Part 1 General

1.1 INTENT

.1 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

.2 Provide fully tested and operational mechanical systems in complete accordance with applicable codes and bylaws.

.3 Contract documents of this section are diagrammatic. They establish scope, material and installation quality and are not detailed installation instructions. Do not scale from the drawings, exact dimensions are to be taken from the site.

.4 Follow Manufacturer's recommendations for installation supplemented by contract documents, unless otherwise specified by the Contract Administrator. Any discrepancies must be brought to the Contract Administrator's attention in writing prior to the close of Bids.

.5 Connect to equipment specified in other Sections. Uncrate equipment, move into place, install complete, start-up, test and commission.

.6 Division 1 shall apply to work in this section.

1.2 SCOPE OF WORK

.1 Work to include labour, materials and equipment required for installing, testing, adjusting, balancing and commissioning of the mechanical systems and the provision of As-built drawings, O&M Manuals and personnel training as detailed in this and other Sections of Division 22 and 23.

.2 In general, Work in this Division includes the provision and installation of the following:

.1 Electromagnetic flow meter (FE-Z0002) and related transmitter and piping.

.2 Effluent circulation pump (P-Z004) and related valves and piping.

.3 Vacuum pump (P-Z005) and related valves and piping.

.4 Effluent sampler (SA-Z006) and related controls and piping.

.5 Sump pump (P-Z501) and related valves and piping.

.6 Air compressor (CMP-Z503) and related piping.

.7 Refrigerator for effluent sample storage.

.3 It is the responsibility of the General Mechanical Contractor to co-ordinate the work among the various sub-trades to ensure complete functioning systems.

1.3 CO-ORDINATION OF WORK

.1 Make reference to all drawings when setting out Work. Consult with respective Divisions and the Contract Administrator to ensure the Work is correctly installed. Jointly resolve all conflicts on-site before fabricating or installing any materials or equipment.

.2 Accuracy of dimensions for new piping, flanges, valves and other equipment items is the Contractor's responsibility. Any fit issues between Site conditions and new materials to be installed remain with the Contractor.

.3 Where dimensional details are required, collect Site dimensions and coordinate with the applicable drawings.

1.4 QUALITY OF WORK

.1 Maintain qualified job site personnel consisting of licensed tradesmen and registered apprentices with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

.2 All Work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates.

.3 Only first class workmanship will be accepted, not only as regards to safety, efficiency, and durability but also as regards to neatness of detail. Pipework must be installed parallel to, or at right angles to building planes. The entire work shall present a neat and clean appearance on completion.

.4 Work which does not conform to standards accepted by the Contract Administrator and the trade may be rejected.

1.5 QUALITY ASSURANCE

.1 Quality assurance submittals: submit the following in accordance with Division1.

.2 Health and Safety

.1 Perform construction occupational health and safety in accordance with the Contractor's COR Safety Program and the requirements of the Authority Having Jurisdiction.

1.6 STANDARDS OF MATERIALS

.1 All materials and equipment installed under this contract shall be new unless otherwise noted.

.2 Materials and equipment specified and acceptable manufacturers are named in this specification for the purpose of establishing the standard of materials and workmanship to which Contractor shall adhere. Bid price shall be based on the use of materials and equipment as specified.

.3 Provide new material and equipment of first class quality, delivered, erected, connected and finished in every detail, and supplied with the acceptance of the Contract Administrator. Assume responsibility of ensuring that provided equipment performs as specified.

.4 In the preparation of the Bid, if a Sub-Contractor neglects to name the manufacturer where accepted equals have been shown, it will be understood that the specified equipment will be provided.

.5 Requests for approval of equals must be submitted not less than seven days prior to closing date of the Bid, and submissions must bear proof of acceptance by the The City or Contract Administrator if used in the Bid.

.6 Assume full responsibility for ensuring that, when providing accepted equals, all space, weight, connections, power and wiring requirements, etc. are considered and adjusted

costs are included in the Bid. Alternative equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.

.7 All additional costs for mechanical, electrical, structural and architectural revisions required to incorporate materials accepted as an equal and substituted by Contractor shall be responsibility of Contractor.

.8 Equipment listed as “equal” in specifications or submitted as equal by the Contractor must meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by the Contract Administrator. Install equipment in strict accordance with Manufacturer’s published recommendations.

1.7 EQUIPMENT IDENTIFICATION AND TAGGING

.1 Lamicoid nameplates are to be provided for all equipment as indicated on the drawings (e.g.: P-Z004, etc.) or as specified elsewhere within this specification. Lamicoids are to be 3 mm thick with white letters on a black background (except where required otherwise by any applicable codes). Letters shall be accurately aligned and machine engraved into the core. Minimum letter height shall be 6 mm and the plate shall be suitably sized for the text contained.

.2 All instrument and control (I&C) devices are to be numbered sequentially and simultaneously with all equipment.

.3 Valves and actuators are to be identified with the use of brass tags with 12 mm stamped code letters and numbers.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original unopened factory packaging, labelled with manufacturer's name, address, material, products included and location of installation.

.2 Storage Requirements:

.1 Store materials indoors in accordance with the manufacturer's recommendations for a clean, dry and well-ventilated area.

.2 All shipping crates and packaging too heavy to be moved by hand are to have adequate lifting eyes and/or attachments for handling.

.3 All packaging will be opened during receiving for inspection. If damage is discovered during receiving inspection, the Contractor shall be responsible for determining the extent of the damage and for arranging for the necessary replacement or on-site or remote repairs.

.4 All exposed machined metal surfaces have been sprayed with anti-corrosion spray. The Contractor shall be responsible for cleaning off all necessary protective coatings.

.5 All tanks, piping and the like are to be clean prior to shipping and shall be inspected upon delivery. If received with water and/or debris, the component(s) are to be cleaned appropriately.

.6 Desiccant bags are to be included in all crates. The size and number of desiccant bags is to be suitable for the size of the crate.

.7 All electrical components must be shipped in vacuum packaging.

.8 Store and protect equipment and materials in storage from nicks, scratches, and blemishes during and after installation and final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign materials into the working parts of piping and duct systems.

.3 Waste Management, Disposal and Cleanup:

.1 Remove tools, surplus and waste materials from the building site upon completion. Clean grease, dirt and excess materials from the walls, floors, ceiling and fixtures for which this Contract was responsible and leave the premise suitable for immediate use.

.2 Dispose of unused materials and waste at disposal sites approved by the Authority Having Jurisdiction.

.3 Dispose of unused paint and/or other hazardous materials at official hazardous materials collection sites approved by the Authority Having Jurisdiction. Do not dispose of unused paints or coating materials into the sewer system, into streams, lakes, onto the ground or in locations where it will pose health or environmental hazard.

1.9 GUARDING

.1 Provide all equipment guarding for all rotating shafts, gears, pinch points and the like for the equipment to protect personnel from accidental contact.

.2 Machine guards shall be designed to meet the requirements of the Manitoba Workplace Health and Safety Regulations.

.3 Drive guards shall be securely fastened but removable for servicing, constructed of expanded metal screen welded to steel frames with sufficient clearances to allow for equipment movement.

1.10 EXAMINATION OF THE SITE AND DOCUMENTATION

.1 Prior to submitting Bid, carefully examine site conditions, adjacent buildings and local conditions at the site, which could affect the work of this Division.

.2 Examine all contract drawings to ensure work can be performed without changes to the building, or work, as shown on plans. No allowance will be made later for necessary changes, unless notification of interferences has been brought to the Contract Administrator's attention, in writing, prior to closing of Bids.

.3 Verify that materials and equipment can be delivered to the place of the work and that sufficient space and access is available to permit installation thereof in locations shown on the drawings.

1.11 CONTRACT DRAWINGS AND SPECIFICATIONS

.1 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both. Many items, such as valves, vents, thermometers, pressure gauges, etc. are shown only on schematics and are not shown on

plan and elevation views. Provide and install all items shown in any or all of the drawings (or schematics).

.2 Should any discrepancy appear between the drawings and specifications, which leave the Contractor in doubt as to the true intent and meaning of the plans, and specifications, notify the Contract Administrator in accordance with B4. If this is not done it will be assumed that the most expensive alternative has been included in the Bid price. For any ruling to become binding, the Contract Administrator must issue the new direction in a published addendum.

.3 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is co-ordinated and satisfactorily carried out without changes to the building or contract value.

.4 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and should not be used as an excuse for deficiencies or omissions.

.5 Follow the recommended installation details and procedures for equipment as found in Supplier technical data, supplemented by contract document details.

.6 Install piping, ductwork, etc., generally in the locations and routes shown on the drawings, close to the building structure to minimize furring and interference with other services or free space. Remove piping, ductwork, etc. that is not properly installed and replace to the satisfaction of the City/Contract Administrator at no additional cost.

.7 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.

.8 The drawings are intended to convey the scope of work and indicate general arrangement and approximate location of apparatus and fixtures, and indicate the general location and route to be followed by pipes and ducts. Where required installations are not shown on plans or are only shown diagrammatically, install in such a way as to conserve headroom and interfere as little as possible with free use of space through which they pass, while allowing adequate space for service, maintenance, repair, or replacement for all equipment.

.9 All serviceable items, such as valves, controls, bearings, filters and similar items, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. Basically, work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.

.10 All individual pieces of equipment shall be provided with appropriate means of isolation and bypass so that systems may continue to operate during maintenance of individual components. It is understood that this may not be possible in all situations, but this is a requirement where isolation is possible.

.11 Drawings and specifications to be considered as an integral part of contract documents and neither drawings nor specifications are to be used alone. Misinterpretation of

requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing work to the approval of the Contract Administrator.

.12 Obtain information involving accurate dimensions from dimensions shown by site measurement. Visit and inspect the site of the work to verify location and elevation of existing services which may affect the Bid and work of this Division (water, electrical, sanitary, ductwork etc.) before submission of Bid and proceeding with work. Make all necessary changes or additions to runs to accommodate structural conditions (pipes or ducts around beams, columns etc.) without additional expense to the City. Locations of pipes, ducts and other equipment to be altered without charge to City, provided change is made before installation and does not necessitate additional materials and that all such changes are acceptable to the Contract Administrator and are suitably recorded on Record Set of Drawings.

.13 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to existing Mechanical & Electrical components.

.14 As work progresses and before installing piping, ductwork, fixtures and equipment interfering with interior treatment and use of building, consult the Contract Administrator for appropriate action before proceeding. This applies to all levels and proper grading of piping. If Contractor fails to perform above checking and fails to inform the Contract Administrator of such interference, Contractor to bear all subsequent expense to make good the installation.

1.12 SHOP DRAWINGS

.1 Submit to the Contract Administrator for review one electronic PDF set of detailed shop drawings.

.2 Check shop drawings for conformity to plans and specifications prior to submission.

.3 Submit shop drawings for all items specified in the sections of Divisions 22 and 23. For equipment, provide performance, physical and operating data as described in the Specifications and listed in equipment schedules. Provide performance curves for all pumps and fans.

.4 Shop drawings shall include copies of applicable brochure or catalogue material clearly indicating manufacturer and model. Ambiguous shop drawings will not be reviewed.

.5 Clearly mark submittal to indicate all differences from the specified material. The Contract Administrator will require all options and material indicated on the shop drawing to be provided and installed. Specifically note on the submittal specified features such as tank linings, pump seal materials, painting finish, etc.

.6 Include dimensional and technical data sufficient to determine if equipment meets requirements, including weights, loading points, electrical data and motor sizes.

.7 Identify the equipment by system name and number, e.g." S1, Second Floor, Air Supply Fan", "P1, Chilled Water Pump", etc.

.8 Installed materials and equipment shall meet specified requirements regardless of whether or not the shop drawings were reviewed by the Contract Administrator.

.9 Each drawing to include name of project, equipment supplier and clause number equipment is specified under.

.10 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to contrary.

.11 Take full responsibility for securing and verifying field dimensions. In cases where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only. In this case guarantee that dimensions will be worked to and ensure that other sub-trades are aware of these dimensions and shall comply with them.

.12 Review by the Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with work are noticed, attention of Contractor will be called to such errors of interferences, but the Contract Administrator's review of drawings will not in any way relieve Contractor from responsibility for said errors or interferences, or from necessity of furnishing such work, and materials as may be required for completion of work as called for in contract documents.

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

.14 Do not order equipment until the Contract Administrator has reviewed and returned the reviewed shop drawings.

.15 Keep one set of shop drawings on the site.

.16 Bind one complete set of checked shop drawings in each operating and maintenance instruction manual.

1.13 PERMITS, FEES AND INSPECTIONS

.1 Apply for, obtain, and pay for all permits, licences, inspections, examinations and fees required for work of Divisions 22 and 23.

.2 Review drawings with authorities having jurisdiction to ensure compliance with all applicable codes and by-laws.

.3 In case of conflict, codes and regulations take precedence over the contract documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein. Any discrepancies must be brought to the Contract Administrator's attention in writing.

.4 Before starting any work submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Contract Administrator immediately of such changes. Prepare and submit any additional drawings, details or information as may be required.

1.14 CUTTING AND PATCHING

.1 Cutting, core drilling, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping to be included by Divisions 22 and 23 - Mechanical in Bid price.

Divisions 22 and 23 to employ and pay appropriate sub-trade whose work is involved, for carrying out work described above.

.2 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening, the opening size will be the minimum required, and that patching will be the responsibility of the trade making the opening to the original or specified conditions.

.3 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.

1.15 PAINTING

.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.2 Prime and paint marred finished paintwork to match original.

.3 Restore to new condition finishes which have been damaged too excessively to be merely primed and touched up.

1.16 TEMPORARY USE OF EQUIPMENT

.1 Permanent systems and/or equipment not to be used during construction period, without the City's permission.

.2 Temporary use of equipment shall in no way relieve Contractor of providing warranties, as described elsewhere in this Section and in Division 1, on all equipment and systems so used.

.3 Operate systems under conditions that ensure no temporary or permanent damage. Operate systems with proper treatment. Operate fans at proper resistance with filters installed. Change filters at regular intervals and prior to final acceptance. Operate with proper safety devices and controls installed and fully operational.

.4 Under no circumstances shall air handling units be used to provide temporary heating or ventilation during construction. Air systems shall only be operated after any operation that creates considerable dust or fibres is complete.

1.17 OPERATING AND MAINTENANCE MANUALS (O&M)

.1 Provide O & M Manuals to the Contract Administrator for review 2 weeks prior to final inspection. Submission of individual data will not be accepted unless directed by the City of Winnipeg. Make changes and incorporate the Contract Administrator's review comments as required and re-submit as directed by the Contract Administrator.

.2 Provide three (3) sets of manuals in separate 3 "D" ring, loose leaf binders with spine and face pockets, with the project name clearly indicated on the spine and face. The D ring binders shall have index tabs, each containing the Subcontractors and suppliers names and telephone numbers, data sheets, valve charts, brochures, operating, maintenance and lubricating instructions as well as number coded wiring diagrams and a complete set of reviewed shop drawings for all equipment provided by this Division.

.3 The final accepted copies shall be provided to the City.

.4 General catalog data for the Operations and Maintenance Manual is unacceptable. If manufacturer's specification sheets are generalized in any way, they shall be clearly marked to show exactly which item has been supplied, and the project designation for that item (e.g., PRV-1) is to be noted on Manufacturer's specification sheet which includes all details for this unit, including complete model number, serial number, and construction & performance data.

.5 The outline for the Operating & Maintenance Manual shall be as follows:

- Introduction
- Purpose
- General Description
- Operating Instructions
- Seasonal Operations
- Normal Valve Positions and Control
- Recommended Inspection and Preventative Maintenance
- Maintenance Schedule
- Description of Maintenance Procedures
- Recommended Major Equipment Spare Parts List
- Estimated Annual O & M Costs (hours and equipment)
- Suggested Maintenance Record Form
- Appendices
  - Equipment Shop Drawings
- Safety Practices
- Equipment Supplier Schedule
- Manufacturer Recommended O & M Information
- Exploded Views and Parts Lists
- As-Built Drawings (reduced)
- Control Narrative

.6 Include the following information in the manuals, incorporated into the outline format above, as applicable:

.1 Mechanical Systems

.1 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their respective controls including sequences of operation.

.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.

.2 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Manufacturer’s preventative maintenance procedures.

.3 Data to include schedules of tasks, frequency, tools required and task time including daily, weekly, monthly, semi-annual and annual checks.

.3 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.

.4 Lubrication Information.

.5 List of Contractors and Equipment Suppliers including contact information.

.6 Parts and Troubleshooting Information.

.2 Certification and Identification

.1 Inspection Certificates

.2 Balance Reports

.3 Component Information

.1 One section for each type of equipment to include shop drawings and installation and maintenance information.

.4 Safety Information

.5 Additional Information

.1 Prepare and insert into Operation & Maintenance Manual additional data when need for it becomes apparent during specified demonstrations and instructions.

1.18 COMMISSIONING

.1 Pre-commissioning Requirements:

.1 The supplier and/or installation Contractor are to prepare pre-commissioning procedures and additional information as required for inclusion in the Project Commissioning Plan and final documentation. The required information is to be submitted to the City and Contract Administrator for review and approval prior to commissioning of the system. Furthermore, the Contractor is to confirm in writing that they have adequate provisions for Testing, Adjusting and Balancing (TAB) and other aspects of the design and installation pertinent to the success of TAB. During construction, the supplier and/or installation Contractor is to coordinate the location and installation of TAB devices, equipment, accessories, measurement ports and fittings with the City and Contract Administrator. TAB personnel shall provide a pre-commissioning instrument setpoint list.

.2 Shop Testing Requirements:

.1 The Contract Administrator may appoint an inspector to provide inspection, quality assurance and testing supervision pertaining to the work being performed at the Contractor’s facility and those of its Subcontractors.

.2 Such tests shall be performed at the expense of the Contractor and shall be in accordance with the appropriate ASME, CSA, ASTM or other applicable standard(s).

.3 All pressure equipment shall be hydrostatically tested in accordance with the Codes, Standards and this Technical Specification.

.4 Prior to leaving the Contractor's facility, the equipment shall be tested under load and operational tests shall be performed on all electrical and mechanical components to demonstrate that the equipment meets the requirements of this specification. All pressure relief valves are to be set in the shop.

.5 The Contractor shall also perform the following factory tests on the equipment electrical systems:

.1 Factory electrical wiring continuity and insulation tests.

.2 Motor insulation tests.

.3 Motor running current under no load and full load are within acceptable ranges.

.3 Field Testing and Commissioning Requirements:

.1 Systems commissioning will be conducted prior to substantial completion. The purpose of the Commissioning is to ensure all systems are functioning as designed prior to substantial completion.

.2 The supplier and/or installation Contractor are to provide all of the necessary equipment for conducting the required field tests. Again, the supplier and/or installation contractor are to prepare commissioning procedures and additional information as required for inclusion in the Project Commissioning Plan and the final documentation.

.3 The site tests, at a minimum, shall prove the following:

.1 Static Tests – Static pressure tests and valve leak tests.

.2 Running Tests – After installation but before being placed into service, the equipment shall be powered and tested to prove the following:

.1 All clearances and alignments are in order.

.2 Lubrication (if applicable) is adequate.

.3 Operation of each controller, relay, limit switch and all other control device is satisfactory and operates correctly.

.4 All circuits, controls and interlocks sequence of operation is correct.

.5 All protective and indicating devices operate satisfactory.

.4 Commissioning will require the presence of knowledgeable representatives of the necessary Mechanical Trades. The Mechanical Contractor shall include all necessary costs for systems commissioning. The Contract Administrator will participate to the extent deemed necessary.

.5 All plumbing control system testing is to be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Contract Administrator is notified of the system demonstration.

.6 All control wiring shall be verified for proper connections, free of all shorts, ground faults and that the terminations are tight. All input devices shall be calibrated individually with the calibration procedures recommended by the manufacturer.

.7 Verify that all binary output devices operate properly and that the normal positions are correct. The installation contractor must also verify that all analog output devices are functional, that start and span are correct and that the direction and normal positions are correct.

.8 All aspects of mechanical systems operations will be operated, checked and verified. If any portion of the work fails to meet design requirements, the Commissioning procedure will be halted and only resumed when all necessary repairs are completed. All extra costs including costs for the Contract Administrator to revisit the site resulting from this postponement will be borne by the Contractor.

.9 Verify that the system operation adheres to the sequence of operation. All modes of operation shall be simulated and observed by overriding and varying inputs and schedules.

.10 Submit, to the Contract Administrator, a commissioning report detailing the commissioning tests performed and the results of these tests. Format of report is to be one sheet for each piece of mechanical equipment and it shall include: Equipment tag, Description, Location and point form description of tests and results.

1.19 SUBSTANTIAL COMPLETION

.1 Prior to requesting any substantial completion inspection, complete all of the following items:

.1 All systems shall be operational with alarms, interlocks and control functions.

.2 Obtain all certificates of approval from the authorities having jurisdiction.

.3 All manufacturer start-ups shall be complete.

.4 Complete valve tagging and identification of all new mechanical systems and components.

.5 Lubricate all equipment as per manufacturers' instructions.

.6 Submit required documentation and perform operator training.

.7 Provide all Manufacturers' reports required by the specifications.

.8 Complete all previously identified deficiencies.

.9 Clean equipment both inside and out.

.10 Complete final air and water balancing and submit reports.

.11 Complete final calibration.

.12 Provide As-Built record drawings in accordance with the Bid documents.

.2 After the completion of tests and adjustments, remove temporary covers, strainers and/or obstructions to flow. Drain, flush and refill piping systems as often as required until all piping is clear of dirt and debris.

.3 Leave all mechanical Works in their specified working order.

.4 Provide spare components as specific in this and other Sections of Divisions 22 and 23.

.5 Provide one set of all specialized tools required to service the equipment as recommended by the manufacturers.

1.20 DOCUMENTATION AND SYSTEMS ACCEPTANCE

.1 Provide the following on substantial completion of the work:

.1 Operation & Maintenance Manuals as called for elsewhere in this Section.

.2 Site records (Record Drawings):

.1 The Contract Administrator will provide [1] set of reproducible mechanical drawings as required for each phase of work. Mark changes as work progresses and as changes occur.

.2 Transfer information weekly to reproducible drawings, revising the reproducible drawings to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.3 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing, 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 using the as-built drawings.

.5 Submit completed reproducible as-built drawings with the Operating & Maintenance Manuals.

.4 Extended warranty certificates where specified in other Sections of Divisions 22 and 23.

1.21 GUARANTEES AND WARRANTEES

.1 Guarantee satisfactory operation of all work and apparatus installed under this contract. Replace, at no expense to the City, all items, which fail or prove defective within a period of time as define in Division 1, but in no circumstances shall the warranty period be less than one (1) year after final acceptance of complete contract by the City. Make good all damage incurred as a result of failure or repair of mechanical work.

.2 No certification given, payment made, partial or entire use of equipment by the City, shall be construed as acceptance of defective work or acceptance of improper materials. Make good at once, without cost to the City, all such defective work or materials and consequence resulting, within the period of time defined in Division 1, but not less than one (1) year from time of final acceptance date.

.3 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.

.4 Comply with requirements of Division One. Where warranties specified in Division 1 are longer, or more stringent than in Divisions 22 and 23, Division 1 shall govern. Provide warranties on specified products, equipment and components as well as on the installation of these items. Include for all costs for cutting and patching, removals and

restoration materials and work and repairs to other equipment affected in performance of warranty work.

.5 Provide warranty certificates, wherever given or required, that are in excess of the normal warranty period showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and system.

1.22 SPECIAL TOOLS AND SPARE PARTS

.1 Furnish the City with spare parts as follows:

.1 Spare parts as detailed in the individual Sections of Division 22 and 23.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings (if applicable).

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 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.

3.2 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers.

3.3 DEMONSTRATION

.1 The Contract Administrator will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 The Contract Administrator will record these demonstrations on video tape for future reference.

3.4 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for effluent circulation pump, P-Z004.

.2 Materials and installation for vacuum pump, P-Z005 with vacuum priming valve, XV-Z0041.

.3 Materials and installation for sump pump, P-Z501 complete with associated controls.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 22 05 00 – Mechanical Plumbing General Provisions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.3 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.4 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 EFFLUENT CIRCULATION PUMP, P-Z004

.1 Complete packaged self priming centrifugal pump designed for 38 mm (1 ½") solids handling capabilities to handle final effluent.

.2 Capacity: 5.7 L/s (90 USGPM) at 5.5 m (18 ft) TDH .

.3 Construction: horizontal, self-priming centrifugal, cast iron Class 30 casing, coverplate, sealplate and bearing housing, a 50 mm (2") NPT fill port, a 19 mm (¾") NPT drain plug, ductile iron two vane semi-open non-clog impeller with integral pump out vanes, AISI 4140 alloy steel shaft, anti-friction oil lubricated ball bearings, oil lubricated shaft seal. Maximum operating design pressure of 545 kPa (79 psi).

.4 Motor: 1.5 kW, (2 HP), TEFC/Premium Efficiency, 208V, 3 phase, 60 Hz, 1750 rpm.

.5 Connections: 50 mm (NPS 2)

.6 Supports: provide as recommended by manufacturer.

.7 Acceptable Product: Gorman-Rupp Pump, Model T2A3-B or approved equivalent.

2.2 VACUUM PUMP, P-Z005

.1 Complete packaged vacuum pump.

.2 Capacity: 0.59 L/s (1.25 cfm) free air flow at 124 kPa (18 psig).

.3 Motor: 0.25 kW (1/3 HP), 115V, 1 phase, 60 Hz

.4 Connections: 6 mm (¼") NPT

.5 Acceptable Product: Gast Vacuum Pump, Model DOA-P703-FB or approved equivalent.

2.3 VACUUM PRIMING VALVE, XV-Z0041

.1 Construction:

.1 Cast iron body and cover.

.2 Stainless steel (Type 316) trim.

.3 Inlet: 50 mm (2") NPT

.4 Outlet: 13 mm (½") NPT

.5 Orifice size: 5 mm (3/16")

.6 Cast iron parts protected with universal alkyd primer paint.

.7 Optional accessories: Mercury-free water level control switch.

.2 Acceptable Product: Valmatic Vacuum Priming Valve, Model 38P or approved equivalent.

2.4 SUMP PUMP, P-Z501

.1 Capacity: 170 L/s (45 USGPM) at 4.6 m (15 ft) TDH.

.2 Construction: simplex CSA approved, housing epoxy coated cast iron, cast switch case, motor, pump housing and base, cast shaft, non-clogging plastic vortex impeller, stainless steel screws, guard, handle, arm and seal assembly. 1 ½" NPT discharge.

.3 Motor: 0.37 kW (0.5 HP), 1725 rpm, 120 V, 1 phase, 60 Hz, permanent split capacitor, oil-filled, hermetically sealed with automatic reset thermal overload protection.

.4 Control: mercury switches and simplex control box.

.5 Provide a check valve and an isolation valve on the discharge line of the pump.

.6 Acceptable Product: Zoeller Engineered Products, Model M98 pump or approved equivalent.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Make piping connections to pumps and motor assemblies and controls as indicated.

.2 Install, level, align and lubricate pumps as indicated. Installation must be in accordance with the manufacturer's written instructions supplied at the time of delivery.

.3 Suction pipe connections shall be vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports to prevent strain and vibration on the pump piping.

.4 Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to the control panel.

.5 Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection.

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

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.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section includes:

.1 The installation of drainage waste and venting piping.

.2 Co-ordination with trades installing the concrete floor slab in order to locate and install pipes.

.3 The design, supply and installation of drainage waste and venting piping by the Contractor in accordance with the National Plumbing Code of Canada, Provincial Plumbing Code and the local Authority Having Jurisdiction.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International)

.1 CAN/CSA-B137.3 Series 13, Thermoplastic Pressure Pipe Compendium

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 22 05 00 – Mechanical Plumbing General Provisions.

Part 2 Products

2.1 MATERIAL

.1 Poly Vinyl Chloride pressure piping (PVC):

.1 PVC water pipe, fittings and solvent cement shall conform to CAN/CSA-B137.3.

.2 Piping, fittings, flanges, flange gaskets, primer and cement are to be the products of one manufacturer.

.3 Standard of Acceptance: IPEX Xirtec 140 or approved equivalent.

2.2 PIPING AND FITTINGS

.1 Piping:

.1 Schedule 40 PVC to ASTM D1785 having a cell classification of 12454 or 14333-D.

.2 Colour: Black or Grey

.2 Pipe Joints:

.1 Solvent welded or flanged to match line pipe.

.3 Fittings:

.1 Schedule 40 socket type to ASTM D2467 having a cell classification of 12454 or 14333-D.

.2 Colour: Black or Grey

.4 Welding Glue:

.1 Solvent based to ASTM D2564.

2.3 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

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 In accordance with the Canadian Plumbing Code and the local Authority Having Jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

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

3.4 PERFORMANCE VERIFICATION

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

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for piping, fittings and equipment used in a compressed air system for the effluent sampler.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA B51-[03], Boiler, Pressure Vessel, and Pressure Piping Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 22 05 00 – Mechanical Plumbing General Provisions.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.

Part 2 Products

2.1 AIR COMPRESSOR

.1 General: Oil-lubricated twin-stack reciprocating air compressor with cast iron cylinder.

.2 Motor: standard protected, 1.5 kW (2 HP).

.3 Tank: 15 L (4 Gallon) twin tank.

.4 Control: Manual control with H-0-A starter switch.

.5 Voltage: 120 V, 1 phase, 60 Hz.

.6 Capacity: 1.5 L/s (3.2 cfm) of free air at 930 kPa (135 psi).

.7 Accessories: Front panel mounted regulator and pressure gauge.

.8 Acceptable Product: Ingersoll Rand Model P1IU-A9 compressor or approved equivalent.

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 equipment as indicated on the drawings and to the manufacturer’s instructions.

END OF SECTION

Part 1 General

1.1 SCOPE OF WORK

.1 Provide and install electromagnetic flow meter, FE-Z0002.

.2 Provide and install electromagnetic flow meter transmitter, FIT-Z0002.

.3 Provide electromagnetic flow meter Verificator.

.4 Provide and install effluent sampler, SA-Z006.

.5 Provide and install refrigerator for the cooled storage of the daily composite sample from the Effluent Monitoring Station effluent circulation loop.

.6 Provide and install Victaulic AGS Rigid Coupling, Style W07 on the stainless steel effluent discharge pipeline in the dry well to allow for the removal of the electromagnetic flow meter for off-site maintenance purposes.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 22 05 00 – Mechanical Plumbing General Provisions.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Instructions: submit manufacturer's installation instructions.

Part 2 Products

2.1 SIEMENS SITRANS F M MAG5100W SENSOR, FE-Z0002

.1 Diameter: DN750 (30”).

.2 Flange Pressure Rating: AWWA C-207, Class D.

.3 Flange Material: Carbon steel flanges to ASTM A105 (150 micron painting).

.4 Liner Material: Ebonite.

.5 Electrode Material: Hastelloy C-276.

.6 Transmitter: Senor with remote transmitter.

.7 Communication: No bus communication.

.8 Cable Gland/terminal box: ½” NPT Polyamid Terminal or 6000 I compact.

.9 Acceptable Product: Siemens Sitrans F M MAG5100W, Part #: 7ME6580-7DL14-2AA2.

2.2 SIEMENS SITRANS F M MAG6000 TRANSMITTER, FIT-Z0002

.1 Measuring Error: Maximum measuring error +/- 0.2% +/- 1 mm/s.

.2 Mounting: Wall mounting with remote mounting kit.

.1 30 m cable.

.2 Wall bracket.

.3 Terminal Box Lid.

.4 Potting Kit (IP68).

.3 Enclosure: IP67/NEMA 4X/6 with fibreglass reinforced polyamide with display.

.4 Power: 115-230 V AC, 50/60 Hz.

.5 Communication: Hart Module, Part #: FDK-085U0226.

.6 Acceptable Product: Siemens Sitrans F M MAG6000, Part #: 7ME6920-1AA10-1AA0.

2.3 SIEMENS SITRANS F M VERIFICATOR

.1 Acceptable Product: Siemens Sitrans F M Verificator, 60 Hz, Part #: FDK-083F5061.

2.4 ISOLOK SERIES SAB-25 AUTOMATIC SAMPLER, SA-Z006

.1 Construction: 316 stainless steel sampler body with 3" Tri-Clamp line mounting interface. Oil less industrial air cylinder, 3 ¼" diameter by 3" stroke with Teflon cylinder seals, 1 ½" plunger diameter, 316 stainless steel, polyurethane plunger seals.

.2 Sample annulus: 25cc fixed sample volume per cycle.

.3 Sampler discharge: 1" male NPT.

.4 Accessories: 10 ft of 1 ½" ID flexible hose for sampler discharge.

.5 Port fittings kit colour coded rings for pneumatics and port plugs.

.6 Mounting kit: saddle style 3" Tri-Clamp with Viton gasket and port closure with clamp for a 4" pipe.\

.7 Controller:

.1 Model SBC, P/N 7-03791C, PLC based automatic controller in a NEMA 4X non-metallic enclosure. 110VAC, 1 phase, 60 Hz.

.2 Air-set 24 vdc, P/N 4-06089A, general purpose mounted to the controller box. Includes filter, pressure regulator, pressure gauge, flow control muffler and 4-way solenoid valve.

.8 Acceptable Product: Sentry ISOLOK Model SAB Automatic Point Sampler or approved equivalent.

2.5 REFRIGERATOR

.1 Energy Star rated 4.4 cu. ft capacity compact all fridge, 120V, 1 phase, 60 Hz.

.2 Acceptable Product: Danby Model DAR482BLS refrigerator or approved equivalent.

2.6 VICTAULIC AGS RIGID COUPLING, STYLE W07

.1 New couplings: Use Victaulic AGS (advanced groove system) W07 rigid coupling. Install as per the manufacturer's instructions.

.2 Size: 750 mm (30"), 2065 kPa (300 psi) maximum working pressure (standard wall).

.3 Pipe end separation: 9.6 mm (3/8").

.4 Housing: Ductile iron conforming to ASTM A0536, grade 65-45-12.

.5 Housing coating: standard orange enamel.

.6 Coupling gasket: Grade “EPW” EPDM

.7 Bolts/Nuts: Stainless steel meeting the mechanical property requirements of ASTM F593, Group 2 (316 stainless steel), condition CW for bolts. Stainless steel meeting the mechanical property requirements of ASTM F594, Group 2 (316 stainless steel), condition CW with galling reducing coating for nuts.

.8 Washers: High strength stainless steel.

.9 A Victaulic factory trained representative shall provide on-site training for Contractor’s field personnel (as required) in the use of grooving tools and installation of grooved joint products. Victaulic’s representative shall visit the jobsite and review the installation. Contractor shall correct any joints deemed improperly installed.

.10 Acceptable Product: Victaulic AGS Rigid Coupling, Style W07.

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 manufacturer's instructions and as specified.

.2 Install all equipment and ancillary products in accordance with the Contract Drawings and the shop drawings reviewed by the Contract Administrator.

.3 Make all necessary adjustments to the equipment to provide a complete operational installation.

END OF SECTION