Part 1 General Conditions

1.1 COMMON

.1 Specification covers the requirements for materials, fabrication and erection of piping and components. Erection shall consist of complete installation of piping systems as defined by the piping drawings and documents. It includes installation of all piping, piping components, and related examination, inspection and testing. It includes fabrication in place or in the field fabrication shop for all piping not furnished as pipe spools.

.2 Fabrication and erection of piping shall be in accordance with the applicable requirements of Process Piping ASME B31.3, and Canadian and Provincial Acts and Regulations.

.3 Contractor shall be responsible for obtaining and providing registrations, data reports, certifications, permits and other authorizations required for compliance with codes and regulations. Contractor shall provide such assistance as may be required to enable The City to obtain certification and acceptance of piping systems by the Authority Having Jurisdiction.

.4 Contractor is to have a current Certificate of Authorization for pressure piping installation registered with the Authority having Jurisdiction. Provide proof of registration to the Contract Administrator.

.5 All equipment shall comply with the provincial or municipal laws and regulations governing the location where the equipment is to be installed. The Contactor is responsible to register the equipment with the relevant Canadian and Provincial Authorities, including paying all fees and arranging for any necessary inspections.

1.2 REFERENCED STANDARDS

.1 American Society of Mechanical Engineers (ASME)

- .1 ASME B1.20.1, Pipe Threads, General Purpose
- .2 ASME B16.3, Malleable Iron Threaded Fittings: Classes 150 and 300
- .3 ASME B16.5, Pipe Flanges and Flanged Fittings
- .4 ASME B31.3, Process Piping

.2 American Society for Testing and Materials (ASTM)

- .1 ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
- .2 ASTM A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
- .3 ASTM A194, Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
- .4 ASTM A197, Standard Specification for Cupola Malleable Iron
- .5 ASTM D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
- .6 ASTM D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
- .7 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

.8 ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

.9 ASTM F2880, Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3/4 in. to 65 in.

.10 ASTM F441, Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

.11 ASTM F439, Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

.12 ASTM F493, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

.13 ASTM F1970, Standard Specification for Special Engineered Fittings, Appurtenances or Valves for use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems

.3 Canadian Standards Association (CSA)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code

.4 Manufacturers Standardization Society (MSS)

.1 MSS SP58, Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation

Part 2 Products

2.1 LEACHATE PIPING

.1 Design Summary:

.1	Fluid:	Landfill Leachate Wastewater
.2	Code:	ASME B31.3
.3	Fluid Service:	Normal
.4	Design Pressure:	310 kPa (45 psig)
.5	Design Temperature:	60°C (140°F)

.2 General:

.1 Piping and fittings shall be from a single manufacturer. All fittings shall be molded or fabricated from compound compatible with the pipe material.

.2 Acceptable Product: IPEX Corzan or approved equivalent in accordance with B7.

.3 Pipe:

.1 CPVC, schedule 40, ASTM F441, Cell Class 24448

.4 Fittings:

.1 CPVC, socket ends, schedule 80, ASTM F439

.2 All fittings shall be molded or fabricated from compound compatible with the pipe material.

.5 Joints:

.1 Solvent welded in accordance with ASTM F493.

.6 Nipples: for use at air release valves only

.1 CPVC, Schedule 80 to ASTM F441, NPT.

.7 Flanges:

.1 CPVC, FF, socket end, schedule 80, ASME B16.5 Class 150 bolt pattern, ASTM F1970, c/w back-up ring.

.8 Gaskets:

.1 Full-face gasket, 100% Glyon PTFE with glass microshperes, 3mm (1/8") thick, suitable for ASME B16.5 150 lb flanges.

.2 Acceptable Product: Garlock Blue Gylon Style 3504 Stress Saver or approved equivalent in accordance with B7

.9 Bolting:

.1 Stud bolt ASTM A193-B7 with ASTM A194-2H nuts

.10 Butterfly Valves:

.1 Lug style for ASME B16.5 Class 150 flanges, 316 SS body and disc, Teflon bushing, EPDM seat, 10 position lever handle standard, gear operator on NPS 8 and larger, electric actuator where required.

.2 Acceptable Product: Triac Controls OS Series or approved equivalent in accordance with B7

.11 Electric Actuator:

.1 Spring return fail safe, CSA approved, 2 position control, 115V, 2 auxilliary limit switches, thermostat and heater – low temp option (-40°C), NEAM 4X/IP67 enclosure, manual override.

.2 Acceptable Product: Triac Controls FSE Series or approved equivalent in accordance with B7

.12 Ball Valves:

.1 NPS 2 and under:

.1 CPVC body, full port, Teflon seats, EPDM seals, true union socket ends, lever handle c/w stem extension to outside insulation and jacket.

.2 Acceptable Product: Chemline Type 21 or approved equivalent in accordance with B7

.13 Check Valves:

.1 NPS 4 and under:

.1 Class 150, flanged, spring-assisted silent closing, stainless steel body to ASTM A351-CF8M, 316 stainless steel trim.

.2 Acceptable Product: DFT Model GLC or approved equivalent in accordance with B7

.14 Hose:

.1 Smooth nitrile tube, wire reinforced, nitrile/PVC blend cover, 1034 kPa (150 psig) rated c/w stainless steel fittings.

.2 Acceptable Product: Polar Bear HTT or approved equivalent in accordance with B7.

2.2 COMPRESSED AIR PIPING

.1 Design Summary:

.1 Fluid: Compressed Air

.2 Code: ASME B31.3

.3 Fluid Service: Category D

.4 Design Pressure: 310 kPa (125 psig)

.5 Design Temperature: 60°C (140°F)

.2 Aboveground – Carbon Steel:

.1 Application: indoors

.2 Pipe:

.1 Carbon steel, ASTM A106-B, Schedule 80, seamless

.3 Fittings:

.1 To ASME B16.3, Class 150, malleable iron ASTM A197, NPT

.4 Flanges:

.1 Class 150, RF, carbon steel ASTM A105, ASME B16.5

.5 Bolting:

.1 ASTM A193-B7 bolts w/ ASTM A194-2H nuts

.6 Ball Valves:

.1 1500 psig WOG, NPT, ASTM A216-WCB carbon steel body, three-piece, full port, stainless steel ball, RPTFE seat, lockable lever handle

.2 Acceptable Product: M.A. Stewart Model CSS-F-3N or equivalent in accordance with B7

.7 Solenoid Valves:

.1 Brass body, PTFE seals and disc, normally closed, 2-way.

.2 Acceptable Product: ASCO Series 8210 or approved equivalent in accordance with B7

.3 Aboveground – Stainless Steel:

.1 Application: outdoors

.2 Pipe:

.1 Stainless steel, ASTM A312-TP316L, Schedule 40S, seamless

.3 Fittings:

.1 Forged stainless steel, ASME B16.11, Class 3000, ASTM A182-F316L, NPT

.4 Flanges:

.1 Class 150, RF, stainless steel ASTM A182-F316L, ASME B16.5

.5 Bolting:

.1 ASTM A193-B8M bolts w/ ASTM A194-8M nuts

.6 Ball Valves:

.1 1500 psig WOG, NPT, ASTM A351-CF8M (316) stainless steel body and ball, two-piece, full port, RPTFE seat, lockable lever handle

.2 Acceptable Product: M.A. Stewart Model G2 or approved equivalent in accordance with B7

.4 Belowground – HDPE:

.1 Pipe:

.1 HDPE, PE4710, DR11, Cell Classification 445484C, ASTM D3035

.2 Fittings:

.1 Butt fusion, HDPE, PE4710, DR11, Cell Classification 445484C, ASTM D3261, F2620

.3 Stub Ends:

.1 HDPE, PE4710, DR11, Cell Classification 445484C, ASTM F2880

.4 Bedding:

.1 Well-graded sand (SW or SW-SM) with no particles larger than 9.5 mm as indicated below.

Metric Sieve Size (mm)	Percent Passing by Weight
9.5	100
4.75	95-100
2.00	80-100
1.18	50-85
0.60	25-60
0.30	10-30
0.15	2-10
0.075	0

.2 Bedding shall be free from any substance that would harm the pipe or otherwise impair performance of the material as bedding for the pipe.

.3 Bedding shall be used to fill the entire pipe surround to an elevation of at least 300 mm above the top of the pipe.

.4 Bedding material passing the 0.30-mm sieve shall have a Liquid Limit not exceeding 25% and a Plastic Index not exceeding 6.

.5 Backfill:

.1 Final backfill shall be material excavated from the work, or borrowed or imported materials, approved for use as final backfill.

.2 Borrow fill materials shall meet the requirements specified herein for suitable backfill materials.

.6 Marking Tape and Tracer Wire:

.1 Plastic Marking Tape shall be of a type specifically manufactured for marking and locating underground utilities. The tape shall be acid and alkali-resistant polyethylene film 150 mm wide with minimum thickness of 4 mil (0.10 mm). Tape shall have a minimum tensile strength of 12 MPa lengthwise and 10 MPa crosswise. Tape shall bear a continuous printed inscription describing the service. Plastic piping shall also be provided with 14 AWG tracer wire.

.5 Hose:

.1 Application: aboveground, manholes

.2 Smooth nitrile tube, braided synthetic reinforcing, nitrile cover, 2171 kPa (315 psig) rated c/w stainless steel fittings.

.3 Acceptable Product: Polar Bear HMP or approved equivalent in accordance with B7.

2.3 SECONDARY CONTAINMENT FLOOR DRAIN

.1 356mm square top prom-deck drain with rotatable square promenade frame with seepage openings, frame clamps and heavy duty grate, galvanized cast iron, 250mm diameter no-hub outlet, secondary strainer.

.2 Acceptable Product: Zurn Z150 or approved equivalent in accordance with B7

2.4 PIPE SUPPORTS

.1 New pipe supports shall conform to MSS SP-58.

.2 All pipe supports, structural attachments, saddles and accessories shall be hot-dipped galvanized following fabrication.

Part 3 Execution

3.1 FABRICATION AND ERECTION – GENERAL

.1 Flange bolt holes shall straddle the vertical centerlines or horizontal north-south, east-west centerlines defined on the piping drawings.

.2 Threads shall be clean cut with no burrs or stripping.

.3 All threads on piping and fittings shall be thoroughly cleaned of cuttings, dirt and oil before applying pipe dope or tape.

.4 Pipe, pipe spools, and in-line components shall be inspected internally for foreign material during final installation. Material shall be removed prior to installation.

.5 Bolting - The use of washers or other packing to use up excessive length of flange bolts is not acceptable. The length of machine and stud bolts shall be such that nuts are fully engaged with a minimum of two full threads protruding and that studs are centered

.6 Control valves and other components removed from piping during pressure testing and line flushing shall be replaced with spool pieces or blanks, as appropriate.

.7 Lines containing butterfly valves shall be checked to ensure that the interior of mating pipe and flanges are free of any obstructions such as internal protrusions before installing the valves. The mating flanges at butterfly valves shall be sufficiently separated for ease of installation. The valve shall not be forced or wedged into position which could damage the valve. Butterfly valves shall be installed and the disk set in the open position prior to tightening the bolts. After the bolts are tight, the operation of the valve shall be checked through a complete open and shut cycle to ensure that the disk has not been jammed during installation.

.8 Field-routed piping shall be located such that it does not obstruct operating aisles, walkways, or equipment operation, maintenance, or removal.

.9 All products shall be installed according to manufacturer's installation instructions.

.10 Provide threaded plug in end of all vent and drain valves, material to match valve body.

.11 Piping shall be properly supported to prevent excessive deflection during handling and installation.

.12 Install piping, fittings, valves, and all equipment as per manufacturer's instructions and recommendations.

3.2 FABRICATION AND ERECTION – UNDERGROUND COMPRESSED AIR PIPING

.1 Excavation Design

.1 The sides of a trench or excavation shall be supported by a retaining structure designed and stamped by a Professional Engineer or shall be cut back in accordance with Manitoba OH&S Regulations.

.2 Preparation

.1 The Contractor shall perform all survey work and calculations, and the setting of all marks and stakes necessary to ensure that the work conforms to the required lines, grades, and dimensions. Relate all such layout to the coordinate grid system, elevation datum, and related survey control monuments and bench marks.

.2 The location and approximate depth below grade of all known existing utilities shall be determined and plainly identified prior to commencing work. Positions of existing services or other obstructions, where shown in the Contract Documents, are not guaranteed as to accuracy and/or completeness, and the Contractor shall verify their positions in accordance with the requirements specified on the excavation permit. Position of services shall be shown on the "As-built" drawings.

.3 Protection

.1 Trenching Safety

.1 Before the start of trenching or excavation, plan for and assemble all materials and equipment required to stabilize the trench or excavation sidewalls to ensure the safety of personnel working in the trench or excavation, and to protect existing facilities and structures in the vicinity of the work. The systems, methods, and techniques used shall be suitable for the intended application.

.2 Slope Stabilization

.1 Stabilize the sides of excavations as necessary to prevent slope failure or any other earth movement that might injure personnel, or damage existing buildings, structures, or other facilities in the vicinity of the work.

.2 Cutting back of the walls or slopes of an excavation shall be in accordance with the requirements of the Manitoba OH&S Regulations.

.3 Existing or Complete Utilities

.1 Support uncovered pipes and other existing work affected by the excavation until they are properly supported by backfill. Report immediately to the Contract Administrator any unknown utility lines or any damages to utility lines or other subsurface facilities.

.4 Control of Water

.1 General

.1 Prevent or control water flow into trenches and excavations, or water accumulation in trenches and excavations, to ensure that the bottoms and sides remain firm and stable throughout construction operations.

.2 Surface Water

.1 Plan and conduct excavation operations so as to minimize the disruption of water drainage in the vicinity of the work. Provide diversion ditches, dikes, and other suitable measures to control and direct runoff around and away from the excavation. Protect the sides of excavations from erosion and sloughing caused by water runoff. Promptly remove water accumulations in excavations. The systems and equipment for control of surface water shall be of sufficient capacity to at least accommodate the runoff rate that can be expected from the 2 year (50 percent annual chance) rainfall event.

.3 Groundwater

.1 When the bottom of the trench must be carried to an elevation below the groundwater level or to such proximity to the ground water level that the excavation bottom will become soft due to its being saturated by groundwater, measures shall be taken to lower the ground water level

sufficiently to maintain the stability of the excavation bottom. Design the groundwater control system using accepted professional methods of design and engineering consistent with the best modern practice. The system shall include trenches and sumps with pumps, well points, and such other equipment, appurtenances, and related earthwork necessary to achieve the groundwater control needs of the work.

.4 Disposal of Removed Water

.1 Convey water removed by the water control systems to an existing stormwater drainage system with sufficient capacity to accommodate the flow rates involved without damage. Secure permits or other approval required from authorities having jurisdiction over such stormwater discharge.

.5 Excavation

.1 General

.1 The Contractor shall excavate, by hand, by hydrovac, or by other appropriate measures, any trial excavations deemed necessary by the Contractor for locating the position of underground services.

.2 When in the course of excavation, the Contractor encounters existing services or any other obstructions, he shall immediately seek instruction from the Contract Administrator as to the course of action. Services or other obstruction shall be physically marked on the ground.

.3 Unless otherwise shown in the Contract documents, the minimum trench width shall be the external diameter of the pipe plus 500 mm.

.4 Carefully excavate trenches to the minimum depths and widths necessary for installing the pipeline and associated appurtenances. In the pipe embedment zone (pipe surround), the trench sidewalls shall be as nearly vertical as practical. From the top of the pipe embedment zone to the surface, the trench sidewalls shall be either sloped sufficiently to prevent sloughing or cave-in, or shall be properly supported in accordance with OH&S requirements.

.2 Unstable Subgrade

.1 When soft, yielding, or otherwise unstable soil conditions are encountered at the required trench bottom elevation, over excavate the trench to a depth of no less than 300 mm below the required trench bottom elevation. When the over excavated pipe trench bottom is above the groundwater surface (i.e., it is dry), backfill the over excavation with common fill or bedding material or any suitable backfill material, and compact to at least 95% Standard Proctor Density. When the unstable trench bottom is near or below the groundwater surface (i.e., it is saturated), backfill the over excavation with bedding material. This bedding material shall be completely separated from the trench soils and the pipe bedding material by a geotextile filter cloth.

.3 Rock Excavation

.1 Remove rock by mechanical methods (such as ripping, wedging, or impacting) to reduce the rock to manageable sized fragments.

.2 When the bottom of the structure is to rest on rock or other unyielding material, clean the bearing surface of loose material, and cut to a firm, level bed that is stepped, keyed, or serrated.

.3 Whenever rock, stone, masonry, or other hard, unyielding material is encountered at or above the required trench bottom elevation, remove it to provide a clearance of not less than 150 mm below, and 300 mm on

each side of pipes and associated fittings, valves, and other appurtenances.

.4 Over-excavation

.1 When a trench has been over-excavated for any reason other than saturated unstable soil conditions, the over-excavated part shall be filled with common fill or bedding materials compacted to a minimum 95% Standard Proctor Density.

.5 Excavation and Construction of Appurtenances

.1 If the excavation sidewalls are to be used to form the sides of the structure, take special care during excavation to secure a true surface conforming to the lines and dimensions indicated on the plans for the structure. Corners and edges of the excavation shall be true and square, not rounded or undercut.

.2 When concrete is to be placed against the bottom or sides of an excavation, take care not to disturb the native soils that the concrete bears against. Excavate to final line and grade just before the concrete or masonry is to be placed. Cut to a firm and stable surface that is either level, stepped, or serrated. Remove loose or deteriorated rock, debris, and thin strata.

.6 Stockpiling

.1 Stockpile excavated materials in an orderly manner at a distance from the banks of the excavation sufficient to avoid overloading the bank. Stockpiled material shall be kept a minimum of 1000 mm from the edge of the excavation, with slopes not less than 45° from the vertical. If depth of excavation exceeds 6 m, stockpiled material shall be placed in accordance with the instructions of a Professional Engineer.

.2 Protect stockpiles containing suitable backfill material from contamination with unsuitable material or other material that may adversely affect the quality of the backfill and render it unfit for use. Arrange stockpiles so as not to obstruct drainage or other construction operations in the vicinity of excavation.

.3 Dispose of excavated materials that are unsuitable for use as backfill or are surplus to that needed for backfilling in a safe and proper manner, at a location designated by Contract Administrator.

.6 Pipe Laying and Assembly

.1 Handling

.1 Pipe shall be protected during handling against impact shocks and free fall. Care shall also be taken to prevent damages to and entry of foreign materials into the pipe system during handling, assembly, backfill and compaction. Proper facilities shall be provided for lowering the sections to prevent disturbance of the bed and sides of the trench.

.2 Installation of Polyethylene Piping

.1 Heat fusion bonding to ASTM F2620 shall be used to join polyethylene pipe in the field. When such methods are used, the pipe manufacturer's instructions shall be strictly followed, and the installation shall be by qualified personnel only.

.3 Coordination With System Testing

.1 Coordinate bedding and backfilling with the applicable piping system installation testing requirements to ensure that required testing and

visual examinations are accomplished before the pipeline is obscured by backfill.

.7 Bedding

.1 Haunching

.1 After placing the pipe and assembling joints in accordance with the applicable system installation specifications. Bedding material shall be placed and compacted under the sides of the pipe to the pipe spring line. Take care during placement and compaction of this material to ensure sound support is developed for the sides of the pipe while avoiding either vertical or lateral displacement of the pipe from its intended position. Place haunching area material and compact to the required density in uniform lifts of not more than 150 mm loose thickness using manual or mechanical tamping techniques.

.2 Place and compact bedding to the top of the pipe embedment zone in uniform horizontal lifts of not more than 150 mm loose thickness, then compact by hand, pneumatic tamper, or other appropriate means. Bring up the level of backfill uniformly on opposite sides of the pipe along the full length of each pipe section. Take care not to damage the pipe or any protective coating it may have.

.3 When installing polyethylene pipe, polyvinyl chloride (PVC) pipe, corrugated steel pipe (CSP), or any other flexible type pipe, give special attention to proper compaction of the materials in the pipe haunch area and sides to ensure that adequate side support of the pipe is developed while avoiding any vertical or lateral displacement of the pipe. For flexible type pipe, the material directly above the pipe in the pipe embedment zone shall be compacted using light weight hand operated equipment to avoid distorting the pipe. Manufacturer's recommendations shall be followed.

.4 Bedding shall be placed to a height of at least 300 mm above the top of the pipe unless otherwise indicated in the Contract documents, the minimum bedding thickness shall be 150 mm below the bottom of the pipe. Excavate small depressions of the minimum size necessary in the prepared trench bottom to allow removal of the pipe handling slings, the assembly of pipe joints, etc.

.8 Common Fill

.1 Place common fill material in 200 mm maximum loose thickness lifts to restore the required finished surface grade.

.2 When slabs, roads and pavement are to be restored or constructed over the filled pipe trench, the final backfill shall be placed to the required subgrade elevation of these structures.

.9 Installing Marking Tape and Tracer Wire

.1 During backfill for all pipelines, install appropriate plastic marking tapes above the pipeline at a depth of 600-1200 mm below the required finished grade. Tracer wire for plastic pipe shall be installed at depth on top of the pipe.

.10 Compaction

.1 General

.1 Compact bedding and backfill materials using vibratory or impact type compacting equipment suitable for use in confined areas, and operated at the frequency and amplitude recommended by the equipment manufacturer for the type of material and lift thickness involved in the work.

.2 The Contractor shall exercise care when operating equipment adjacent to structures so as not to cause damage or displacement. If the Contractor's placement and compaction operation result in damage in the structures, the Contractor shall be required to repair all damages at no additional cost.

.2 Moisture Content

.1 At the time of compaction, the moisture content of the material shall be such that the specified compacted density will be obtained and the completed backfill will be in a firm and stable condition. Adjust the moisture content as necessary to achieve a condition suitable for compaction.

.2 For cohesive materials, the moisture content at the time of compaction shall be within 2 percentage points of optimum.

.3 Compacted Density

.1 Bedding: Compact bedding material placed in the pipe embedment zone to a density of not less than 95% of Standard Proctor Density.

.2 Backfill: Compact the backfill to not less than 95% of Standard Proctor Density.

.11 Restoration and Clean Up

.1 After completing backfill placement and compaction, restore or replace shrubbery, turf, fences, and other features, surfaces, and structures disturbed during the work, except as otherwise noted in the Contract documents. Return restored features and facilities to a condition equivalent in accordance with B7 to or superior to that which existed before the work began.

.2 Remove off the jobsite and properly dispose of surplus piping materials, soils, temporary structures, and other debris resulting from the work. Leave the site in a neat and clean condition, ready to receive topsoil, seeding, or whatever final surface treatment is indicated.

.3 If the work involves borrowing materials or stockpiling of unsuitable or surplus materials, the borrow pits and/or stockpiles shall be well graded to facilitate proper draining.

.12 Horizontal Directional Drilling

.1 Pipeline shall be installed by horizontal directional drilling (HDD) at road crossings. HDD shall be in accordance with the following:

.1 Prior to trenchless installations, underground structures shall be identified and located to enable the required clearance to be maintained. The drill head, reamer location, or both, should be periodically monitored to determine that the clearance requirements are being met. Where the field conditions indicate that the required clearance might be difficult to achieve, the drill head or reamer location should be monitored by exposing some structures to determine that the clearance requirements are being met.

.2 Personnel shall be protected against electrical hazards.

.3 Polyethylene pipe shall not be bent to a radius less than the minimum recommended by the manufacturer.

.4 The longitudinal force applied on the pipe shall not exceed the limit recommended by the pipe manufacturer.

.5 Drilling fluids and associated waste material shall be disposed of in a manner that minimizes adverse environmental effects.

.6 After the installation is completed, the exposed end of the pipe that was pulled through the bore shall be inspected for scratches and other imperfections on the coating or the pipe itself. Where imperfections are found, they shall be evaluated and, if found to be defects, pulling or reaming shall continue until defects are not observed.

3.3 INSPECTION AND TESTING

.1 Leachate Piping:

.1 Inspection and testing standard: ASME B31.3, Normal Fluid Service

.2 Test: Hydrotest at 465 kPa (68 psig)

.2 Compressed Air Piping:

.1 Inspection and testing standard: ASME B31.3, Category D Fluid Service

.2 Test: Service

.3 Inspect and test all piping, valves, and all equipment as per the manufacturer's instructions and recommendations.

.4 Zero leakage is permitted throughout the specified test period for all piping.

.5 Give the Contract Administrator a minimum of 2 business days' notice prior to testing. Timing of testing to be coordinated with The City.

3.4 CLEANING

.1 Clean interior and exterior of all systems prior to start-up of new systems.

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

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This section includes the construction features, materials, fabrication quality assurance, inspection and preparation for shipment of one new skid mounted compressed air system enclosure including, but not limited to, air compressor (C-1), wet air receiver (AR-1), air dryer (AD-1), dry air receiver (AR-2) and flow controller (FC-1) complete with all necessary appurtenances, controls, interconnecting piping and wiring within the enclosure.

1.2 REFERENCES

.1 ANSI/ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels

.2 ANSI/ASME B31.3 Process Piping

.3 CSA B51-M, Boiler, Pressure Vessel, and Pressure Piping Code

.4 Canadian Electric Code (CEC)

.5 Canadian Standards Association (CSA)

.6 Compressed Air and Gas Institute standards (CAGI)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Shop Drawings:

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

.2 Performance curves showing rated and normal operating conditions.

.3 Dimensional drawings shall be provided for the overall system enclosure showing the equipment layout. Drawings shall include weights, major component identification and service connection locations, sizes and ratings

.4 Dimensional drawings for all individual items supplied as part of the package. Drawings shall include weights, major component identification and service connection locations, sizes and ratings.

.5 Recommended spare parts list.

.6 Consumable products price list (oil, filter cartridges, etc.).

.7 Instructions: submit manufacturer's installation instructions.

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

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 PERFORMANCE

.1 The compressed air system shall be designed to deliver 195 m^3/hr (115 scfm) of dry air at 621 kPa (90 psig) downstream of the compressed air flow controller.

.2 The system shall provide Class 1.1.1 air in accordance with ISO 8573-1.

2.2 AIR COMPRESSOR (C-1)

.1 General

.1 The air compressor shall be electric motor driven, continuous duty, rotary screw compressor complete with a replaceable cartridge type inlet air filter. The compressor shall be capable of continuous flow operation 24 hours/day at full capacities and pressures. The utility connections to the compressor shall be mounted for ease of installation and maintenance.

.2 The compressor shall be mounted on the wet air receiver (AR-1) and shall be pre-piped.

.3 Unit shall be CSA approved.

.2 Performance and Design:

.1	Capacity (minimum @ operating):	115 scfm
.2	Maximum Pressure Rating:	125 psig
.3	Operating Pressure:	100 psig
.4	Electrical Characteristics:	208 V / 3 ph / 60 Hz

.3 Motor:

.1 TEFC, soft start variable frequency drive.

.2 The integral controls shall adjust speed to meet system demand and maintain system pressure and provide protection from the following:

.1 Over temperature of motor or drive

.2 Under or over voltage conditions

.3 Over speed

.4 Phase failure or reversal

.5 Excessive voltage imbalance

.6 Short circuit of main or control power.

.4 Enclosure:

.1 The compressor shall have a complete sheet metal enclosure with access panels that can be easily removed for servicing the compressor.

.5 Control Panel:

.1 The control panel shall include a user interface which has Start / Stop Keys, Display Keys, Navigation Keys, Information Key, LED status indicators and LCD display screen. The LCD display screen shall show the status of the machine, maintenance intervals, warnings and alarms, setup and service screens. The control Panel also includes an emergency stop and dew point indicator.

.6 Temperature Protection:

.1 Should the compressed air temperature exceed 109□C (228°F) at the airend discharge, the controller will shut down the compressor, and illuminate the fault indicator.

.7 Baseplate:

.1 A one-piece folded mild steel base, with steel strengthening supports. It is protected from corrosion with a high grade of powder coated finish. The baseplate supports all the components in the package.

.8 Piping:

.1 The compressor utilises flexible SAE hoses with JIC fittings, rigid steel piping or copper tubing, flexible connectors and nylon tubing as appropriate to provide vibration free operation. Each compressor system after manufacturing and assembly is 100% inspected and tested to provide a piping system with minimum potential for leaks.

.9 The following items shall be provided with the compressor:

.1 Electronic drain valve.

.2 Start-up kit.

.3 Power outage restart kit to allow for automatic restart of the compressor after power interruption.

.10 Acceptable Product: Ingersoll Rand Model IRN30-150 or approved equal

2.3 WET AIR RECEIVER (AR-1)

.1 The compressor (C-1) shall be mounted on and pre-piped to the wet air receiver.

.2 762 mm diameter x 2134 mm long horizontal tank: to CSA B51, ASME Section VIII and provincial regulations, with a minimum design pressure of 862 kPa (125 psig).

.3 Capacity: 0.9 m^3 (240 usgal)

.4 Outlet connections: NPS 1

.5 Accessories: safety valve, drain cock and automatic condensate trap

.6 Provincial inspector's certificate and label.

.7 Finish: vendor standard paint

2.4 AIR DRYER (AD-1)

.1 General

.1 Modular heatless desiccant air dryer with a minimum capacity of 115 scfm at 100 psig.

.2 Technical Specifications

.1 Dew point: -100°F (-73°C)

.2 Standard Electrical Supply: 115 V / 1 Ph / 60 Hz

.3 Dryer shall employ twin-drying towers comprising ASME code welded pressure vessels, spherical-particle, non-corrosive activated alumina desiccant, and desiccant fill and empty ports. A continuous supply of dry air shall be provided by the automatically cycled operation of the drying vessels on a fixed cycle, including drying, pressure stabilization and regeneration. Automatic cycling shall be controlled by an electronic controller. Airflow shall be directed through alternate drying vessels by pneumatically operated valves which require no lubrication.

.4 Fire rated relief valves shall be located on each pressure vessel.

.5 The purge air control system shall include mufflers to reduce the noise level of the purge air exhaust to within OSHA standards. No electrical or other energy shall be supplied to the dryer from an outside source for reactivation. The dryer shall include, as a minimum,

gauges showing pressure in each drying tower, a gauge showing purge pressure, a manual purge adjustment valve, a button for selecting power ON/OFF, and an indicating light signaling power ON.

.6 The dryer shall include an Energy Management System (EMS):

.1 A hygrometer sensor located in the airstream downstream of the desiccant bed will determine moisture content of process air and the integral controls will correspondingly modulate the dryer cycle. At the end of the purge and repressurization cycles, if the dew point is better than required, purge exhaust valves will remain closed and no purge air will be consumed. Although no longer purging, the dryer will continue the drying cycle in order to maintain heat of adsorption within both desiccant beds. When dew point reaches the EMS control setpoint, the dryer will revert to fixed cycle with the last regenerated bed switched for online drying.

.2 The EMS option shall also include a digital dewpoint display, system status and cycle point indications and a common alarm dry contact. Selections can be made for DRYER OFF, DRYER ON and EMS ON.

.7 Prefilter:

.1 A prefilter shall be included for installation upstream of dryer to remove oil and liquid water down. Filter shall include automatic drain valve for periodic removal of separated contaminants and a dual scale differential pressure gauge for indication of element replacement.

.8 Afterfilter:

.1 An afterfilter shall be included as standard for installation downstream of the dryer to remove particulate matter. Filter shall include a dual scale differential pressure gauge for indication of element replacement.

.9 Acceptable Product: Ingersoll Rand Model HL120 or approved equal

2.5 DRY AIR RECEIVER (AR-2)

.1 762 mm diameter x 2134 mm long vertical tank: to CSA B51, ASME Section VIII and provincial regulations, for a minimum design pressure of 862 kPa (125 psig).

.2 Capacity: 0.9 m^3 (240 usgal)

.3 Accessories: safety valve, electronic drain valve, pressure gauge

.4 Provincial inspector's certificate and label.

.5 Finish: vendor standard paint

2.6 AIR FLOW CONTROLLER (FC-1)

.1 The compressed air system shall include an air flow controller to allow for storage of compressed air at higher than the required system output pressure of 90 psig. The controller shall have a maximum allowable inlet pressure of 125 psig or greater and shall have a minimum control range of 0 – 125 psig. The controller shall include:

.1 Nitrile seals

.2 NPT threads

.3 Glycerine-filled, stainless steel, inlet and outlet pressure gauges

.4 Powder-coated steel chassis

.2 Acceptable Product: Ingersoll Rand Model Pace or approved equal

2.7 OIL/WATER CONDENSATE SEPARATOR

.1 Self-contained unit requiring no electrical connection or pumping devices. Alumina silicate substrate media bed c/w internal decompression chamber, five inlet hub, inlet and outlet hose, 15 usgal, 2 usgpm max flow.

.2 Acceptable Product: Sullivan CRP-15-IDC or approved equal

2.8 PIPING

.1 In accordance with Section 22 11 17 – Process Piping and Valves.

2.9 SYSTEM ENCLOSURE

.1 All equipment shall be housed inside 1-hour fire rated enclosure designed for outdoor ambient temperature limits of -40°C to +40°C.

.2 Structure: The enclosure shall be constructed from a standard shipping container.

.3 Insulation: Wall and roof shall have minimum insulation value of R16.

.4 Doors: Access shall be through the existing shipping container doors.

.5 Painting: All bases, enclosure floors and exteriors shall be factory painted. Enclosure paint shall have weather resistant finish designed for minimum 25 year performance life expectancy. Color to be confirmed by Contract Administrator.

.6 Exhaust Fan: Install exhaust fan for forced ventilation of the enclosure, sized to provide adequate ventilation cooling to maintain space temperature within operating range of all equipment at an outside ambient air temperature of +40°C. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. Fan shall be enclosed in minimum 18 gauge galvanized steel wall housing with inlet guard, insulated gravity backdraft damper and 45° weatherhood with birdscreen. Fan shall be interlocked with the ventilation damper actuator and thermostat.

.7 Ventilation louver and damper: Install stationary, storm proof louver with bird screen and motorized damper for forced ventilation of the enclosure. Damper blades shall be insulated and have thermal break. Air leakage through a 48” x 48” damper shall not exceed 10.5 CFM/SQFT against 4” w.g. differential static pressure @ standard air. Operating outside air temperature range shall be -40°C to +40°C. Supply an actuator to modulate the damper open or close. Interlock with exhaust fan and thermostat.

.8 Unit Heater: Install a unit heater sized to maintain enclosure temperature within operating range of all equipment with an outside air temperature of -40°C. Interlock to thermostat.

.9 Thermostat: Provide wall mount thermostat and interlock to unit heater, exhaust fan and ventilation damper.

.10 Luminaires and wall switch near door to provide illumination within the room, including wiring to the electrical panelboard. Illumination level shall be average 300 lumens measured at the floor. Luminaire shall be LED vapour tight linear luminaire, surface mounted, polycarbonate IP65 housing and lens with uniform gasket, stainless steel latches, 5 year warranty. Acceptable material includes Aimlite model VP4-LA1A-2/40K/SS. Exterior lighting is not required.

.11 Two (2) duplex wall receptacles, 15 amps, with one duplex receptacle located near each end of the building, including wiring to the electrical panelboard. Receptacles may be connected to the same circuit.

.12 Panelboard complete with circuit breakers as required to supply all equipment within the building, and shall be as specified on the electrical drawings. The equipment within the

building includes but is not limited to the air compressor, air dryer, luminaires, receptacles, electric unit heater, supply and/or exhaust fans.

.13 All conduit, wire, cables, boxes, and other electrical equipment shall be provided in accordance with Division 26 specifications.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 In accordance with manufacturer's written installation requirements.

3.2 INSPECTION, TESTING AND COMMISSIONING

.1 Inspect, test and commission new equipment in accordance with manufacturer's recommendations including demonstration and training of operation and maintenance of the equipment with the Owner.

3.3 COMPRESSED AIR PIPING

.1 Install, inspect and test piping in accordance with Section 22 11 17 – Process Piping and Valves.

3.4 CLEANING

.1 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.

.2 Check entire installation is approved by authority having jurisdiction.

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

END OF SECTION