING FWD	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10020	DISCRETE INPUT	18	RTU INPUT	1
0020	0	YI-L01B	RUNNING REV	P-L01 DISCHARGE PUMP	P-05						RTU	DI	10021	DISCRETE INPUT	19	RTU INPUT	1
0021	0	YA-L01	VFD FAULT	P-L01 DISCHARGE PUMP	P-05					OFF	RTU	DI	10022	DISCRETE INPUT	20	RTU INPUT	0
0022	0	YI-L01C	SEAL WATER FLOW SWITCH	P-L01 DISCHARGE PUMP	P-05					OFF	RTU	DI	10023	DISCRETE INPUT	21	RTU INPUT	1
0023	0		SPARE								RTU	DI	10024	DISCRETE INPUT	22	RTU INPUT	-
0024	0	HS-L02A	MANUAL MODE	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10025	DISCRETE INPUT	23	RTU INPUT	1
0025	0	HS-L02B	AUTO MODE	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10026	DISCRETE INPUT	24	RTU INPUT	1
0026	0	YI-L02A	READY	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10027	DISCRETE INPUT	25	RTU INPUT	1
0027	0	YI-L02B	RUNNING FWD	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10028	DISCRETE INPUT	26	RTU INPUT	1
0028	0	YI-L02B	RUNNING REV	P-L02 DISCHARGE PUMP	P-05						RTU	DI	10029	DISCRETE INPUT	27	RTU INPUT	1
0029	0	YA-L02	VFD FAULT	P-L02 DISCHARGE PUMP	P-05					OFF	RTU	DI	10030	DISCRETE INPUT	28	RTU INPUT	0
0030	0	Y-L02C	SEAL WATER FLOW SWITCH	P-L02 DISCHARGE PUMP	P-05					OFF	RTU	DI	10031	DISCRETE INPUT	29	RTU INPUT	1
0031	0		SPARE								RTU	DI	10032	DISCRETE INPUT	30	RTU INPUT	-
0032	0	HS-L03A	MANUAL MODE	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10033	DISCRETE INPUT	31	RTU INPUT	1
0033	0	HS-L03B	AUTO MODE	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10034	DISCRETE INPUT	32	RTU INPUT	1
0034	0	YI-L03A	READY	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10035	DISCRETE INPUT	33	RTU INPUT	1
0035	0	YI-L03B	RUNNING FWD	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10036	DISCRETE INPUT	34	RTU INPUT	1
0036	0	YI-L03B	RUNNING REV	P-L03 DISCHARGE PUMP	P-05						RTU	DI	10037	DISCRETE INPUT	35	RTU INPUT	1
0037	0	YA-L03	VFD FAULT	P-L03 DISCHARGE PUMP	P-05					OFF	RTU	DI	10038	DISCRETE INPUT	36	RTU INPUT	0
0038	0	YI-L03C	SEAL WATER FLOW SWITCH	P-L03 DISCHARGE PUMP	P-05					OFF	RTU	DI	10039	DISCRETE INPUT	37	RTU INPUT	1
0039	0		SPARE								RTU	DI	10040	DISCRETE INPUT	38	RTU INPUT	-
0040	0	FA-L201	FLOW METER FAULT	FORCE MAIN 1	P-05					OFF	RTU	DI	10041	DISCRETE INPUT	39	RTU INPUT	0
0041	0	FQ-L201	FLOW METER TOTALIZER PULSE	FORCE MAIN 1	P-05						RTU	DI	10042	COUNTER INPUT	1	RTU INPUT	1
0042	0	FA-L202	FLOW METER FAULT	FORCE MAIN 2	P-05					OFF	RTU	DI	10043	DISCRETE INPUT	40	RTU INPUT	0
0043	0	FQ-L202	FLOW METER TOTALIZER PULSE	FORCE MAIN 2	P-05						RTU	DI	10044	COUNTER INPUT	2	RTU INPUT	1
0044	0		SPARE								RTU	DI	10045	DISCRETE INPUT	41	RTU INPUT	0
0045	0		SPARE								RTU	DI	10046	DISCRETE INPUT	42	RTU INPUT	1
0046	0		SPARE								RTU	DI	10047	DISCRETE INPUT	43	RTU INPUT	-
0047	0		SPARE								RTU	DI	10048	DISCRETE INPUT	44	RTU INPUT	-
0048	0	YI-L04A	GAS ENGINE READY	P-L04 STORM PUMP	P-05						RTU	DI	10049	DISCRETE INPUT	45	RTU INPUT	1
0049	0	YI-L04B	GAS ENGINE RUN	P-L04 STORM PUMP	P-05						RTU	DI	10050	DISCRETE INPUT	46	RTU INPUT	1
0050	0	YA-L04A	GAS ENGINE FAIL	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10051	DISCRETE INPUT	47	RTU INPUT	0
0051	0	YI-L04C	GAS ENGINE IDLE	P-L04 STORM PUMP	P-05						RTU	DI	10052	DISCRETE INPUT	48	RTU INPUT	1
0052	0	YA-L04C	GAS ENGINE BATTERY FAULT	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10053	DISCRETE INPUT	49	RTU INPUT	0
0053	0	YA-L04D	GAS ENGINE CHARGER FAIL	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10054	DISCRETE INPUT	50	RTU INPUT	0
0054	0	YI-L04D	GAS ENGINE MANUAL HI SPEED	P-L04 STORM PUMP	P-05						RTU	DI	10055	DISCRETE INPUT	51	RTU INPUT	1
0055	0	YI-L04E	SEAL WATER FLOW SWITCH	P-L04 STORM PUMP	P-05					OFF	RTU	DI	10056	DISCRETE INPUT	52	RTU INPUT	0
0056	0	GDC-L550	GAS DETECTOR FAULT	STATION	P-05					OFF	RTU	DI	10057	DISCRETE INPUT	53	RTU INPUT	0

DNP3 MAPPING TABLE

			Description				I/O SPECIFICATION				RTU			DNP3			
RECORD	REV.	TAG	FUNCTION	SERVICE	P&ID	ENG.	SCALE		ALARMS		RTU	I/O	I/O	DNP3	DNP3 POINT	USAGE	ACTIVE
NO.	N0.	NAME			DRAWING	UNITS	LOW	HIGH	LOW	HIGH	CABINET	TYPE	ADDRESS	TABLE	ADDRESS	DESCRIPTION	STATE
0057	0	GDC-L550	GAS DETECTOR LEVEL HIGH	STATION	P-05					ON	RTU	DI	10058	DISCRETE INPUT	54	RTU INPUT	1
0058	0	GDC-L550	GAS DETECTOR LEVEL HIGH HIGH	STATION	P-05					ON	RTU	DI	10059	DISCRETE INPUT	55	RTU INPUT	1
0059	0		SPARE								RTU	DI	10060	DISCRETE INPUT	56	RTU INPUT	1
0060	0		SPARE								RTU	DI	10061	DISCRETE INPUT	57	RTU INPUT	-
0061	0		SPARE								RTU	DI	10062	DISCRETE INPUT	58	RTU INPUT	-
0062	0		SPARE								RTU	DI	10063	DISCRETE INPUT	59	RTU INPUT	-
0063	0		SPARE								RTU	DI	10064	DISCRETE INPUT	60	RTU INPUT	-
0064	0	VFD-L01	RUN FWD COMMAND	P-L01 DISCHARGE PUMP	P-05						RTU	DO	00001	DISCRETE INPUT	61	RTU OUTPUT	1
0065	0	VFD-L01	RUN REV COMMAND	P-L01 DISCHARGE PUMP	P-05						RTU	DO	00002	DISCRETE INPUT	62	RTU OUTPUT	1
0066	0	VFD-L02	RUN FWD COMMAND	P-L02 DISCHARGE PUMP	P-05						RTU	DO	00003	DISCRETE INPUT	63	RTU OUTPUT	1
0067	0	VFD-L02	RUN REV COMMAND	P-L02 DISCHARGE PUMP	P-05						RTU	DO	00004	DISCRETE INPUT	64	RTU OUTPUT	1
0068	0	VFD-L03	RUN FWD COMMAND	P-L03 DISCHARGE PUMP	P-05						RTU	DO	00005	DISCRETE INPUT	65	RTU OUTPUT	1
0069	0	VFD-L03	RUN REV COMMAND	P-L03 DISCHARGE PUMP	P-05						RTU	DO	00006	DISCRETE INPUT	66	RTU OUTPUT	1
0070	0	ENG-L04	ENGINE RUN COMMAND	P-L04 STORM PUMP	P-05						RTU	DO	00007	DISCRETE INPUT	67	RTU OUTPUT	1
0071	0	YC-L111	PLC MODE	P-L01, P-L02, P-L03 DISCHARGE PUMPS							RTU	DO	00008	DISCRETE INPUT	68	RTU OUTPUT	1
0072	0	LT-L543	SECURITY SYSTEM ON LIGHT	BUILDING SECURITY							RTU	DO	00009	DISCRETE INPUT	69	RTU OUTPUT	1
0073	0	KS-L543	LIGHT	SECURITY DOOR ON							RTU	DO	00010	DISCRETE INPUT	70	RTU OUTPUT	1
0074	0	KS-L543	LIGHT	SECURITY DOOR OFF							RTU	DO	00011	DISCRETE INPUT	71	RTU OUTPUT	1
0075	0		SPARE								RTU	DO	00012	DISCRETE INPUT	72	RTU OUTPUT	1
0076	0		SPARE								RTU	DO	00013	DISCRETE INPUT	73	RTU OUTPUT	1
0077	0		SPARE								RTU	DO	00014	DISCRETE INPUT	74	RTU OUTPUT	1
0078	0		SPARE								RTU	DO	00015	DISCRETE INPUT	75	RTU OUTPUT	1
0079	0		SPARE								RTU	DO	00016	DISCRETE INPUT	76	RTU OUTPUT	1
0080	0	YA-L01A	INTERNAL ALARM	P-L01 DISCHARGE PUMP - FAILED TO START						ON	INTERNAL	DO	00101	DISCRETE INPUT	77	RTU -> SCADA	1
0081	0	YA-L01B	INTERNAL ALARM	P-L01 DISCHARGE PUMP - LOW FLOW						ON	INTERNAL	DO	00102	DISCRETE INPUT	78	RTU -> SCADA	1
0082	0	YA-L01C	INTERNAL ALARM	P-L01 DISCHARGE PUMP - VFD FAULT						ON	INTERNAL	DO	00103	DISCRETE INPUT	79	RTU -> SCADA	1
0083	0	YI-L01	INTERNAL ALARM	P-L01 DISCHARGE PUMP - AVAILABLE						OFF	INTERNAL	DO	00104	DISCRETE INPUT	80	RTU -> SCADA	0
0084	0	YA-L02A	INTERNAL ALARM	P-L02 DISCHARGE PUMP - FAILED TO START						ON	INTERNAL	DO	00105	DISCRETE INPUT	81	RTU -> SCADA	1
0085	0	YA-L02B	INTERNAL ALARM	P-L02 DISCHARGE PUMP - LOW FLOW						ON	INTERNAL	DO	00106	DISCRETE INPUT	82	RTU -> SCADA	1
0086	0	YA-L02C	INTERNAL ALARM	P-L02 DISCHARGE PUMP - VFD FAULT						ON	INTERNAL	DO	00107	DISCRETE INPUT	83	RTU -> SCADA	1
0087	0	YI-L02	INTERNAL ALARM	P-L02 DISCHARGE PUMP - AVAILABLE						OFF	INTERNAL	DO	00108	DISCRETE INPUT	84	RTU -> SCADA	0
0088	0	YA-L03A	INTERNAL ALARM	P-L03 DISCHARGE PUMP - FAILED TO START						ON	INTERNAL	DO	00109	DISCRETE INPUT	85	RTU -> SCADA	1
0089	0	YA-L03B	INTERNAL ALARM	P-L03 DISCHARGE PUMP - LOW FLOW						ON	INTERNAL	DO	00110	DISCRETE INPUT	86	RTU -> SCADA	1
0090	0	YA-L03C	INTERNAL ALARM	P-L03 DISCHARGE PUMP - VFD FAULT						ON	INTERNAL	DO	00111	DISCRETE INPUT	87	RTU -> SCADA	1
0091	0	YI-L03	INTERNAL ALARM	P-L03 DISCHARGE PUMP - AVAILABLE						OFF	INTERNAL	DO	00112	DISCRETE INPUT	88	RTU -> SCADA	0
0092	0	YA-L01/02/03	INTERNAL ALARM	ONLY ONE PUMP IN AUTO						ON	INTERNAL	DO	00113	DISCRETE INPUT	89	RTU -> SCADA	1
0093	0	YA-L01/02/03	INTERNAL ALARM	NO PUMPS IN AUTO						ON	INTERNAL	DO	00114	DISCRETE INPUT	90	RTU -> SCADA	1
0094	0	YA-L04A	INTERNAL ALARM	P-L04 STORM PUMP - FAILED TO START						ON	INTERNAL	DO	00115	DISCRETE INPUT	91	RTU -> SCADA	1
0095	0	YA-L04B	INTERNAL ALARM	P-L04 STORM PUMP - LOW FLOW						ON	INTERNAL	DO	00116	DISCRETE INPUT	92	RTU -> SCADA	1
0096	0	YI-L04	INTERNAL ALARM	P-L04 STORM PUMP - AVAILABLE						OFF	INTERNAL	DO	00117	DISCRETE INPUT	93	RTU -> SCADA	0
0097	0	YA-L04D	INTERNAL ALARM	STORM PUMP NOT IN AUTO						ON	INTERNAL	DO	00118	DISCRETE INPUT	94	RTU -> SCADA	1
0098	0	YA-L111/112	INTERNAL ALARM	WET WELL HIGH LEVEL WARNING						ON	INTERNAL	DO	00119	DISCRETE INPUT	95	RTU -> SCADA	1
0099	0	YA-L111/112	INTERNAL ALARM	WET WELL HIGH LEVEL ALARM						ON	INTERNAL	DO	00120	DISCRETE INPUT	96	RTU -> SCADA	1
0100	0	YA-L111/112	INTERNAL ALARM	LEVEL TRANSMITER VARIANCE ALARM						ON	INTERNAL	DO	00121	DISCRETE INPUT	97	RTU -> SCADA	1
0101	0	YA-L201	INTERNAL ALARM	FLOW TRANSMITTER FAULT ALARM						ON	INTERNAL	DO	00122	DISCRETE INPUT	98	RTU -> SCADA	1
0102	0	YA-L202	INTERNAL ALARM	FLOW TRANSMITTER FAULT ALARM						ON	INTERNAL	DO	00123	DISCRETE INPUT	99	RTU -> SCADA	1
0103	0	YA-L501A	INTERNAL ALARM	ROOM LOW TEMPERATURE ALARM						ON	INTERNAL	DO	00124	DISCRETE INPUT	100	RTU -> SCADA	1
0104	0	YA-L501B	INTERNAL ALARM	ROOM HIGH TEMPERATURE ALARM						ON	INTERNAL	DO	00125	DISCRETE INPUT	101	RTU -> SCADA	1
0105	0	YA-L522	INTERNAL ALARM	DRY WELL FLOOD ALARM						ON	INTERNAL	DO	00126	DISCRETE INPUT	102	RTU -> SCADA	1
0106	0	YA-L550A	INTERNAL ALARM	CO LEVEL HIGH						ON	INTERNAL	DO	00127	DISCRETE INPUT	103	RTU -> SCADA	1
0107	0	YA-L550B	INTERNAL ALARM	CH4 LEVEL HIGH						ON	INTERNAL	DO	00128	DISCRETE INPUT	104	RTU -> SCADA	1
0108	0	YA-L550C	INTERNAL ALARM	CH4 LEVEL HIGH HIGH						ON	INTERNAL	DO	00129	DISCRETE INPUT	105	RTU -> SCADA	1
0109	0		INTERNAL ALARM	24 VDC POWER SUPPLY 1 FAIL ALARM						ON	INTERNAL	DO	00130	DISCRETE INPUT	106	RTU -> SCADA	1
0110	0		INTERNAL ALARM	24 VDC POWER SUPPLY 2 FAIL ALARM						ON	INTERNAL	DO	00131	DISCRETE INPUT	107	RTU -> SCADA	1
0111	0		INTERNAL ALARM	120 VAC POWER FAIL ALARM						ON	INTERNAL	DO	00132	DISCRETE INPUT	108	RTU -> SCADA	1
0112	0		INTERNAL ALARM	600 VAC POWER FAIL ALARM						ON	INTERNAL	DO	00133	DISCRETE INPUT	109	RTU -> SCADA	1
0113	0		RESET STATUS	ALARM RESET						ON	INTERNAL	DO	00134	DISCRETE INPUT	110	RTU -> SCADA	1

DNP3 MAPPING TABLE

			Description				I/O SPECIFICATION				RTU			DNP3			
RECORD	REV.	TAG	FUNCTION	SERVICE	P&ID	ENG.	SCALE		ALARMS		RTU	I/O	I/O	DNP3	DNP3 POINT	USAGE	ACTIVE
NO.	N0.	NAME			DRAWING	UNITS	LOW	HIGH	LOW	HIGH	CABINET	TYPE	ADDRESS	TABLE	ADDRESS	DESCRIPTION	STATE
0114	0	VFD-L01	STOP COMMAND RECEVIED	P-L01 DISCHARGE PUMP							INTERNAL	DO	00135	DISCRETE INPUT	111	RTU -> SCADA	1
0115	0	VFD-L02	STOP COMMAND RECEVIED	P-L02 DISCHARGE PUMP							INTERNAL	DO	00136	DISCRETE INPUT	112	RTU -> SCADA	1
0116	0	VFD-L03	STOP COMMAND RECEVIED	P-L03 DISCHARGE PUMP							INTERNAL	DO	00137	DISCRETE INPUT	113	RTU -> SCADA	1
0117	0	VFD-L01	RUN FWD COMMAND RECEIVED	P-L01 DISCHARGE PUMP							INTERNAL	DO	00138	DISCRETE INPUT	114	RTU -> SCADA	1
0118	0	VFD-L01	RUN REV COMMAND RECEIVED	P-L01 DISCHARGE PUMP							INTERNAL	DO	00139	DISCRETE INPUT	115	RTU -> SCADA	1
0119	0	VFD-L02	RUN FWD COMMAND RECEIVED	P-L02 DISCHARGE PUMP							INTERNAL	DO	00140	DISCRETE INPUT	116	RTU -> SCADA	1
0120	0	VFD-L02	RUN REV COMMAND RECEIVED	P-L02 DISCHARGE PUMP							INTERNAL	DO	00141	DISCRETE INPUT	117	RTU -> SCADA	1
0121	0	VFD-L03	RUN FWD COMMAND RECEIVED	P-L03 DISCHARGE PUMP							INTERNAL	DO	00142	DISCRETE INPUT	118	RTU -> SCADA	1
0122	0	VFD-L03	RUN REV COMMAND RECEIVED	P-L03 DISCHARGE PUMP							INTERNAL	DO	00143	DISCRETE INPUT	119	RTU -> SCADA	1
0123	0	VFD-L01	IN SERVICE STATUS	P-L01 DISCHARGE PUMP							INTERNAL	DO	00144	DISCRETE INPUT	120	RTU -> SCADA	1
0124	0	VFD-L02	IN SERVICE STATUS	P-L02 DISCHARGE PUMP							INTERNAL	DO	00145	DISCRETE INPUT	121	RTU -> SCADA	1
0125	0	VFD-L03	IN SERVICE STATUS	P-L03 DISCHARGE PUMP							INTERNAL	DO	00146	DISCRETE INPUT	122	RTU -> SCADA	1
0126	0	P-L04	RUN COMMAND RECEIVED	P-L04 STORM PUMP							INTERNAL	DO	00147	DISCRETE INPUT	123	RTU -> SCADA	1
0127	0	P-L04	STOP COMMAND RECEVIED	P-L04 STORM PUMP							INTERNAL	DO	00148	DISCRETE INPUT	124	RTU -> SCADA	1
0128	0	P-L04	IN SERVICE STATUS	P-L04 STORM PUMP							INTERNAL	DO	00149	DISCRETE INPUT	125	RTU -> SCADA	1
0129	0	LIT-L111	LIT-L111 SELECTED	ACTIVE LEVEL CONTROL SIGNAL							INTERNAL	DO	00150	DISCRETE INPUT	126	RTU -> SCADA	1
0130	0	LIT-L112	LIT-L112 SELECTED	ACTIVE LEVEL CONTROL SIGNAL							INTERNAL	DO	00151	DISCRETE INPUT	127	RTU -> SCADA	1
0131	0		AVERAGE SELECTED	AVERAGE LEVEL CONTROL MODE							INTERNAL	DO	00152	DISCRETE INPUT	128	RTU -> SCADA	1
0132	0		IN PLC MODE	LEVEL CONTROL MODE							INTERNAL	DO	00153	DISCRETE INPUT	129	RTU -> SCADA	1
0133	0		IN PLC AUTO MODE	P-L01 DISCHARGE PUMP							INTERNAL	DO	00154	DISCRETE INPUT	130	RTU -> SCADA	1
0134	0		IN PLC MANUAL MODE	P-L01 DISCHARGE PUMP							INTERNAL	DO	00155	DISCRETE INPUT	131	RTU -> SCADA	1
0135	0		IN PLC AUTO MODE	P-L02 DISCHARGE PUMP							INTERNAL	DO	00156	DISCRETE INPUT	132	RTU -> SCADA	1
0136	0		IN PLC MANUAL MODE	P-L02 DISCHARGE PUMP							INTERNAL	DO	00157	DISCRETE INPUT	133	RTU -> SCADA	1
0137	0		IN PLC AUTO MODE	P-L03DISCHARGE PUMP							INTERNAL	DO	00158	DISCRETE INPUT	134	RTU -> SCADA	1
0138	0		IN PLC MANUAL MODE	P-L03DISCHARGE PUMP							INTERNAL	DO	00159	DISCRETE INPUT	135	RTU -> SCADA	1
0139	0	VFD-L01	BACKFLUSH INITIATED	P-L01 BACKFLUSH							INTERNAL	DO	00160	DISCRETE INPUT	136	RTU -> SCADA	1
0140	0	VFD-L02	BACKFLUSH INITIATED	P-L02 BACKFLUSH							INTERNAL	DO	00161	DISCRETE INPUT	137	RTU -> SCADA	1
0141	0	VFD-L03	BACKFLUSH INITIATED	P-L03 BACKFLUSH							INTERNAL	DO	00162	DISCRETE INPUT	138	RTU -> SCADA	1
0139	0	VFD-L01	BACKFLUSH ACTIVE	P-L01 BACKFLUSH							INTERNAL	DO	00160	DISCRETE INPUT	136	RTU -> SCADA	1
0140	0	VFD-L02	BACKFLUSH ACTIVE	P-L02 BACKFLUSH							INTERNAL	DO	00161	DISCRETE INPUT	137	RTU -> SCADA	1
0141	0	VFD-L03	BACKFLUSH ACTIVE	P-L03 BACKFLUSH							INTERNAL	DO	00162	DISCRETE INPUT	138	RTU -> SCADA	1
0142	0	VFD-L01	RUN FWD COMMAND	P-L01 DISCHARGE PUMP							INTERNAL	DO	00033	DISCRETE OUTPUT	0	SCADA -> RTU	
0143	0	VFD-L01	RUN REV COMMAND	P-L01 DISCHARGE PUMP							INTERNAL	DO	00034	DISCRETE OUTPUT	1	SCADA -> RTU	
0144	0	VFD-L01	STOP COMMAND	P-L01 DISCHARGE PUMP							INTERNAL	DO	00035	DISCRETE OUTPUT	2	SCADA -> RTU	
0145	0	VFD-L01	OUT OF SERVICE COMMAND	P-L01 DISCHARGE PUMP							INTERNAL	DO	00036	DISCRETE OUTPUT	3	SCADA -> RTU	
0145	0	VFD-L01	IN SERVICE COMMAND	P-L01 DISCHARGE PUMP							INTERNAL	DO	00037	DISCRETE OUTPUT	4	SCADA -> RTU	
0146	0	VFD-L02	RUN FWD COMMAND	P-L02 DISCHARGE PUMP							INTERNAL	DO	00038	DISCRETE OUTPUT	5	SCADA -> RTU	
0147	0	VFD-L02	RUN REV COMMAND	P-L02 DISCHARGE PUMP							INTERNAL	DO	00039	DISCRETE OUTPUT	6	SCADA -> RTU	
0148	0	VFD-L02	STOP COMMAND	P-L02 DISCHARGE PUMP							INTERNAL	DO	00040	DISCRETE OUTPUT	7	SCADA -> RTU	
0149	0	VFD-L02	OUT OF SERVICE COMMAND	P-L02 DISCHARGE PUMP							INTERNAL	DO	00041	DISCRETE OUTPUT	8	SCADA -> RTU	
0149	0	VFD-L02	IN SERVICE COMMAND	P-L02 DISCHARGE PUMP							INTERNAL	DO	00042	DISCRETE OUTPUT	9	SCADA -> RTU	
0150	0	VFD-L03	RUN FWD COMMAND	P-L03 DISCHARGE PUMP							INTERNAL	DO	00043	DISCRETE OUTPUT	10	SCADA -> RTU	
0151	0	VFD-L03	RUN REV COMMAND	P-L03 DISCHARGE PUMP							INTERNAL	DO	00044	DISCRETE OUTPUT	11	SCADA -> RTU	
0152	0	VFD-L03	STOP COMMAND	P-L03 DISCHARGE PUMP							INTERNAL	DO	00045	DISCRETE OUTPUT	12	SCADA -> RTU	
0153	0	VFD-L03	OUT OF SERVICE COMMAND	P-L03 DISCHARGE PUMP							INTERNAL	DO	00046	DISCRETE OUTPUT	13	SCADA -> RTU	
0153	0	VFD-L03	IN SERVICE COMMAND	P-L03 DISCHARGE PUMP							INTERNAL	DO	00047	DISCRETE OUTPUT	14	SCADA -> RTU	
0154	0	P-L04	RUN COMMAND	P-L04 STORM PUMP							INTERNAL	DO	00048	DISCRETE OUTPUT	15	SCADA -> RTU	
0155	0	P-L04	STOP COMMAND	P-L04 STORM PUMP							INTERNAL	DO	00049	DISCRETE OUTPUT	16	SCADA -> RTU	
0156	0	P-L04	OUT OF SERVICE COMMAND	P-L04 STORM PUMP							INTERNAL	DO	00050	DISCRETE OUTPUT	17	SCADA -> RTU	
0156	0	P-L04	IN SERVICE COMMAND	P-L04 STORM PUMP							INTERNAL	DO	00051	DISCRETE OUTPUT	18	SCADA -> RTU	
0157	0		RESET ON	ALARM RESET							INTERNAL	DO	00052	DISCRETE OUTPUT	19	SCADA -> RTU	
0158	0		RESET OFF	ALARM RESET							INTERNAL	DO	00053	DISCRETE OUTPUT	20	SCADA -> RTU	
0159	0		IN PLC MODE	LEVEL CONTROL MODE							INTERNAL	DO	00054	DISCRETE OUTPUT	21	SCADA -> RTU	
0160	0		IN PLC AUTO MODE	P-L01 DISCHARGE PUMP							INTERNAL	DO	00055	DISCRETE OUTPUT	22	SCADA -> RTU	
0161	0		IN PLC MANUAL MODE	P-L01 DISCHARGE PUMP							INTERNAL	DO	00056	DISCRETE OUTPUT	23	SCADA -> RTU	
0162	0		IN PLC AUTO MODE	P-L02 DISCHARGE PUMP							INTERNAL	DO	00057	DISCRETE OUTPUT	24	SCADA -> RTU	
0163	0		IN PLC MANUAL MODE	P-L02 DISCHARGE PUMP							INTERNAL	DO	00058	DISCRETE OUTPUT	25	SCADA -> RTU	

DNP3 MAPPING TABLE

			Description				I/O SPECIFICATION				RTU			DNP3			
RECORD	REV.	TAG	FUNCTION	SERVICE	P&ID	ENG.	SCALE		ALARMS		RTU	I/O	I/O	DNP3	DNP3 POINT	USAGE	ACTIVE
NO.	N0.	NAME			DRAWING	UNITS	LOW	HIGH	LOW	HIGH	CABINET	TYPE	ADDRESS	TABLE	ADDRESS	DESCRIPTION	STATE
0164	0		IN PLC AUTO MODE	P-L03 DISCHARGE PUMP							INTERNAL	DO	00059	DISCRETE OUTPUT	26	SCADA -> RTU	
0165	0		IN PLC MANUAL MODE	P-L03 DISCHARGE PUMP							INTERNAL	DO	00060	DISCRETE OUTPUT	27	SCADA -> RTU	
0166	0	LIT-L111	SELECT LIT-L111	ACTIVE LEVEL CONTROL SIGNAL							INTERNAL	DO	00061	DISCRETE OUTPUT	28	SCADA -> RTU	
0167	0	LIT-L112	SELECT LIT-L112	ACTIVE LEVEL CONTROL SIGNAL							INTERNAL	DO	00062	DISCRETE OUTPUT	29	SCADA -> RTU	
0168	0		SELECT AVERAGE	AVERAGE LEVEL CONTROL MODE							INTERNAL	DO	00063	DISCRETE OUTPUT	30	SCADA -> RTU	
0172	0	VFD-L01	INITIATE BACKFLUSH	P-L01 BACKFLUSH							INTERNAL	DO	00064	DISCRETE OUTPUT	31	SCADA -> RTU	
0173	0	VFD-L02	INITIATE BACKFLUSH	P-L02 BACKFLUSH							INTERNAL	DO	00065	DISCRETE OUTPUT	32	SCADA -> RTU	
0174	0	VFD-L03	INITIATE BACKFLUSH	P-L03 BACKFLUSH							INTERNAL	DO	00066	DISCRETE OUTPUT	33	SCADA -> RTU	
0175	0	LIT-L111	LEVEL TRANSMITTER	WETWELL	P-05	m	0	5			RTU	AI	30001	ANALOGUE INPUT	0	RTU INPUT	
0176	0	LIT-L112	LEVEL TRANSMITTER	WETWELL	P-05	m	0	5			RTU	AI	30002	ANALOGUE INPUT	1	RTU INPUT	
0177	0	TIT-L501	MAIN FLOOR TEMPERATURE	STATION	P-05	C	-10	40	10	35	RTU	AI	30003	ANALOGUE INPUT	2	RTU INPUT	
0178	0		SPARE								RTU	AI	30004	ANALOGUE INPUT	3	RTU INPUT	
0179	0	FIT-L201	DISCHARGE FLOW	P-L01 DISCHARGE PUMP	P-05	L/SEC	0	400	100		RTU	AI	30005	ANALOGUE INPUT	4	RTU INPUT	
0180	0	FIT-L202	DISCHARGE FLOW	P-L02 DISCHARGE PUMP	P-05	L/SEC	0	400	100		RTU	AI	30006	ANALOGUE INPUT	5	RTU INPUT	
0181	0	GDC-L550-1	GAS DETECTION LEVEL - CO	STATION	P-05	ppm	0	250		100	RTU	AI	30007	ANALOGUE INPUT	6	RTU INPUT	
0182	0	GDC-L550-2	GAS DETECTION LEVEL - CH4	STATION	P-05	%LEL	0	100	10	25	RTU	AI	30008	ANALOGUE INPUT	7	RTU INPUT	
0183	0	VFD-L01	MOTOR SPEED	P-L01 DISCHARGE PUMP	P-05	%	0	100			RTU	AI	30009	ANALOGUE INPUT	8	RTU INPUT	
0184	0	VFD-L01	MOTOR CURRENT	P-L01 DISCHARGE PUMP	P-05	A	0	50		45	RTU	AI	30010	ANALOGUE INPUT	9	RTU INPUT	
0185	0	VFD-L02	MOTOR SPEED	P-L02 DISCHARGE PUMP	P-05	%	0	100			RTU	AI	30011	ANALOGUE INPUT	10	RTU INPUT	
0186	0	VFD-L02	MOTOR CURRENT	P-L02 DISCHARGE PUMP	P-05	A	0	50		45	RTU	AI	30012	ANALOGUE INPUT	11	RTU INPUT	
0187	0	VFD-L03	MOTOR SPEED	P-L02 DISCHARGE PUMP	P-05	%	0	100			RTU	AI	30013	ANALOGUE INPUT	12	RTU INPUT	
0188	0	VFD-L03	MOTOR CURRENT	P-L03 DISCHARGE PUMP	P-05	A	0	50		45	RTU	AI	30014	ANALOGUE INPUT	13	RTU INPUT	
0189	0		SPARE								RTU	AI	30015	ANALOGUE INPUT	14	RTU INPUT	
0190	0		SPARE								RTU	AI	30016	ANALOGUE INPUT	15	RTU INPUT	
0191	0		SPARE								RTU	AI	30017	ANALOGUE INPUT	16	RTU INPUT	
0192	0		SPARE								RTU	AI	30018	ANALOGUE INPUT	17	RTU INPUT	
0193	0		SPARE								RTU	AI	30019	ANALOGUE INPUT	18	RTU INPUT	
0194	0		SPARE								RTU	AI	30020	ANALOGUE INPUT	19	RTU INPUT	
0195	0		SPARE								RTU	AI	30021	ANALOGUE INPUT	20	RTU INPUT	
0196	0		SPARE								RTU	AI	30022	ANALOGUE INPUT	21	RTU INPUT	
0197	0		SPARE								RTU	AI	30023	ANALOGUE INPUT	22	RTU INPUT	
0198	0		SPARE								RTU	AI	30024	ANALOGUE INPUT	23	RTU INPUT	
0199	0	SC-L201	SPEED SETPOINT	P-L01 DISCHARGE PUMP	P-03	%	0	60			INTERNAL	AI	40101	ANALOGUE INPUT	24	RTU -> SCADA	
0200	0	SC-L202	SPEED SETPOINT	P-L02 DISCHARGE PUMP	P-03	%	0	60			INTERNAL	AI	40102	ANALOGUE INPUT	25	RTU -> SCADA	
0201	0	SC-L203	SPEED SETPOINT	P-L03 DISCHARGE PUMP	P-03	%	0	60			INTERNAL	AI	40103	ANALOGUE INPUT	26	RTU -> SCADA	
0202	0	LI-1	LEVEL SETPOINT	LEAD PUMP START		m					INTERNAL	AI	40104	ANALOGUE INPUT	27	RTU -> SCADA	
0203	0	LI-2	LEVEL SETPOINT	LEAD PUMP STOP		m					INTERNAL	AI	40105	ANALOGUE INPUT	28	RTU -> SCADA	
0204	0	LI-3	LEVEL SETPOINT	LAG PUMP START		m					INTERNAL	AI	40106	ANALOGUE INPUT	29	RTU -> SCADA	
0205	0	LI-4	LEVEL SETPOINT	LAG PUMP STOP		m					INTERNAL	AI	40107	ANALOGUE INPUT	30	RTU -> SCADA	
0206	0	LI-5	LEVEL SETPOINT	STANDBY PUMP START		m					INTERNAL	AI	40108	ANALOGUE INPUT	31	RTU -> SCADA	
0207	0	LI-6	LEVEL SETPOINT	STANDBY PUMP STOP		m					INTERNAL	AI	40109	ANALOGUE INPUT	32	RTU -> SCADA	
0208	0	LI-7	LEVEL SETPOINT	STORM PUMP START		m					INTERNAL	AI	40110	ANALOGUE INPUT	33	RTU -> SCADA	
0209	0	LI-8	LEVEL SETPOINT	STORM PUMP STOP		m					INTERNAL	AI	40111	ANALOGUE INPUT	34	RTU -> SCADA	
0210	0		TIMER SETPOINT	BACKFLUSH		s					INTERNAL	AI	40112	ANALOGUE INPUT	35	RTU -> SCADA	
0211	0	FIQ-L201	TOTALIZED FLOW	FLOW METER L201		M^3					INTERNAL	AI	40113	ANALOGUE INPUT	36	RTU -> SCADA	
0212	0	FIQ-L202	TOTALIZED FLOW	FLOW METER L202		M^3					INTERNAL	AI	40114	ANALOGUE INPUT	37	RTU -> SCADA	
0213	0	FIQ	TOTALIZED FLOW	STATION		M^3					INTERNAL	AI	40115	ANALOGUE INPUT	38	RTU -> SCADA	
0214	0	YIQ-L201	RUNTIME	P-L01 DISCHARGE PUMP		HOURS					INTERNAL	AI	40116	ANALOGUE INPUT	39	RTU -> SCADA	
0215	0	YIQ-L202	RUNTIME	P-L02 DISCHARGE PUMP		HOURS					INTERNAL	AI	40117	ANALOGUE INPUT	40	RTU -> SCADA	
0216	0	YIQ-L203	RUNTIME	P-L03 DISCHARGE PUMP		HOURS					INTERNAL	AI	40118	ANALOGUE INPUT	41	RTU -> SCADA	
0217	0	YIQ-L204	RUNTIME	P-L04 DISCHARGE PUMP		HOURS					INTERNAL	AI	40119	ANALOGUE INPUT	42	RTU -> SCADA	
0218	0	LIT-111/112	LEVEL TRANSMITTER	AVERAGE WETWELL LEVEL							INTERNAL	AI	40120	ANALOGUE INPUT	43	RTU -> SCADA	
0219	0	VFD-L01	VFD SPEED COMMAND	P-L01 DISCHARGE PUMP	P-05	%	0	60			RTU	AO	40001	ANALOGUE OUTPUT	0	RTU OUTPUT	
0220	0	VFD-L02	VFD SPEED COMMAND	P-L02 DISCHARGE PUMP	P-05	%	0	60			RTU	AO	40002	ANALOGUE OUTPUT	1	RTU OUTPUT	
0221	0	VFD-L03	VFD SPEED COMMAND	P-L03 DISCHARGE PUMP	P-05	%	0	60			RTU	AO	40003	ANALOGUE OUTPUT	2	RTU OUTPUT	
0222	0		SPARE								RTU	AO	40004	ANALOGUE OUTPUT	3	RTU OUTPUT	
0223	0		SPARE								RTU	AO	40005	ANALOGUE OUTPUT	4	RTU OUTPUT	

DNP3 MAPPING TABLE

			Description				I/O SPECIFICATION				RTU			DNP3			
RECORD	REV.	TAG	FUNCTION	SERVICE	P&ID	ENG.	SCALE		ALARMS		RTU	I/O	I/O	DNP3	DNP3 POINT	USAGE	ACTIVE
NO.	N0.	NAME			DRAWING	UNITS	LOW	HIGH	LOW	HIGH	CABINET	TYPE	ADDRESS	TABLE	ADDRESS	DESCRIPTION	STATE
0224	0		SPARE								RTU	AO	40006	ANALOGUE OUTPUT	5	RTU OUTPUT	
0225	0		SPARE								RTU	AO	40007	ANALOGUE OUTPUT	6	RTU OUTPUT	
0226	0		SPARE								RTU	AO	40008	ANALOGUE OUTPUT	7	RTU OUTPUT	
0227	0	SC-L201	SPEED SETPOINT	P-L01 DISCHARGE PUMP	P-03	%	0	60			INTERNAL	AO	40009	ANALOGUE OUTPUT	8	SCADA -> RTU	
0228	0	SC-L202	SPEED SETPOINT	P-L02 DISCHARGE PUMP	P-03	%	0	60			INTERNAL	AO	40010	ANALOGUE OUTPUT	9	SCADA -> RTU	
0229	0	SC-L203	SPEED SETPOINT	P-L03 DISCHARGE PUMP	P-03	%	0	60			INTERNAL	AO	40011	ANALOGUE OUTPUT	10	SCADA -> RTU	
0230	0	LI-1	LEVEL SETPOINT	LEAD PUMP START		m					INTERNAL	AO	40012	ANALOGUE OUTPUT	11	SCADA -> RTU	
0231	0	LI-2	LEVEL SETPOINT	LEAD PUMP STOP		m					INTERNAL	AO	40013	ANALOGUE OUTPUT	12	SCADA -> RTU	
0232	0	LI-3	LEVEL SETPOINT	LAG PUMP START		m					INTERNAL	AO	40014	ANALOGUE OUTPUT	13	SCADA -> RTU	
0233	0	LI-4	LEVEL SETPOINT	LAG PUMP STOP		m					INTERNAL	AO	40015	ANALOGUE OUTPUT	14	SCADA -> RTU	
0234	0	LI-5	LEVEL SETPOINT	STANDBY PUMP START		m					INTERNAL	AO	40016	ANALOGUE OUTPUT	15	SCADA -> RTU	
0235	0	LI-6	LEVEL SETPOINT	STANDBY PUMP STOP		m					INTERNAL	AO	40017	ANALOGUE OUTPUT	16	SCADA -> RTU	
0236	0	LI-7	LEVEL SETPOINT	STORM PUMP START		m					INTERNAL	AO	40018	ANALOGUE OUTPUT	17	SCADA -> RTU	
0237	0	LI-8	LEVEL SETPOINT	STORM PUMP STOP		m					INTERNAL	AO	40019	ANALOGUE OUTPUT	18	SCADA -> RTU	
0238	0		TIMER SETPOINT	BACKFLUSH		s					INTERNAL	AO	40020	ANALOGUE OUTPUT	19	SCADA -> RTU	

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Supply and install Remote Terminal Unit (RTU) based control panels for the pumping system, and building monitoring.

.2 RTU to utilize a Programmable Logic Controller (PLC) for control and monitoring with a RTU interface card for connection to the City's SCADA system

.3 The RTU system shall consist of control panels, PLC processor, RTU interface card, I/O hardware, terminal blocks and Ethernet network.

.4 PLC controllers, Input/Output (I/O) sub-systems, and operator interface terminals shall be housed in central control panels in each of the respective areas. General requirements for the control panels are defined in Section 29 10 01 – Enclosures.

.5 Coordinate and cooperate with other Contractors, suppliers, and the City's Representatives during system programming, start-up and commissioning of the complete control system and associated field devices and wiring.

.6 Provide complete PLC, RTU and operator graphic interface programming, start-up and commissioning.

.7 Cell modem.

.8 PSTN modem.

1.2 SUBMITTALS

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

.2 Submit product data sheets.

.3 Submit PLC/DNP mapping list.

.4 Submit Operator Graphic Interface (OGI) screens.

.5 Submit variable naming.

1.3 CLOSEOUT SUBMITTALS

.1 Submit O&M Manuals in accordance with 01 78 00 – Closeout Submittals.

.2 Include the following:

- .1 Product datasheets.
- .2 DNP mapping list.
- .3 PLC/OGI mapping list.
- .4 OGI screen printouts.
- .5 Electronic copy of all programs with complete documentation.

Part 2 Products

2.1 REMOTE TERMINAL UNIT

.1 General

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.1 Wall (or floor with leg kit) mounted NEMA twelve (12) enclosure.

.2 Cable entry via top and bottom.

.3 Terminate all field wiring on terminal blocks in RTU control panels.

.4 Provide fused terminal blocks for all field power sourced from the control panel.

.5 All spare I/O shall be wired to field terminal blocks.

.6 Provide LED light fixture inside panel c/w door open switch.

.7 Provide 120VAC receptacle on panel interior and door mounted.

.8 Provide ZipPort interface with RJ45 connector and USB.

.9 Provide folding shelf on panel door.

.2 Power Supply

.1 Panel shall contain redundant 24VDC power supplies complete with 24VDC UPS.

.2 Panel shall accept a single 120VAC, 15 amp circuit.

2.2 PROGRAMMABLE LOGIC CONTROLLER

.1 General

.1 PLC equipment shall be based on the Schneider M580 hardware platform.

.2 Provide all necessary racks, power supplies, cables, communication cards and accessories to provide a complete and functioning system.

.3 Communication protocol for the PLC processor network to be MBTCP.

.4 I/O signal voltage to be based on the following:

.1 Digital inputs and outputs: 24 VDC.

.2 Analog inputs and outputs: 4 to 20 mA, 24 VDC.

.2 PLC Rack

.1 X-bus and dual Ethernet.

.2 8 slot.

.3 Rack extender kit.

.3 PLC Power Supply

.1 Source: 24 VDC.

.2 Power output: 32 W.

.4 PLC Processor

.1 BME P58 4040.

.5 Discrete Input Card

.1 24 VDC.

.2 16 channel.

.3 BMX DAI 1602.

.6 Discrete Output Card

.1 24 VDC relay.

□

.2 16 channel.

.3 BMX DAI 1602.

.7 Analogue Input Card

.1 4-20 mA.

.2 8 channel, non-isolated.

.3 BMX AMI 0800.

.8 Analogue Output Card

.1 4-20 mA.

.2 8 channel, non-isolated.

.3 BMX AMO 0802.

.9 RTU Interface Card

.1 DNP communication.

.2 BMX NOR 0200H.

.3 Complete with 128 MB SD card.

2.3 PROGRAMMING

.1 Utilize Function Block programming language.

.2 Document all programming logic.

.3 Alarming functions to be generated in the PLC program and not the OGI.

.4 Communicate all station alarms/monitoring via DNP3 and integrate into the City of Winnipeg SCADA system for monitoring at 360 McPhillips.

.5 Provide the RTU programs and the operator interface program to the City after the completion of the commissioning.

Part 3 Execution

3.1 INSTALLATION

.1 Install the hardware in accordance with the foregoing requirements to satisfy the performance requirements defined in this and other divisions of the Specification.

.2 Cooperate with other contractors, suppliers, the City and the Contract Administrator to commission and start-up the system as defined herein.

3.2 FACTORY ACCEPTANCE TESTING

.1 Install the complete PLC and OGI programs and conduct loop testing all inputs and outputs.

3.3 STARTUP TESTING

.1 Provide testing protocol procedures for acceptance by the Contract Administrator ten (10) days prior to startup.

.2 Perform complete loop testing from field device to PLC inputs and outputs.

□

.3 Confirm DNP mapping is correct and the City SCADA system is receiving and transmitting the correct information.

.4 Simulate all alarm conditions.

3.4 TRAINING

.1 Provide a minimum of two (2) training sessions for City personnel, each two (2) hours in length and held on separate days.

.2 Training shall include:

.1 Operation of the pump station in manual mode and auto mode.

.2 Acknowledging alarms.

.3 Pump duty selection.

.4 Operating and alarm set-point changes.

.5 Overview of the PLC program logic.

END OF SECTION

□

Part 1 General

1.1 REFERENCES – GENERAL

.1 The Work includes the provision of all instrument specification sheets.

.2 Refer to Section 29 05 00 – Common Work – Instrumentation and Control.

1.2 SUBMITTALS

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

.2 Provide datasheets to itemize detailed as-built information regarding the Specification of instruments included as part of this Work for each instrument supplied. The datasheets already included in this section list specific minimum requirements for particular applications.

.3 Use forms in accordance with the ISA Standard S20 as a template for the preparation of the Specification sheets.

Part 2 Products

2.1 GENERAL

.1 Refer to the following Specification sheets.

INSTRUMENT SPECIFICATION NUMBER:	**I-101**
DEVICE:	Flow Meter
TAG:	Refer to Instrument Index, Section 29 40 21 – Instrumentation index
TYPE:	Magnetic Flow Meter
SERVICE:	Waste Water
SIZE AND MATERIAL:	Size as per P&IDs
END CONNECTIONS:	Flanged
LINER MATERIAL:	PFA
ELECTRODES:	Stainless Steel
GROUNDING:	Stainless Steel grounding rings
RANGE:	Refer to Instrument Index, Section 29 40 21 – Instrumentation index
INACCURACY:	±0.2% for flows greater than 0.3 m per second
OUTPUT:	4 to 20 mADC into 500 ohm load Scaled pulse output
POWER SUPPLY:	24 VDC
INDICATION:	Local indication of flow rate and totalized flow
ELECTRONIC ENCLOSURE:	NEMA 4X. Remote wall-mount transmitter.
MANUFACTURER AND MODEL:	Siemens Sitrans MAG 5100 W

INSTRUMENT SPECIFICATION NUMBER:	**I-102**
DEVICE:	Temperature
TAG:	Refer to Instrument Index, Section 29 40 21 – Instrumentation index
SERVICE:	Space temperature
SPAN:	**-**10 to 40 degrees C
SENSOR:	3 wire RTD, PT 100
INACCURACY:	±0.1% of span
OUTPUT:	4 to 20 mA DC into 500 OHM
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	Stainless steel wetted parts
ELECTRONIC ENCLOSURE:	Universal head, aluminum alloy
LOCAL DISPLAY:	Head mounted LCD Display
ACCESSORIES:	Mounting bracket
MANUFACTURER AND MODEL:	Siemens Sitrans TF

INSTRUMENT SPECIFICATION NUMBER:	**I-103**
DEVICE:	Magnetic Door Contact
TAG:	Refer to Instrument Index, Section 29 40 21 – Instrumentation index
SERVICE:	Door position monitoring
SENSOR:	Reed Switch
OUTPUT:	N.O. Contacts, rated 0.5 A, 30 VDC
MOUNTING:	Recessed into door frame
CONSTRUCTION:	Designed for use in Steel Doors
MANUFACTURER AND MODEL:	GE Interlogix

INSTRUMENT SPECIFICATION NUMBER:	**I-104**
DEVICE:	Switch Lock
TAG:	Refer to Instrument Index, Section 29 40 21 – Instrumentation index
SERVICE:	Alarm On/Off
OUTPUT:	Rated 7A at 125/250 VAC
POSITIONS:	Two maintained positions, key removable in both
MOUNTING:	Mount in Allen Bradley 800T enclosure
ACCESSORIES:	Complete with two LED indicator lamps, Green = alarm ON, Red = alarm Off
MANUFACTURER AND MODEL:	Medeco lock tumbler set

INSTRUMENT SPECIFICATION NUMBER:	**I-105**
DEVICE:	Level Transmitter (Pressure measurement based)
TAG:	Refer to Instrument Index, Section 29 40 21 – Instrumentation index
SERVICE:	Wastewater
PROCESS CONNECTIONS:	75 mm flange
RANGE:	Refer to Instrument Index, Section 29 40 21 – Instrumentation index
INACCURACY:	±1% of span or lower
OUTPUT:	4 to 20 mA DC into 500 OHM load
POWER SUPPLY:	Loop powered 24 VDC
CONSTRUCTION:	316 SST
ELECTRONIC ENCLOSURE:	EEMAC/NEMA 4X
LOCAL DISPLAY:	Unit mounted LCD Display
MANUFACTURER AND MODEL:	Siemens Sitrans P DS III

END OF SECTION

Part 1 General

1.1 OVERVIEW

.1 The contractor shall provide complete PLC and Operator Graphic Interface (OGI) programming, testing, commissioning, training and warranty support services for the pumping station.

.2 Contractor shall supply all software, hardware, and labour to provide a fully functional and commissioned control system.

.3 The pump station design is a separate wet well and dry well arrangement.

.4 Wastewater enters the wet well via two (2) influent pipes from the exterior of the building.

.5 The drywell contains three (3) wastewater pumps, one (1) storm pump, manual control valves, and instrumentation.

1.2 GENERAL REQUIREMENTS

.1 The control system for the pumping station shall consist of Programmable Logic Controllers (PLCs), Operator Graphic Interfaces (OGIs), Remote Terminal Unit (RTU) interface card, City operated Clearview SCADA system, and modem.

.2 Discrete input signals shall be processed using “de-bounce” logic.

.3 The PLC I/O list shall contain at a minimum the list contained in Section 29 40 11- RTU I-O Index.

.4 The instrumentation list shall be as per P&ID drawing P-05 and Section 29 40 21 - Instrumentation Index.

.5 PLC control logic shall be developed using function block programming language and custom function blocks.

1.3 SUBMITTALS

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

.2 Submit proposed OGI graphic screen layouts and variable declarations.

.3 Submit proposed DNP3 mapping list.

.4 Submit proposed PLC/OGI mapping list

.5 Submit proposed PLC function blocks logic.

1.4 WASTEWATER PUMP CONTROL

.1 The pump control configuration shall operate as Lead/Lag/Standby. A maximum of two (2) wastewater pumps shall operate at a time.

.2 The Lead/Lag/Standby Pump designations shall cycle through the three (3) wastewater pumps after each start/stop cycle.

.3 The Lead/Lag/Standby Pump designations shall only select in-service, non-faulted available pumps in “Local Automatic” mode.

□

.4 Start/stop pump control shall be based on the wet well level as measured by level/pressure transmitters PIT-L111 and PIT-L112.

.5 Pump Control Level Setpoints:

.1 Start Lead Pump: 2200 mm

.2 Start Lag Pump: 2300 mm

.3 Stop Lead Pump: 1400 mm

.4 Stop Lag Pump: 1500mm

.5 Level control setpoints shall be adjustable from the OGI and the City SCADA system. Final settings determined by the Contract Administrator during commissioning.

.6 Pumps are operated by Variable Frequency Drives (VFDs) programmed to run at a fixed speed. Ramp up/down time shall be set at ten (10) seconds and adjusted during commissioning

.7 Local Manual and Local Automatic Operation

.1 Local Manual Mode:

.1 Start when Hand-Off-Auto selector switch in “Hand” mode.

.2 Stop when:

.1 Hand-Off-Auto selector switch changed from “Hand” position.

.2 Emergency Stop pushbutton activated.

.3 Adjust speed via panel mounted potentiometer.

.2 Local Automatic Mode:

.1 Hand-Off-Auto selector switch in “Auto” mode.

.2 PLC Auto/Manual mode selection in “Auto”.

.3 Start “Lead” pump when the first level setpoint in wet well reached.

.4 Start “Lag” pump when second level setpoint in wet well is reached.

.5 Run at a fixed speed adjustable from the OGI and the City SCADA system. All pumps shall operate at the same speed.

.6 Stop when the low level setpoints in wet well are reached.

.3 Remote Manual Forward Mode:

.1 Hand-Off-Auto selector switch in “Auto” mode.

.2 PLC Auto/Manual mode selection in “Manual”.

.3 Start forward when either the OGI or SCADA system “RUN FWD COMMAND”.

.4 RTU asserts “RUN FWD COMMAND RECEIVED” input.

.5 PLC activates Start Forward PLC output.

.6 Stop when the OGI or SCADA system “STOP COMMAND” signal is activated.

.7 RTU asserts “STOP COMMAND RECEIVED” input.

.8 Speed adjusted from either OGI or City SCADA system.

□

.4 Remote Manual Reverse Mode:

.1 Hand-Off-Auto selector switch in “Auto” mode.

.2 PLC Auto/Manual mode selection in “Manual”.

.3 Start reverse when either the OGI or SCADA system “RUN REV COMMAND”.

.4 RTU asserts “RUN REV COMMAND RECEIVED” input.

.5 PLC activates Start Reverse PLC output.

.6 Stop when the OGI or SCADA system “STOP COMMAND” signal is activated.

.7 RTU asserts “STOP COMMAND RECEIVED” input.

.8 Speed adjusted from either OGI or SCADA system.

.8 Pump Available

.1 Pump “Available” shall be determined by:

.1 Pump “Failed to Start” alarm not present.

.2 Pump “Low Flow” alarm not present.

.3 Pump VFD alarm not present.

.4 Pump in “Local Automatic” mode.

.5 Emergency Stop push button not pressed.

.6 Pump motor starter breaker on.

.9 Pump In-Service

.1 Pump “In Service” shall be determined by the SCADA system using the DNP3 communication to the pump station PLC and operate as follows:

.1 Out of Service - SCADA will send an “Out of Service” signal to the NOR card and the PLC will need to put the pump out of service. The PLC will also need to control a digital input “In Service Status” status signal to OFF that will signify that the pump is out of Service. Then the PLC will need to change the status of “Out of Service” signal from state 1 to 0.

.2 In Service - When the pump needs to be back in service, SCADA will send another signal “In Service” to the NOR card and then the PLC will need to put the pump back in service. The PLC will also need to control a digital input “In Service Status” status signal to ON that will signify that the pump is back in Service. Then the PLC will need to change the status of “In Service” signal from state 1 to 0.

.10 Level Control in Precision Digital Level Control Mode

.1 Signal from SCADA to PLC to switch pump control from the PLC to the precision digital controller when maintenance is performed or defaults over in a PLC failure.

.11 Pump Backflush Cycle

.1 The pump backflush cycle will be programmed as follows:

.1 The operator will set the desired backflush time by adjusting the backflush cycle timer on the OGI or SCADA system.

□

.2 The operator will then press the “Backflush Cycle Initiate” button and the pump will go through the following sequence:

.1 The pump is requested “out-of-service”.

.2 The pump is commanded to run in reverse for the amount of time as indicated by the backflush timer.

.3 The pump is commanded to stop.

.4 The pump is requested back “in-service”.

.3 During this sequence the “Backflush Cycle Initiate” button should be greyed out and the OGI or SCADA should indicate that the cycle is taking place. Following the cycle the “Backflush Cycle Initiate” button should be made available.

.12 Level Control in Precision Digital Level Control Mode

.1 Signal from SCADA to PLC to switch pump control from the PLC to the precision digital controller when maintenance is performed or defaults over in a PLC failure.

1.5 STORM PUMP CONTROL

.1 The storm pump shall be the only pump operating at a time.

.2 Start/stop pump control shall be based on the wet well level as measured by level/pressure transmitters PIT-L111 and PIT-L112.

.3 Pump Control Level Setpoints:

.1 Start Storm Pump: 2500 mm

.2 Stop Storm Pump: 1800 mm

.3 Level control setpoints shall be adjustable and final settings determined by the Contract Administrator during commissioning.

.4 Pump is operated by a natural gas engine programmed to run at a fixed speed.

.5 OGI Manual and Local Automatic Operation

.1 OGI Manual Mode:

.1 Hand-Off-Auto selector in OGI in “Hand” mode.

.2 Stop when:

.1 “Off” button pressed.

.2 Local Automatic Mode:

.1 Hand-Off-Auto selector in OGI in “Auto” mode.

.2 Start pump when the level setpoint in wet well reached.

.3 Stop when the low level setpoint in wet well reached.

.3 Remote Manual Mode:

.1 Hand-Off-Auto selector switch in OGI in “Auto” mode.

.2 PLC Auto/Manual mode selection in “Manual”.

.3 Start when either the OGI or SCADA system “RUN COMMAND”.

.4 RTU asserts “RUN COMMAND RECEIVED” input.

.5 PLC activates Start PLC output.

.6 Stop when the OGI or SCADA system “STOP COMMAND” signal is activated.

.7 RTU asserts “STOP COMMAND RECEIVED” input.

.6 Pump Available

.1 Pump “Available” shall be determined by:

.1 Pump “Failed to Start” alarm not present.

.2 Pump “Low Flow” alarm not present.

.3 Pump in “Local Automatic” mode.

.4 “Gas Engine Ready”.

.7 Pump In-Service

.1 Pump “In Service” shall be determined by the SCADA system using the DNP3 communication to the pump station PLC and operate as follows:

.1 Out of Service - SCADA will send an “Out of Service” signal to the NOR card and the PLC will need to put the pump out of service. The PLC will also need to control a digital input “In Service Status” status signal to OFF that will signify that the pump is out of Service. Then the PLC will need to change the status of “Out of Service” signal from state 1 to 0.

.2 In Service - When the pump needs to be back in service, SCADA will send another signal “In Service” to the NOR card and then the PLC will need to put the pump back in service. The PLC will also need to control a digital input “In Service Status” status signal to ON that will signify that the pump is back in Service. Then the PLC will need to change the status of “In Service” signal from state 1 to 0.

1.6 ALARMS

.1 The following alarm signals shall be programmed:

.1 Pump fail to start: PLC pump start forward or start reverse active for five (5) seconds without VFD running status activated.

.2 Pump VFD fault.

.3 Pump low flow: Pump running in “Local Automatic” mode and flow less than eighty percent (80%) for one pump running and less than fifty percent (50%) when two pumps running.

.4 Seal water fail.

.5 Gas engine fail.

.6 Gas engine battery fault.

.7 Gas engine charger fault.

.8 Gas detector fault.

.9 Gas detector CO level high.

.10 Gas detector CH4 level high.

.11 Gas detector CH4 level high high.

.12 No pumps in “Local Automatic Mode”.

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.13 Only one pump in “Local Automatic Mode”.

.14 Wet well high level warning.

.15 Wet well high level.

.16 Level transmitter variance: level transmitter signals differ by more than fifteen percent (15%) of full range.

.17 Flow transmitter fault.

.18 Room low temperature.

.19 Room high temperature.

.20 Dry well room flood.

.21 UPS power fail.

.22 24VDC power fail.

.23 120VAC power fail.

.24 600VAC power. Fail.

.25 HVAC fail.

.2 Additional alarm signals shall be added during commissioning as identified by the Contract Administrator.

.3 All alarm logic shall be programmed in the PLC, not the OGI.

.4 Alarms shall be latched.

.5 Alarm reset shall be available on the OGI and the SCADA system and operate as follows:

.1 To reset alarms from SCADA two DNP3 Digital output (Reset On and Reset Off) and one Digital Input (Reset Status) are needed:

.1 Reset On - SCADA will send a “Reset On” signal to the NOR card and the PLC will need to activate the reset. The PLC will also need to control a digital input “Reset Status” status signal to ON that will signify that the Reset is activated. Then the PLC will need to change the status of “Reset On” signal from state 1 to 0.

.2 Reset Off- SCADA will send another signal “Reset Off” to the NOR card and then PLC will need to deactivate the reset. The PLC will also need to control a digital input “Reset Status” status signal to OFF that will signify that the reset is deactivated. Then PLC will need to change the status of “Reset Off” signal from state 1 to 0.

1.7 LEVEL MONITORING

.1 The level in the wet well is measure by level/pressure transmitters PIT-L111 and PIT-L112.

.2 The measured wet well level shall be determined by the following modes:

.1 The average of PIT-L111 and PIT-L112.

.2 PIT-L111.

.3 PIT-L112.

.3 The three (3) level measuring modes shall be selectable via the OGI and the SCADA system using “SELECT AVERAGE, SELECT LIT-L111, or SELECT LIT-112” commands.

1.8 HVAC SYSTEM INTERLOCKS

.1 The HVAC system shall be run at one hundred percent (100%) upon the following scenarios:

.1 Station occupancy as determined by the main floor light switch L71-2.

.2 CO levels detected above 100ppm.

.3 CH4 levels detected above ten percent (10%) LEL.

1.9 OPERATOR GRAPHIC INTERFACE

.1 Standards:

.1 Pump running: red

.2 Pump stopped: green

.3 Pump alarm: amber

.2 Display of all instrumentation signals.

.3 Process flow diagram graphic screen.

.4 Setpoint adjustment graphic screen.

.5 Instrumentation calibration graphic screen.

.6 Active alarm banner.

.7 Historical alarm screen.

.8 Individual trend screens for all instrumentation and pump running signals. Trends shall be configurable to have multiple pens.

1.10 CITY SCADA INTERFACE

.1 Provide DNP mapping for integration into the City’s SCADA system.

.2 DNP mapping list shall match the OGI/PLC mapping list.

.3 Duplicate all functionality available on the Local OGI for the SCADA system.

.4 SCADA system configuration by the City.

.5 DNP mapping shall include all PLC I/O points and alarm conditions.

.6 DNP mapping shall include the status of the emergency stop pushbuttons.

.7 DNP mapping shall include the pump start and stop level setpoints.

.8 DNP mapping shall include pump VFD speed setpoints.

.9 All DNP3 Out points need to be mapped to DNP3 Inputs points (while keeping the DNP3 Out points) in the DNP3 mapping list so Output Status can be monitored on SCADA.

Part 2 Testing

2.1 FACTORY ACCEPTANCE TESTING

.1 Factory acceptance testing (FAT) shall be conducted off site at the control manufacturing facility in Winnipeg, Manitoba.

.2 Notify Contract Administrator two (2) days prior to testing.

.3 Witnessing of FAT shall be available to the Contract Administrator and City personnel.

.4 FAT shall include:

.1 Testing of Ethernet network.

.2 Testing of all alarm conditions.

.3 Testing of pump control logic.

.4 Confirmation of OGI graphics.

.5 Confirmation of instrumentation trending.

.6 Testing and confirmation of the DNP3 mapping to the City's Clearview SCADA system.

.7 Testing of both cellular and telephone communications to City's Clearview SCADA system.

2.2 SITE ACCEPTANCE TESTING

.1 Notification of the start site acceptance testing shall be provided to the Contract Administrator two (2) days prior to testing.

.2 Site acceptance testing shall be conducted prior to commissioning.

.3 Confirm measure and display of correct field instrumentation reading.

.4 Testing of all control logic and alarm conditions.

.5 Force input signals to generate alarm conditions and verify correct PLC logic.

.6 Confirmation of connection to the City SCADA system and verification of instrumentation readings and DNP mapping index.

.1 Functional testing to be completed with City SCADA staff.

.7 Document all testing procedures and results. Submit documentation to the Contract administrator two (2) days prior to commissioning.

2.3 COMMISSIONING

.1 Submit commissioning plan to the Contract Administrator five (5) days prior to proposed start date.

.2 Commissioning plan to include at a minimum:

.1 Contractor staff contact list.

.2 Emergency conditions and response plan.

.3 Detailed schedule of activities including start/stop times and dates for each activity.

.4 Support required from Contract Administrator and City personnel.

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.5 Additional actions as identified by the Contract Administrator.

.3 Control logic shall be modified at the request of the Contract Administrator to achieve desired operation of the pump station.

.4 Commissioning shall be considered complete after facility operation without alarm conditions for a period of seven (7) consecutive days.

.5 Substantial Performance will not be granted until after successful completion of the commissioning and training.

Part 3 Project Closeout

3.1 TRAINING

.1 Training of City personnel shall be performed during and after the seven day (7) commissioning period.

.2 The Contractor shall provide a minimum of three (3) two (2) hour training sessions, each on a separate day.

.3 Training schedule shall be provided to the Contract Administrator three (3) days prior to training sessions.

3.2 WARRANTY SUPPORT

.1 The Contractor shall provide onsite technical support for the facility's control system for one (1) year after Total Performance.

.2 Support personnel shall be available within 24 hours of notification by the Contract Administrator or City.

3.3 DOCUMENTATION

.1 All PLC and OGI programming shall be fully documented to the satisfaction of the Contract Administrator and City personnel.

.2 PLC and OGI programs shall be provided to the Contract Administrator at successful completion of commissioning on USB memory sticks

END OF SECTION

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PART 1 General

1.1 SECTION INCLUDES

.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).
.2 CSA-A3001, Cementitious Materials for Use in Concrete.
.3 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.

.3 Fine grained soils with plasticity index less than ten (10) when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136.

.4 Coarse grained soils containing more than twenty percent (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.

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:

.1 Suitable site sub-base material will be of a type approved by the Contract Administrator.

.2 Clay borrow sub-base material will be of a type approved by the Contract Administrator.

.3 Crushed sub-base material will be crushed aggregate, crushed limestone or crushed concrete pavement.

.2 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**	**150 mm 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 300 mm

.3 150 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than forty percent (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.

.4 50 mm crushed limestone material when subjected to the abrasion test will have a loss of not more than forty percent (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.

.5 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 eight-five percent (85%) recycled Portland Cement concrete

.2 maximum of fifteen percent (15%) recycled asphaltic concrete

.3 maximum of three percent (3%) clay

.4 maximum of one percent (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

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 thirty-five percent (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 twenty-five (25) and a plasticity index not greater than six (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 thirty-five percent (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 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.

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 mm, unless otherwise indicated in the Specifications.

.2 Remove existing asphalt pavement including curbs at locations as show on the Drawings or as directed by the Contract Administrator. Remove pavement to a maximum thickness of 150 mm, 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 other 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 materials 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 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 ninety-five percent (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 three (3) times the maximum aggregate size or as directed by the Contract Administrator. Compact to a minimum of one hundred percent (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 Re-compact 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 favorably 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).

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 one hundred percent (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 ninety percent (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 2.1 of this Specification.

.3 Compact to a minimum of ninety percent (90%) Standard Proctor Density.

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 ninety percent (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

.2 Excavation limits.

3.11 BACKFILLING

.1 Vibratory compaction equipment is required.

.2 Do not proceed with backfilling operations until completion of the 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 form work.

.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.

.6 Compact each layer before placing succeeding layer.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within forty-eight (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.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies requirements for the supply of all materials, labour, process and equipment for the installation, testing and putting into satisfactory operation of all pumping station piping, fittings and appurtenances as shown on the Drawings. Connections to all equipment are included.

.2 This section also describes the supply and installation of two (2) Displaced Pressure (DP) Level Measurement System units.

.3 In-line devices are specified under other sections of these Specifications. The physical installation of all these devices in the lines, including the supply of all jointing materials, couplings, etc., unless otherwise noted, is specified under this section.

.4 Process piping is all piping inside structure, above ground, exposed or underground to 0.5 m (1.6 feet) outside of structure.

.5 Pipes 50 mm (2 inches) and less may not be shown on the piping Drawings. Line to be field routed with the approval of the Contract Administrator. The Drawings designate the Site and line service specifications of all pipes, fittings, valves and equipment to be supplied by the Contractor.

1.2 SUBMITTALS

.1 Produce Shop Drawings for Contract Administrator's review, as per Section 01 33 00 – Submittal Procedures. Details to include spool length, welds, unions, flange positions and articulation or expansion joints.

.2 Contractor to produce Pipe Support Drawing for all piping sealed by a Professional Engineer registered in Manitoba. Details to include location, size and type of supports. Pipe supports shown on Drawings are a minimum requirement.

.3 Material Certification:

.1 At least ten (10) business days prior to commencing Work; submit manufacturer's test data and certification that pipe materials meet the requirements of this section. Include manufacturer's drawings, information and Shop Drawings where pertinent.

1.3 CLOSEOUT SUBMITTALS

.1 Maintain operating and maintenance data, including project record documents according to Section 01 78 00 – Closeout Submittals.

1.4 INSTALLATION OF PIPING, JOINTS, ETC.

.1 Install all piping, joints, fittings, valves and other items covered in this section in accordance with the manufacturer's recommendations, except where there is

conflict between the Contract Specifications and the manufacturer's recommendations, in which case the Contract Specifications shall govern.

.2 Submit welding procedures and copies of "Record of Qualifications" for each welder in accordance with ASME Code, Section IX and TSSA to the Contract Administrator. Welders shall be qualified for each separate material group.

.3 Seal all pipe penetrations to the building and substructure/wells. Submit Shop Drawings for approval.

1.5 PIPE LIST

.1 Pipe drawings specify pipe diameters, materials, service and accessories.

.2 Pipe drawings specify valves and inline devices.

.3 Piping drawings indicate routing of pipe and joint connections.

1.6 HANDLING AND STORAGE OF MATERIALS

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

.2 Assume complete responsibility for the safe delivery to the site of all pipe and fittings.

.3 Store pipe and fittings on timber platforms or in a manner approved by the Contract Administrator and protect by weatherproof housings.

.4 Inspect all fabricated material for damage in transit before installation.

.5 Exercise particular care to avoid damage to internal and external coating on pipe and fittings. Repair damaged coating to the satisfaction of the Contract Administrator before installation.

.6 The Contract Administrator reserves the right to reject pipes and fittings that are damaged or defective.

1.7 FABRICATED ITEMS

.1 The Contractor shall assume full responsibility for detailed layout, coordination of system and field measurement for fabricated items.

1.8 PIPE IDENTIFICATION

.1 Follow City of Winnipeg Standards for pipe identification.

Part 2 Products

2.1 PIPES AND FITTINGS

.1 This Specification may include materials that are not required for the specific project.

.2 The Drawings take precedence for dictating piping for specific uses or applications unless otherwise indicated.

.3 The allowable pipe materials are carbon steel, stainless steel and ductile iron as specified below.

2.2 DUCTILE IRON PIPE (DI)

.1 Material: Ductile iron pipes and fittings.

.2 Pipe to be in accordance with the latest edition of ANSI/AWWA C151/A21.51 and CSA B131.13 and fittings to ANSI/AWWA C110/A21.10 with cement lining.

.3 Cement lining: All pipes and fittings to have cement lining to ANSI/AWWA C104/A21.4 latest edition.

.4 Pipe class: Class 52 unless higher class is specified elsewhere.

.5 Pressure temperature rating: 1050 kPa at 40 degrees Celsius.

.6 Joints:

.1 Indoors use all flanged 150 lb connections and victaulic couplings.

.2 Maintenance and connection to other pipe classes: flange adaptors or victaulic coupling.

.3 Adaptor flanges: Ductile Iron, Grade 65-45-12, conforming to the current ASTM Standard A536 for Ductile Iron Casting. Bolt holes shall be drilled in accordance with AWWA C1115 or ASME B16.1.

.4 Clamping screws on adaptor flanges shall be zinc-plated, heat treated steel with a minimum tensile strength of 28 MPa.

.7 Bolting: to ANSI/AWWA C207 (ASTM A 307 Grade B, ANSI B18.2.1) latest edition for diameters 150 mm and larger or ASTM A193-B7 for smaller diameters. Corresponding nuts to be ASTM A 194/A 194M - Grade 2.

.8 Gaskets:

.1 Garlock 7797, or approved equal in accordance with B7.

.9 Painting:

.1 In accordance with Section 09 91 00 – Painting and Protective Coatings.

2.3 CARBON STEEL PIPE (CS)

.1 Manufacture fabricated seamless steel pipe to AWWA C200 for diameters 150 mm and larger or ASTM A-106, Grade B, PE for diameters less than 150 mm.

.2 Design pressure, 1,050 kPa.

.3 Temperature range: 1 degrees C to 30 degrees Celsius.

.4 Minimum wall thicknesses for pipe and fittings:

- .1 50 mm and smaller: Schedule 40.
- .2 75 mm to 200 mm: 2 mm.

.5 Fittings: to AWWA C208 or ASTM 234.

.6 Protective coatings to pipe and fittings:

- .1 Interior lining: to AWWA C210.
- .2 Exterior coatings: in accordance with Section 09 91 00 – Painting and Protective Coatings.

.7 Flanges: forged steel flanges to AWWA C207, or ASTM A181, Grade I or II, drilled to ANSI B16.1, Class D.

.8 Joints:

- .1 Maintenance: flanged or grooved coupling.
- .2 Normal: welded to AWWA C206.
- .3 Instrument connections: threaded.
- .4 Expansion: Rockwell, Dresser flexible coupling, or Victaulic Flex coupling, or approved equal in accordance with B7.

.9 Bolting: to AWWA C207 (ASTM A307 Grade B, ANSI B18.2.1) for diameters 150 mm and larger or ASTM A193-B7 for smaller diameters.

.10 Gaskets:

- .1 Garlock 7797, or approved equal in accordance with B7.
- .2 Flat-faced flanges to have full face gaskets, raised face flange to have ring gaskets.

2.4 STAINLESS STEEL PIPE (SS)

.1 Material: Type 304 stainless steel pipe and fittings.

.2 Pipe: to ASTM/A778 for diameter larger than 150 mm, and ASTM A 312, PE (plain end) for 150 mm diameter or less. Minimum wall thickness as follows:

- .1 13 mm to 50 mm diameter: Schedule 40.
- .2 75 to 300 mm diameter: Schedule 10.
- .3 350 to 600 mm diameter: 3.18 mm (11 gauge).
- .4 750 to 1,200 mm diameter: 4.76 mm (7 gauge).

.3 Fittings: to ANSI B16.9 or MSS SP-43. Materials to conform to ASTM A 403. Smooth flow elbows shall be used where available from manufacturer. Larger elbows not manufactured in smooth flow type can be five(5)-piece section type.

.4 Joints:

.1 Maintenance: flanged, or groove coupling where necessary for ease of installation, disassembly and maintenance.

.2 Normal: buttweld.

.3 Instrument connections: threaded nipple.

.4 Expansion: flexible stainless steel couplings by Straub Flex 2, or approved equal in accordance with B7.

.5 Fabricate stainless steel pipe systems as completely as possible in the shop to minimize connections by field welding.

.6 Welding materials, methods, operations and inspection shall be in accordance with current Provincial and Federal Regulations for welding of stainless steel. Use automatic welding techniques – Tungsten inert gas or metal inert gas method. Make circumferential welds using metallic arc process.

.7 Use welding rod or wire of the same composition or superior to the pipe and fittings material.

.8 Weld deposit at the seams shall have a slight crown on both sides of the weld. No cracks or crevices shall be allowed.

.9 Remove excessive weld deposits, slag, weld spatter and projections into the interior of the pipe by grinding.

.10 Secure all backing rings on spools to pipe flanges to prevent damage during shipment.

.11 Mark all spool items in the shop with drawing and item numbers. Mark the type of stainless steel used.

.12 Flanges: Mild steel galvanized backing flanges drilled to ANSI B16.5 class 150# for all indoor locations. All other locations shall have 304SS flanges drilled to 150#. All flange connections on stainless steel pipes in tanks shall be 316 stainless steel flanges or 316 stainless Type B stud ends backing flanges with stainless steel bolts and nuts. Stainless steel grooved flanges and couplings installed in Schedule 40 spool pieces are an approved alternate.

.13 Bolting: to latest edition of ANSI/AWWA C207 (ASTM A 307 Grade B, ANSI B18.2.1) for diameters 150 mm and larger or ASTM A 193/A 193M for smaller diameters. Corresponding nuts to be ASTM A 194/A 194M, Grade 2.

.14 Gaskets:

.1 Garlock 7797, or approved equal in accordance with B7.

.15 Fabricated stainless steel pipe to be as supplied by one (1) of the following, or approved equal in accordance with B7:

.1 Douglas Barwick Inc.

.2 The Robert Mitchell Company Ltd.

.3 Atlas Alloys.

.16 Provide reinforcing saddles (re-pad) at all pipe support locations of similar material, tack welded to pipe.

2.5 DISPLACED PRESSURE LEVEL MEASUREMENT SYSTEM

.1 Two (2) new DP Level Measurement System will be installed in the lift station at the pump room level. They will be installed complete with isolation valves, sight glass, flush line, drain line and level transmitter

.1 Sight glass piping and fittings to be Schedule 80 PVC.

.2 Four (4) 50 mm (2 inch) PVC ball valves.

.3 Level Transmitter: Supply and Installation falls under the “Automation Work” line item on the Form B.

.2 Water Supply Connection for DP Level Measurement System

.1 Water supply will be installed at the pump room level to the DP Level Measurement Systems as detailed on the Drawings.

2.6 PVC PIPING AND FITTINGS

.1 Schedule 80 PVC piping and fittings to ASTM D1785 - Standards for PVC Plastic Pipe.

.2 PVC Ball Valves (for use with PVC pipe only): shall have a PVC body conforming to the current ASTM Standard D1784, Standard for PVC Rigid PVC compound; ASTM D1785, Standard for PVC Plastic Pipe; ASTM D2467, Standard for PVC Pipe Fittings (Schedule 80); and shall have an EPDM or Teflon seat, a hand operating lever and integral threaded union joints

.3 PVC Sight Glass Pipe: Transparent PVC pipe, 50 mm (2 in) diameter.

.4 Solvent welded joints: Primer and solvent cement shall conform to the current ASTM.

2.7 DISMANTALING JOINTS

.1 Use Dresser style 131 dismantling joint with tie rods or approved equivalent in accordance with B7.

.2 Materials

.1 Spool Piece; Steel – AISI C1010-C1015.

.2 Flange Adaptor: Steel – AISI C1010-C1015.

.3 Tie Rods: Steel – ASTM A193 Grade B7.

.4 Nuts: ASTM A194 Grade 2H.

.5 Gasket: Grade 27 BUNA S.

.6 Coatings: Fusion Bonded Epoxy.

2.8 FASTENERS

.1 Flange nuts and bolts shall be ASTM A276, TYPE 316 stainless steel sized to requirements of flange. Thread on bolts to extend past nut minimum of 6 mm.

.2 Anchors shall be Kwik-Bolt or Rawl Stud ASTM A276, Type 316 stainless steel. Embedment depth and size, where not shown on the Drawings, to be as required for load being carried or resisted.

2.9 PIPE COUPLINGS

.1 As a general rule, Piping ≥100 mm (4 inch) will be flanged, welded or grooved to provide rigid connections of "ferrous" piping. Smaller piping will be typically welded or have threaded connections. Other piping materials such as the various forms of plastic, non-ferrous metals etc. will be joined as recommended by the manufacturer and/or to suit project conditions as required by codes or good trade practice.

.2 Drawings will show where joints are required for serviceability. These will be required as a minimum. The Contractor will be allowed some flexibility on the type of material to be used, additional joints will be as required to suit the material e.g. welded steel piping vs. flanged ductile iron.

.3 Notwithstanding the previous comment, provide joints which may be disassembled within 1.0 m (3.3 feet) of any connection to equipment, on both sides of structural penetrations and within 0.6 m (2 feet) of all threaded end valves.

.4 Where noted on the Drawings to allow for serviceability or flexibility, the Contractor shall supply and install "Victaulic" or Smith-Blair flange adapter couplings. The Victaulic couplings shall be Style 31 (or as indicated) for grooved end fitting. Smith-Blair flange adapters shall be Type 912 up to 300 mm (12 inch) and 913 for pipes greater than 300 mm (12 inch). Type 913 shall be hot dipped galvanized.

.5 Do not use slip-on flanges that are attached to a pipe by means of set screws and gaskets (Uni-flange, etc.) except as approved by the Contract Administrator. They may be considered within a restrained run of pipe or where connections are made to existing pipe where there may be no other means to make the connection and as long as the joint can be restrained in other ways.

.6 Provide for other methods of connection to external pipes as detailed on the Drawings or as directed by the Contract Administrator.

2.10 CONCRETE

.1 Concrete for anchor blocks, thrust block and other pipe supports: to be Class I.

2.11 FITTINGS

.1 Fittings for piping systems to be compatible for the piping material and service.

.2 Provide fittings with a wall thickness equal to or greater than the pipe.

.3 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise. Provide concentric reducers in vertical lines unless indicated otherwise.

.4 Provide long radius elbows unless otherwise shown. Provide smooth flow carbon steel, ductile iron or stainless steel elbows 350 mm (14 inch) and less. Provide mitred elbows greater than 350 mm (14 inch) unless otherwise shown or specified.

2.12 EXPANSION JOINTS

.1 Design and fabricate expansion joints in accordance with EJMA standards.

.2 Provide expansion joints as shown and unless otherwise shown provide elastomer spool type expansion joints.

.3 Ensure corrugated type expansion joints are capable of a minimum ten thousand (10,000) pressure, temperature and deflection cycles, not concurrent.

.4 For metal expansion joints of the metal bellows type, in systems handling gases, air, water or other liquids, provide liners to produce a smooth flow path, reduce vibration and reduce noise through the expansion joint.

.5 Provide sufficient bends and expansion joints to allow for thermal movement of piping from 0 degrees Celsius to maximum service temperature.

.6 Provide factory pre-compressed expansion joints where required to suit installation temperature.

2.13 TAPPING FOR PRESSURE GAUGES OR INSTRUMENTS

.1 Provide 12 mm (0.5 inch) diameter stainless steel tapping with stainless steel ball valve for temporary pressure gauge connections on discharge side of pumps where specified.

.2 Provide a tapping as described above compatible with pipe material for instrument connections or sampling points where shown complete with local isolation ball valve.

Part 3 Execution

3.1 GENERAL PIPE INSTALLATION AND LAYOUT

.1 Contractor must verify all dimensions and new equipment locations in the field prior to the start of Work. Install all piping and appurtenances to the dimensions indicated on the Drawings, square, straight, plumb and level.

.2 Carefully position pipe and fittings without strain or deflection and using proper appliances.

.3 Be aware of and contend with the wastewater in the existing forcemains when preparing to make the required piping modifications.

.4 Make due allowance for dimensional variation of equipment. Bring any dimensional discrepancies to the Contract Administrator's attention.

.5 The detailed layout of the piping, etc. is the responsibility of the Contractor. If required by the Contract Administrator, produce field drawings to show relative positions of various services, and receive Contract Administrator's approval before the Work is started.

.6 Clear all foreign matter from inside piping and dispose of in accordance with proper environmental procedures.

.7 For pressure piping 75 mm (3 inch) diameter and under, the Contractor may, subject to the Contract Administrator's prior approval, deviate locally from the layout indicated on the Drawings to suit local conditions and preserve proper headroom of 2.1 m (6.9 feet) minimum under all exposed pipes, unless otherwise noted.

.8 Where piping is not shown or is shown diagrammatically, install the pipes neatly to suit the structure, subject to the Contract Administrator's prior approval.

.9 Bolt piping to equipment before grouting piping into walls.

.10 Before commencing installation, determine specific piping support and thrust restraint requirements to suit the materials of construction, the piping materials and the operating conditions. Prepare and submit a detailed schedule of piping supports for the Contract Administrator's review.

.11 Make adequate provision in piping and pipe support systems for expansion, contraction, slope, and anchorage.

.12 Install expansion joints where shown and at other locations as necessary to allow piping expansion and contraction.

3.2 PIPE CONNECTIONS TO EQUIPMENT, TANKS, ETC.

.1 The Contractor shall fully inform himself of the installation requirements and dimensions of equipment required to be connected to piping. Where piping is to tie into equipment, preliminary dimensions have been shown and are not guaranteed.

.2 Any change in such dimensions shall not relieve the Contractor of his responsibility to make the piping fit the equipment.

.3 Any fitting shown on the Drawings by a consistent symbol, but not described or scheduled, shall be incorporated into the work by the Contractor, who shall first determine from the Contract Administrator the requirements for such fitting.

.4 All connection fittings to tanks, equipment, etc. shall be such that the fittings may be easily removed from and replaced in the lines, or lines easily disconnected from equipment or tanks for maintenance purposes.

.5 Make connections compatible with that specified or shown on the Drawings for fittings, tanks or equipment, etc. or for intended service.

.6 In the event that the type of connection is not indicated on the Drawings or in the Specifications, use an approved flange, union or coupling.

.7 Unless otherwise shown or specified, install gauge taps on the suction and discharge of all pumps, fans, blowers, compressors and vacuum pumps. Attach gauge taps with a threaded nipple and valve to the pipeline, duct or equipment.

3.3 PIPE SUPPORTS, ANCHORS AND GUIDES

.1 Adequately support all piping, fittings and valves either from the floor on concrete piers or approved supports or from above with approved hangers.

.2 Design and place supports so that no weight will be taken directly on the equipment sleeve coupling or sleeves through walls, and will be satisfactory for the service intended.

.3 Provide supports for thrust forces as indicated on Drawing P-03.

.4 Adequately brace pipes and fittings cast into concrete floors, walls, etc. at each joint, to resist all buoyant or lateral forces imposed on the piping during concrete pours. Replace any piping or fittings found to yield from their intended position.

.5 Attach hangers to steelwork with approved clamps or welded tabs. Submit the proposed method of attaching pipe hangers to structural steelwork for approval.

.6 Attach hangers to concrete with approved threaded rod sockets cast into the concrete. Cinch anchor sockets may be permitted by the Contract Administrator in light duty service.

.7 Isolate supports and pipes of dissimilar materials using neoprene sheet or other approved material.

.8 Contractor to size and provide reinforcing saddles (re-pad) at all pipe support locations of similar material.

.9 Locate anchors and guides as shown on the Drawings and install elsewhere, as required by the piping systems. Design shall be adequate so that no stress is imposed on equipment and allowable stress in piping is not exceeded. Contractor to provide pipe support drawings for Contract Administrator's review. Details to include location, size and type of supports.

.10 Acceptable manufacturers:

.1 Standon Pipe Supports;

.2 Approved equal in accordance with B7.

3.4 PIPE JOINING

.1 Conform to requirements of ANSI B31 code for pressure piping.

.2 Install straight, parallel and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes.

.3 Install groups of piping parallel to each other, spaced to permit application of insulation, identification, and service access, on trapeze hangers.

.4 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets, i.e., with flat side up.

.5 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.

.6 Install flanged or welded nozzles, branch connections, welding outlets, adapters and taps, true and faced at right angles to the axis of the pipe. Do not extend connection inside of pipe.

.7 Make pipe ends round and true, suitable for weld connection as applicable. Prepare pipe ends in accordance with ANSI B16.25 for butt welding.

.8 Copper pipe and tubing to be free from surface damage. Replace damaged pipe or tubing. Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked.

.9 Ream ends of pipe and tubes before being made up.

.10 Use non-corrosive lubricant or Teflon tape applied to male thread only.

.11 Groove pipe ends, cut square, seating surface clean and free from indent and score marks.

.12 Install dielectric fittings wherever piping of dissimilar metals are joined.

.13 Clean ends of pipes or tubing and recesses of fittings to be brazed or soldered. Assemble joints without binding.

.14 Support piping during construction to prevent abnormal stresses on the pipe works.

.15 Do not weld adjacent to valves when the valve is in place to avoid heat damage to seats.

.16 The Contractor shall fully inform themselves of the installation requirements and dimensions of equipment required to be connected to piping. Where piping is to tie into equipment, preliminary dimensions have been shown and are not guaranteed.

.17 Any change in such dimensions shall not relieve the Contractor of their responsibility to make the piping fit the equipment.

.18 Any fitting shown on the Drawings by a consistent symbol, but not described or scheduled, shall be incorporated into the Work by the Contractor, who shall first determine from the Contract Administrator the requirements for such fitting.

.19 All connection fittings to tanks, equipment, etc. shall be such that the fittings may be easily removed from and replaced in the lines, or lines easily disconnected from equipment or tanks for maintenance purposes.

.20 Make connections compatible with that specified or shown on the Drawings for fittings, tanks or equipment, etc. or for intended service.

.21 In the event that the type of connection is not indicated on the Drawings or in the Specifications, use an approved flange, union or coupling.

3.5 PIPE DRAINAGE

.1 At the low points in piping systems and at other locations indicated on the Drawings, install drains to permit draining any system without breaking a joint.

.2 Drains shall be 25 mm IPS for pipes larger than 50 mm diameter, and 13 mm IPS for pipes 50 mm diameter and under or as shown on Drawings. Terminate drains 150 mm from the pipe in a valve suitable for the particular service and approved by the Contract Administrator. Plug or cap valves on the atmospheric side.

.3 Drain valves shall be accessible from the floor. Run drains to the collection point or provide quick disconnects at easily accessible locations.

3.6 CUTTING OF PIPE

.1 Whenever cutting of pipe is required, cut pipes as recommended by pipe manufacturer.

.2 Method of cutting and cutting equipment to be subject to the approval of the Contract Administrator.

3.7 PAINTING AND PROTECTIVE COATINGS

.1 Painting and protective coatings for pipe shall be in accordance with the foregoing and Section 09 91 00 - Painting and Protective Coatings.

3.8 PIPE INSPECTION AND TESTING

.1 General:

.1 Provide all necessary equipment and perform all work required in connection with the tests.

.2 Bear the cost of all testing, location and remedying of leaks and any necessary retesting and alignment.

.3 All pipes shall be thoroughly flushed prior to pressure testing.

.4 All tests shall be documented on application forms provided by the Contract Administrator.

.2 Testing of pressure piping systems:

.1 Hydrostatically test all plant piping, other than non-pressure piping, in accordance with ANSI B31.1.0 at 1.5 times working pressure.

.2 All liquid and chemical carrying pipes shall be watertight under the test pressure and all suction piping shall be straight.

.3 Leave pipes uncovered in every part of the building until approved by the Contract Administrator.

.4 Should any leak develop in any of the pipes, repair the leaks or replace the defective section at no cost to the City.

.5 Continue repairs and testing until the leakage has been stopped.

.6 Extend each test over a period of at least two hours, unless a short period complies with ANSI B31.1.0.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Specification covers the installation and commissioning of the process valves which have been pre-purchased by the City as specified in Division 01 11 20 – Pre-Selected and Pre-Purchased Equipment.

1.2 REFERENCES

.1 American Water Works Association (AWWA), American National Standards Institute (ANSI) / American society of Mechanical Engineers (ASME).

.2 ASNI/ASME Bl.20.1, Pipe Threads, General Purpose (Inch).

Part 2 Products

2.1 DESCRIPTION

.1 Materials Supplied by City.

.1 Dry Pit Location:

.2 Four (4) 350 mm (14 inch) metal seated rising stem Iron Gate Valves – manually actuated, for the suction side of the pumps.

.3 One (1) 350 mm (14 inch) metal seated rising stem Iron Gate Valves – manually actuated, for the discharge side of the storm pump.

.4 Three (3) 300 mm (12 inch) metal seated rising stem Iron Gate Valves – manually actuated, for the discharge side of the wastewater sewage pumps.

.5 Two (2) 300 mm (12 inch) metal seated rising stem Iron Gate Valves – manually actuated, for the forcemains.

.6 Three (3) 300 mm (12 inch) Check Valves with “hold-open” device – manually actuated, for the discharge side of the wastewater sewage pumps.

.7 One (1) 350 mm (14 inch) Check Valve with “hold-open” device – manually actuated, for the discharge side of the storm pump.

.8 By-Pass Manhole Location:

.9 Two (2) 300 mm (12 inch) rising stem Iron Gate Valves, resilient seated.

.10 Two (2) 250 mm (10 inch) non-rising stem Iron Gate Valves, resilient seated.

Part 3 Execution

3.1 GENERAL

.1 Supply all necessary labour and tools for the complete installation of all valves.

.2 Install all valves in strict accordance with the manufacturer's instructions and as specified.

.3 Install the new station piping and pumping equipment as indicated in this Specification and shown on the Drawings. Make no changes, revisions or substitutions to the layout without obtaining written approval from the Contractor Administrator.

3.2 INSTALLING VALVES

.1 Construct foundations for valves to provide support per industry standards. Temporarily support the equipment as may be required. All temporary supports shall be rigid and so constructed as not to subject the equipment to any undue stresses or cause any damage.

3.3 HANDLING OF VALVES

.1 Do not place chains, cables and ropes through valve ports or attached to operating cylinders or hand wheels. Use slings either around the valve body or with bolts or rods through the flange bolt holes.

.2 Store valves in a cool location clear of moving vehicles or other objects. Dirt and debris shall be prevented from entering the valve internals. Do not rest valves on cylinders, hand wheels or operating shafts.

.3 Cover valves to shield them from dirt and to avoid exposing the seats to sunlight or mercury arc light.

3.4 PAINTING AND PROTECTIVE COATINGS

.1 Painting and protective coatings for valves shall be in accordance with the foregoing and Section 09 91 00 – Painting and Protective Coatings.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies the installation and commissioning of three (3) 220 L/s centrifugal vertical shaft pumps (wastewater sewage pumps) and one (1) 340 L/s centrifugal vertical shaft pump (storm pump). The pumps shall be supplied by the City.

.2 The pumps must be installed and commissioned prior to March 1, 2021.

.3 Pumping equipment shall include motors, extended drive shafts, anchor bolts, base plates, supporting frame, and all appurtenances required for an operating system.

.4 Coordinate with Division 26 - Electrical.

.5 In case of damage to pumps or pumping equipment, the Contractor shall repair or replace the damaged equipment, as directed by the Contract Administrator at the Contractors cost.

1.2 SUBMITTALS

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

Part 2 Products

2.1 CENTRIFUGAL PUMPS

.1 The pumps are supplied by the City and issued for the Contractor:

- .1 Install and commission three (3) centrifugal vertical shaft pumps (wastewater sewage pumps) as detailed in this specification.
- .2 The wastewater sewage pumps shall be installed complete with:
  - .1 Motor.
  - .2 Base (four (4) legged).
  - .3 Flanged suction and discharge piping connections.
  - .4 Extended drive shafts and guards.
  - .5 Couplings.
  - .6 Mechanical seals and solenoid valves.
- .3 Install and commission one (1) centrifugal vertical shaft pump (storm pump) as detailed in this Specification.
- .4 The storm pump shall be installed complete with:
  - .1 Base (four (4) legged).
  - .2 Flanged suction and discharge piping connections.
  - .3 Extended drive shafts and guards.
  - .4 Couplings.

.5 Mechanical seals and solenoid valves.

.5 The storm pump will be installed with existing gas engine.

.2 To be supplied by the Contractor:

.1 Pressure Gauge.

.1 Install diaphragm between pressure gauge inlet and wastewater flow.

.2 Add liquid fill between diaphragm and pressure gauge.

2.2 EQUIPMENT MOUNTING

.1 Pump and motor shall be supported by a heavy cast-iron or fabricated steel base with four (4) legs. The height of the base shall be sufficient to permit the use of decreasing suction and increasing discharge elbows, which shall be provided when the nominal pump size is smaller than the suction line. The suction and discharge openings shall be flanged faced and drilled one hundred and twenty-five (125) pound American Standard.

.2 The pump must be secured to base at the factory or in the field, with bolts and/or dowels such that the motor-pump shaft shall be centered, in relation to the motor base within 0.1 mm (0.005 inch).

Part 3 Execution

3.1 GENERAL

.1 Prior to pumping unit installation, provide a portable sewage pump and discharge hose to remove remaining wastewater in the wet well. The wastewater shall be disposed as per Section E4-E10 of the Tender.

3.2 SUPERVISION OF INSTALLATION

.1 All equipment and material shall be installed in a workmanlike manner, in accordance with the manufacturer's recommendations.

.2 Supplier to provide installation instructions, in accordance with the manufacturer's requirements, including details for anchor bolts, frames and other items to be cast into concrete work, prior to the installation of the equipment.

.3 The Contractor shall install the equipment where shown on the Drawings and in strict accordance with the manufacturer's instructions and in compliance with applicable local, provincial and federal codes and regulations.

.4 Supplier to provide appurtenances, fittings, connecting piping, framing, accessories and anchor bolts not herein or elsewhere specifically mentioned or included, but necessary for the operation of the equipment package.

.5 The Contractor shall provide concrete and grout, final piping and electrical connections and other appurtenances not herein or elsewhere specifically mentioned or included, but necessary for the installation, operation and testing of the equipment, without additional payment.

.6 All possible precautions should be taken to ensure proper alignment of equipment shafts and pipe connections to avoid transmission of piping weight reactions to the equipment at pipe connections or equipment damage due to misalignment.

.7 Set anchor bolts for equipment at least 150 mm (6 inches) into the concrete base.

.8 Comply with requirements of Hydraulic Institute Standards for installation of all pumps.

3.3 COMMISSIONING

.1 Provide two (2) weeks' notice to the Contract Administrator prior to commencement of commissioning to witness the activities.

.2 The manufacturer has included the following services in the pre-purchase contract including:

.1 Initial start-up inspection and testing for the pumping equipment.

.2 Two (2) days training for operation of pumping equipment.

.3 After the equipment has been installed and prior to final acceptance, protect the equipment from damage. Ensure that protection measures are to the satisfaction of the Contract Administrator.

.4 The Equipment Manufacturer's Technical Representative or approved alternate shall inspect the pump installation to ensure that the equipment has been installed in accordance with the manufacturer's requirements. If the installation is not in order, equipment manufacturer's technical representative shall provide instruction to the Contractor. The equipment shall be started and run, and adjustments made at this time.

.5 The manufacturer's technical representative, Contractor and Contract Administrator shall jointly commission the works in accordance with the written procedure for commissioning. The Contractor shall provide sufficient manpower for the duration of the commissioning period. The Contractor shall make necessary adjustments during commissioning to put the works into continuous operation.

.1 The Contract Administrator will request that the equipment be operated to demonstrate that it performs as specified. If the Contract Administrator notes deficiencies, the deficiency shall be corrected immediately by the Contractor. The Contractor shall advise the Contract Administrator, in writing, when the deficiencies have been corrected.

.2 Deficiencies of a serious nature, as determined by the Contract Administrator, shall be corrected by the manufacturer's representative.

3.4 PUMP TESTING

.1 Provide pump testing as specified in Section 01 91 00 – Commissioning, Start-Up and Field Trial Operation.

END OF SECTION