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REVISION 0	SECTION 13122 FRAMED FABRIC STRUCTURES	

PART 1. GENERAL

1.01 SUMMARY

- A. Comply with Division 1, General Requirements.
- B. Section includes design of:
 - 1. Structural framing for the building, including structural steel door frames for equipment doors, man doors and louvers.
 - 2. Secondary framing, supports and attachments for mechanical equipment, ducting and piping, conveyor equipment openings, louvers, electrical equipment and controls, lighting fixtures.
 - 3. Building frame truss anchor bolts.
 - 4. Fire-resistant, waterproof fabric cover.
- C. Products supplied but not installed under the Work of this Section.
 - 1. Building anchor bolts installed under the Work of Section 05500, Metal Fabrications and Castings.
- D. Items not supplied but installed under this Section:
 - 1. Steel doors and frames as specified in Section 08110, Steel Doors and Frames.
 - 2. Overhead curtain door as specified in Section 08380, Traffic Doors
 - 3. Door hardware as specified in Section 08710, Door Hardware.
 - 4. Aluminum louvers as specified in Section 10200, Louvers and Vents.

1.02 REFERENCES

- A. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- B. ASTM A500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- C. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- D. CAN/ULC S102 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- E. CAN/ULC S109 Flame Tests of Flame Resistant Fabrics and Films
- F. CSA G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel

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- G. CSA S136 North American Specification for the Design of Cold Formed Steel Structural Members
- H. CSA W59 Welded Steel Construction (Metal Arc Welding)
- I. National Building Code of Canada (NBCC) 2010

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 1. Design buildings for applicable dead and live loads established by the NBCC for the locality, hourly wind pressures of one in 50 years.
 2. Allow for loads imposed by securely attached and supported mechanical and electrical equipment, ducting and services including fans. Design must include all secondary framing and support components for mechanical and electrical equipment supported from structure. Coordinate with mechanical and electrical equipment suppliers for sizes, weights and support requirements.
 3. Design anchor bolts for primary and secondary framed connections to concrete.
 4. Design building for openings shown in Drawings. Coordinate with mechanical shop drawings for mechanical equipment requirements prior to fabrication.
 5. Deflection of fabric roof and wall panels: Maximum 1/180 of span when supporting applicable loads.
 6. Provide secondary supports and attachments for fire extinguishers in locations shown on Drawings.
 7. Provide support attachment and suitable fabric flashing details for leachate tank vent pipe to building frame.

1.04 SUBMITTALS

- A. Shop drawings:
 1. Submit shop drawings indicating shape and thickness, finishes, dimensions of components of building including details of appurtenances, spacing and location of supports, connections, type and location of fastenings, metal finishes and other pertinent information.
 2. Indicate provision for structural and thermal movement between building components and between building components and adjacent materials.
 3. Indicate details of attaching and supporting mechanical and electrical equipment and services.
 4. Submit anchor bolt plan layout indicating design load reactions at supports.
 5. Indicate all equipment openings in structure and provide watertight and sealed details.
 6. Submit manufacturer's specifications.
- B. Certificates: Submit three copies of certificates for design loads and design standards

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used in design of building.

- C. Submit certificate for structure indicating the design loadings, including drift snow loads for which the structure has been designed are in compliance with the National Building Code. Submit shop drawings and certification signed and sealed by professional engineer licensed in the Province of Manitoba.
 - 1. Submit certificate for building frame, roof, and enclosure on Canadian Sheet Steel Building Institute form - Certificate of Design and Manufacturing Performance.
 - 2. Submit shop drawings and certification for the structure frame and anchor bolt design signed and sealed by a professional engineer registered in the Province of Manitoba.
- D. Submit building permit application documents to the Contract Administrator for review before applying for permit. Refer to Section 01060, Regulatory Requirements.
- E. Submit colour selection chart and two samples 300 mm long of finish and colors for:
 - 1. Fabric cover.
- F. Submit accepted drawings and calculations certified by a Professional Engineer licensed to design structures and registered in the Province of Manitoba and to the City to obtain approval as required for building permit. Base design on design loads. Pay fees as required by the City to obtain approval and building permit.

1.05 QUALITY ASSURANCE

- A. Qualifications of installer:
 - 1. Approval and authorization by building manufacturer.
 - 2. Evidence of acceptable experience in all phases of Work involved on projects of comparable size and scope.

PART 2. PRODUCTS

2.01 MANUFACTURERS

- A. Framed Fabric Structure acceptable manufacturers
 - 1. Guard-All.
 - 2. Norseman.
 - 3. MegaDome.
- B. Drawings have been based on C36-50-18 model by Guard-All. Models by other listed manufacturers are acceptable subject to meeting the specified requirements.

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2.02 SELF FRAMED SYSTEM

- A. Design: Structure to be self framing truss design as primary structural supporting components. Transmission of horizontal wind loads will be to cast-in-place concrete walls shown in Drawings. Anchor bolt design by structure manufacturer. Bracing to be provided where required for transmission of lateral wind loads.
- B. Components:
 - 1. Steel framing members:
 - a. Conform to ASTM A500 with minimum 345 MPa yield point.
 - b. Hot dipped galvanized conforming to ASTM A123.
 - 2. Fabric cover:
 - a. Flame retardant fabric cover conforming to CAN/ULC S109 for flame resistance.
 - b. Woven clear HDPE scrim with 94 g/m² coating each side.
 - c. Thickness 0.59 mm; weight 407g/m².
 - d. Fabric: Guard-All NovaShield II with ArmorKote, FRU88X-6, 4 mil fire rated. Colour: to later selection.

2.03 BUILDING COMPONENTS: STEEL DOORS AND FRAMES, HARDWARE, LOUVERS

- A. Steel doors and frames as specified in Section 08110, Steel Doors and Frames.
- B. Overhead curtain door as specified in Section 08380, Traffic Doors
- C. Door hardware as specified in Section 08710, Door Hardware.
- D. Aluminum louvers as specified in Section 10200, Louvers and Vents.

PART 3. EXECUTION

3.01 EXAMINATION

- A. Examine concrete support wall after construction and report conditions which would adversely affect erection of building. Framed fabric structure shall not be erected until concrete has reached 30MPa.
- B. Comply with details of attaching mechanical and electrical equipment and services to building.
- C. Commencing erection will imply acceptance of substrate conditions.

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3.02 ERECTION

- A. Erect building in accordance with manufacturer's specifications and instructions.
- B. Provide galvanized steel framing for door frames, and supports for louvers and all other mechanical equipment openings and suspensions.
- C. Accurately fit assemblies to provide airtight and watertight installation and provide clearance required due to expansion, contraction and deflection of building structures and frames. Anchor units securely to concrete foundation and ensure minimum edge distances have been met.

3.03 INSTALLATION – DOORS AND FRAMES

- A. Install door frames. Install doors to operate freely and close tightly.
- B. Installation tolerances:
 - 1. Vertical position: plus/minus 3 mm.
 - 2. Horizontal position: plus/minus 3 mm.
 - 3. Deviation from plumb: 3 mm maximum each plane.

3.04 INSTALLATION - DOOR HARDWARE

- A. Install and adjust hardware on doors and frames.
- B. Provide lubricants required and use in manner to ensure smooth function of hardware consistent with manufacturer's recommendations.
- C. Adjust weather stripping as required.

3.05 INSTALLATION – OVERHEAD CURTAIN DOOR

- A. Install and adjust door and track in accordance with manufacturer's instructions.
- B. Provide lubricants required and use in manner to ensure smooth function of hardware consistent with manufacturer's recommendations.
- C. Adjust guides and weather stripping as required.

END OF SECTION

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PART 1. GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. CSA B66-10 - Design, material, and manufacturing requirements for prefabricated septic tanks and sewage holding tanks.
 2. ANSI AWWA: D 120-02 Thermosetting Fiberglass-Reinforced Plastic Tanks.
 3. Underwriters' Laboratories of Canada (ULC) S615-98, Standard for Reinforced Plastics Underground Storage Tanks for Flammable and Combustible Liquids.

1.02 SUBMITTALS

- A. Shop Drawings:
1. Fabricator's catalog information, descriptive literature, specifications, and identification of materials of construction. Include complete resin system information.
 2. Detailed fabrication drawings.
 3. Complete design calculations for tanks, supports, and appropriate accessories stamped by a registered Professional Engineer in the Province of Manitoba.
 4. Tank data indicating equipment number, material of composition, pressure rating, diameter, straight shell lengths, overall lengths, wall thickness, and details of nozzle/opening designs.
 5. Tank capacity chart indicating cubic metres for incremental depths and cumulative total from bottom.
 6. Fabricator's detailed requirements for tank foundations.
 7. Recommended bolt torques for all bolted FRP connections.
 8. Recommended material selection and fabrication methods for the tank.
 9. Final Configuration of Tank Appurtenances: The final locations of tank appurtenances including, but not limited to, nozzles, manways, pipe supports, and anchor lugs will be confirmed by the Contract Administrator during review of Contractor's drawing submittals.
- B. Quality Control Submittals:
1. Fabricator's Certificate of Compliance with fabrication requirements.
 2. Qualifications of fabricator's Quality Assurance Supervisor.
 3. Copy of the fabricator's Quality Assurance Program.
 4. Certification of Factory Testing. Submit factory test reports to the Contract Administrator.
 5. Special shipping, storage and protection, and handling instructions.
 6. Fabricator's written/printed installation and tank support instructions.
 7. Manufacturer's Certificate of Proper Installation in accordance with Section 01640, Manufacturers' Services.
 8. Certified test data on representative samples of standard laminate materials which

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verify that their physical properties meet the requirements and service conditions specified. Include verification of structural design parameters.

9. Installation instructions and recommendations for buried installation.
- C. Contract Closeout Submittals: Service records for repairs performed during construction.

PART 2. PRODUCTS

2.01 GENERAL

- A. Loading Conditions: Tank shall meet the following design criteria:
1. The tank is to withstand external loads due to soil and water table with a 3:1 safety Factor against failure and without deflection beyond manufacturer's recommended limits. Such loading shall be considered with tank empty of all liquid and external water levels at surface of backfill.
 2. Tank shall withstand surface H-20 axle loading of any position over the tank without failure or deflection beyond manufacturer's recommended limits.
 3. Tank shall resist continuous uplifting forces due to ground water pressure without rising or deflection beyond manufacturer's recommended limits. Such loading shall be considered with tank empty of all liquid and external water level at surface of backfill.
 4. Tank(s) shall have integrally moulded ribs for reinforcement of tank walls against pressures due to soil and high water table.
 5. Tank shall support accessory equipment such as manway installations, attached collars, flanges, nozzles, inlet pipes, service connections, air vent, drop/fill tubes, and other accessories as shown on the Drawings and in accordance with tank manufacturer's current installation manual and operating guidelines.
- B. Product Storage:
1. Tank shall be capable of storing leachate (strong wastewater product).
 2. Tank shall be vented to atmospheric pressure.
- C. Materials:
1. Tank shall be manufactured with 100 percent resin and fiberglass reinforcement. No sand fillers.
 2. Resin used in tank and accessories shall be premium isophthalic polyester.
- D. Tank Dimensions:
1. Tank shall have a minimum nominal capacity of 40 m³.
 2. Tank shall have nominal outside diameter of 2.44 m (8 ft).
 3. Depth of burial: 2.315 m (7 ft.) to top of tank.

2.02 ACCESSORIES

- A. Anchor Straps:
1. Straps shall be stainless steel anchor straps with anchor bolts as recommended

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and supplied by tank manufacturer.

2. Concrete anchors to be formed on Site as recommended by tank manufacturer complete with concrete pad.
3. Optional: precast concrete “deadman” anchors.
4. Anchoring System shall be capable of withstanding continuously the uplift forces caused by ground water pressure. Such loading shall be considered with the tank empty of all liquid and external water levels at surface of backfill. Each component of the Anchoring System shall have a factor of safety of a minimum of 2.1 against failure under the most severe loading condition. Such loading shall be considered with tank empty of all liquid and external water level at surface of backfill.
5. Each strap assembly shall be proof tested by the manufacturer to a minimum 150% of design load. Upon request, manufacturer shall supply engineered design calculations demonstrating that the anchoring system shall provide the necessary hold-down force for the design conditions.

B. Manways:

3. All manways are to be flanged and sized as shown on Drawings 1-0400B-P0001-001-00, Process Leachate Tank Detail, complete with cover, gasket, and hardware.
4. Location(s) shall be shown on tank drawings.
5. Manway extension tube material shall be as recommended by manufacturer for deep burial installation.
6. Manways lids are to be of **non-sparking** material.

C. Gauge Plates: Gauge plates shall be installed under each service fitting and manway opening.

D. Fittings:

1. All fittings shall be located as shown on the drawings.
2. All threaded fittings shall be constructed of carbon steel or FRP.
3. All standard NPT threaded fittings shall be half-couplings of 4-inch, or 6-inch diameter.
4. All NPT fittings shall withstand a minimum of 150 foot-pounds of torque and 1,000 foot-pounds of bending, both with a 2:1 safety factor.
5. FRP and PVC nozzles shall be flat-faced, flanged and gusseted, and nozzles shall conform to ANSI B 16.5 150-pound bolting pattern. Size and locate nozzles in the sizes and location shown on Drawings.

E. Piping:

1. Material and type of inlet and outlet piping shall be compatible to mate with interconnecting pipe as shown on the Drawings (HDPE and PVC).
2. All piping shall be factory-sealed to enable field tightness testing with at least one pipe opening provided with a threaded filling for connecting a pressure-test manifold.

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F. Resin:

1. Suitable for storage of leachate (strong wastewater) with the below characteristics:
 - a. pH 2 to 8
 - b. Sulfur -
 - c. BOD – 210 – 400 mg/L
 - d. TSS – 740 1800 mg/L
 - e. TKN - 80 to 2600 mg/L
 - f. NH4 – N - 5.1 – 1200 mg/L
 - g. NO3 – N - non-detect to 190 mg/L
 - h. Pb - 10 - 200 ug/L
 - i. Cl - 30 -500 mg/L
 - j. Cd non-detect to 200 ug/L
 - k. Pb non-detect to 50 ug/L
 - l. Sulfer – 0 to 20 ug/L

G. Manufacturer:

1. Equinox.
2. ZCL Composites Inc
3. Or approved equal in accordance with B6.

PART 3. EXECUTION

3.01 GENERAL

A. Testing:

1. Each tank shall be tested by manufacturer with 35kPA (5psi) internal pressure. During pressure test, the exterior of the tank shall be tested to be free of leaks with soapy water solution.
2. Each tank shall be designed such that it is capable of being subjected to a Precision Leak Test after installation.

B. Installation:

1. Contractor shall be trained by the tank manufacturer in proper installation procedures.
2. Tank shall be installed according to the manufacturer's manual and operating guidelines in effect at time of installation.
3. Coordinate with level sensor installation as shown on Drawings.

C. Anchoring:

1. Anchor Straps shall be installed as recommended by the tank manufacturer.
2. Concrete anchors shall be formed on Site.

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- D. Compaction: The backfill shall be placed and compacted completely under the tank haunches and dome area. Voids must be eliminated by pushing backfill into the spaces. The natural angle of repose is not acceptable.
- E. Backfill: Use only approved backfill material. Material must conform to the specifications of CW2030 and CW3110. Carefully place and compact the backfill material around and, additionally, up to half of the diameter over the tank.

3.02 **GUARANTEE**

- A. Provided underground storage tank shall be unconditionally guaranteed by the Contractor as to material and workmanship, including settling of backfilled areas below grade for a period of 1 year following the date of final acceptance of the Work. Contractor shall make all adjustments without extra cost to the City, including complete restoration of all damaged piping, paving, or other improvements during the 1-year period from the date of completion.
- B. Operational difficulties in connection with the underground storage tank within the specified guarantee period shall be immediately repaired at no additional cost to the City, including any and all other damage caused by such defects.

END OF SECTION

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PART 1. GENERAL

1.01 GENERAL

- A. This section requires that the Contractor provide a fully functional control system for the City of Winnipeg Leaf and Yard Waste Compost Facility including the ASP Control System, the Mixer/Conveyor and all alarm monitoring and reporting equipment as depicted on the drawings.
- B. The Contractor shall furnish all material, all installation labor, all programming, all wiring, and everything required for calibration, check-out, start-up and testing.
- C. The Contractor shall provide all protective packaging and preparation for shipping, all shipping and transportation charges, all unloading at the Site, all assembly, all electrical and network connections.
- D. The Contractor shall provide all appurtenances not shown in these specifications or drawings necessary to provide a complete and fully functional system. The Contractor shall ensure that all materials and equipment are compatible and fully functional. The Contractor shall provide submittal data on all materials and equipment whether or not specifically identified herein.
- E. The Contractor shall verify all interconnections between all supplied control systems. The Contractor shall including all power, control and communications wiring as well as any additional programming or communications hardware to ensure that all signals and data are available to the Control System's PLC and HMI. The Contractor shall ensure that all permissive and shutdown interlocks to control systems are provided within the Control System.

1.02 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. Instrument Society of America (ISA): S50.1, Compatibility of Analog Signals for Electronic Process Instruments.
 - 2. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. AB 1, Molded Case Circuit Breakers and Molded Case Switches.
 - c. ICS 2, Industrial Control Devices, Controllers and Assemblies.
 - 3. National Fire Protection Association (NFPA): 70.
 - 4. Canadian Electrical Code (CSA)

1.03 SYSTEM DESCRIPTION

- A. The APS Control System consists of the following major equipment:
 - 1. Four (4) Zone expandable Control System.

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2. Four (4) zones of temperature probes with 2- RTD transmitter probes per zone.
3. Four (4) Zone blowers - Variable Frequency Drive (VFD) speed controlled.
4. One (1) 75 hp 575V Biofilter blower VFD speed controlled.
5. Two (2) duct pressure and two (2) duct temperature sensors for controlling biofilter duct.
6. One (1) industrial grade 8 port Ethernet Switch for communications between the PC, PLC, remote I/O module and remote communications antenna to the City's Network.
7. One (1) Touch Screen Industrial Computer housed in a CSA 4X enclosure complete with a full sized swing-out panel and panel mounted heater to maintain a minimum temperature of 3° C.

B. The Leachate Tank monitor and Alarm system consists of the following major equipment:

1. One (1) level sensor.
2. One (1) remote high level Hi-Vis warning light.

C. Compost Mixer System consists of the following major equipment:

1. One (1) 400 Amp 575V Main Disconnect.
2. One (1) 150 hp 575V Soft Start Mixer.
3. Two (2) 20 hp 575 V conveyors FVNR Starter
4. One (1) 15 hp 575 V Power Pack
5. Mixer and Conveyor controls and alarms
6. Refer to Division 14 for mixer and conveyor details.

D. System shall be as shown on the Drawings and as described herein.

E. Test complete system for proper operation prior to shipment from equipment manufacturer's factory.

F. The design as presented in the Drawings and specifications is for general guidance only, but as such it establishes system concept and quality and workmanship minimums. It is the Contractor's responsibility to select materials and assemble and interconnect them so as to produce a system that is fully functional in all respects and will operate with a minimum of operator intervention and maintenance.

1.04 OPERATION PHILOSOPHY

A. The packaged control system will integrate the control, monitoring and smooth operation of the major equipment and instrumentation, whether operating in attended or unattended mode.

1.05 EQUIPMENT & SYSTEM OPERATIONAL SEQUENCE

A. Refer to system Process Control Narrative 13390 Supp-1 (attached).

B. In the event of an alarm the facility PLC will annunciate

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1.06 SUBMITTALS

A. General:

1. Panelboards and circuit breaker data.
2. Wiring devices.
3. Control relays.
4. Transformers.
5. Intrinsic safety barriers.
6. All instrumentation and control devices.

B. Shop Drawings:

1. All documents intended for review shall be submitted at the same time.
2. For all components or material, provide catalog information, descriptive literature, wiring diagrams, shop drawings, and any other documentation such as is required to fully describe components or material proposed.
3. Shop Drawings, catalog material, and dimensional layout drawings for control panels and enclosures.
4. Provide diagrams of prewired panels. Include in diagrams full details for control devices and auxiliary devices, for example, relays, alarms, fuses, lights, fans, and heaters.
5. Interconnection wiring diagrams that include numbered terminal designations showing external interfaces.
6. Drafting standards and symbols shall be consistent with construction documents.

C. Information Submittals:

1. Programmable Controller Submittals:
 - a. Complete set of user manuals.
 - b. Fully documented ladder logic listings.
 - c. Function listing for function blocks not fully documented by ladder logic listings.
 - d. Cross-reference listing.
2. Manufacturer's list of proposed spares, expendables, and test equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prior to shipment, include corrosive-inhibitive vapor capsules in shipping containers and related equipment as recommended by capsule manufacturer.

1.08 EXTRA MATERIALS

A. Spares, Expendables, and Test Equipment:

1. Selector Switch, Pushbutton, and Indicating Light: 20 percent, one minimum, of each type used.

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2. Light Bulb: 100 percent, 2 minimum, of each type used.
3. Fuse: 100 percent, 5 minimum, of each size and type used.
4. Surge Suppressors: 20 percent, one minimum, of each type used.

PART 2. PRODUCTS

2.01 MATERIALS

- A. All electrical equipment/components and the entire assembly shall bear the approval of the Canadian Standards Association or another accredited certification organization by the Standards Council of Canada. Where approval is not available, approval shall be secured by contacting:

Manitoba Department of Labour
Mechanical & Engineering Branch
500-401 York Avenue, Winnipeg, Manitoba, Canada R3C 0P8
TEL: (204) 945-3373 FAX: (204)948-2308
Attention: Electrical Inspector

2.02 SIGNAL CHARACTERISTICS

- A. Analog Signals, Current Type:
1. 4 to 20 mA dc signals conforming to ISA S50.1.
 2. Unless otherwise indicated for specific PICS Subsystem components, use the following ISA 50.1 options:
 - a. Transmitter Type: Number 2, two-wire.
 - b. Transmitter Load Resistance Capacity: Class L.
 - c. Fully isolated transmitters and receivers.
 3. Discrete signals, two-state logic signals using dc or 120V ac sources as indicated.
 4. Millivolt signals from thermocouples.
 5. Special Signals: Other types of signals used to transmit analog and digital information between field elements, transmitters, receivers, controllers, and digital devices.

2.03 CONTROL ENCLOSURE

- A. Rating
1. Non-Hazardous CSA 4.X
- B. Minimum Metal Thickness: 14 gauge.
- C. Doors: Pad lockable latching mechanisms.
- D. Cutouts shall be cut, punched, or drilled and finished smoothly with burrs removed.
- E. Access: Front, suitable for installation with back and sides adjacent to or in contact with other surfaces, unless otherwise specified.

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- F. Temperature Control:
 - 1. Size panels to adequately dissipate heat generated by equipment mounted on or in the panel.
 - 2. Provide cooling fans with air filters if required to dissipate heat.
 - 3. Provide thermostatically controlled heaters to maintain temperature above 4°C (40 degrees F).
- G. Lighting: Minimum of one door switch controlled internal fluorescent light for panels 0.34 cubic meters (12 cubic feet) and larger.
- H. Minimum of one 120-volt duplex GFI receptacle for panels 12 cubic feet and larger.
- I. Finish:
 - 1. Metallic External Surfaces (Excluding Aluminum and Stainless Steel): Special color as approved by City.
 - 2. Internal Surfaces: White enamel.
- J. Enclosure Manufacturers:
 - 1. Hoffman.
 - 2. Hammond
 - 3. Or approved equal in accordance with B6.
- K. Breather and Drains: Provide with NEMA 250, Type 4 and 4X panels.
 - 1. Manufacturer and Product: Crouse-Hinds; Model ECD18.

2.04 CONTROL PANEL ELECTRICAL

- A. Control Panels Without Motor Starters:
 - 1. Provide main circuit breaker and a circuit breaker for each individual branch circuit.
 - 2. Locate so as to provide clear view of and access to breakers when door is open. Group on single subpanel. Provide typed directory.
 - 3. Circuit Breakers:
 - a. Coordinate branch circuit breakers with main.
 - b. Branch Circuit Breakers: As required by load.
 - c. Breaker Manufacturers and Products:
 - 1) Square D.
 - 2) Allen-Bradley.
 - 3) ABB
- B. Wiring:
 - 1. ac Circuits:
 - a. Type: 600-volt, Type SIS stranded copper.
 - b. Size: For current to be carried, but not less than No. 14 AWG.
 - 2. Analog Signal Circuits:

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- a. Type: 600-volt stranded copper, twisted shielded pairs.
- b. Size: No. 18 AWG, minimum.
- 3. Other dc Circuits.
 - a. Type: 600-volt, Type SIS stranded copper.
 - b. Size: No. 18 AWG, minimum.
- 4. Separate analog and other dc circuits at least 6 inches from any ac power and control wiring.
- 5. Enclose wiring in sheet metal raceways or plastic wiring ducts.
- 6. Wire Identification:
 - a. Numbered and tagged at each termination.
 - b. Wire Tags: Shrink sleeve wire markers with legible machine printed markings and numbers. Do not use adhesive or taped-on tags.
- C. Wiring Interface:
 - 1. For analog and discrete signal, terminate at numbered terminal blocks.
 - 2. For voltages greater than 120V, terminate directly on component terminals.
- D. Terminal Blocks:
 - 1. Quantity:
 - a. For external connections.
 - b. Wire spare or unused panel mounted components to their panels' terminal blocks.
 - c. Spare Terminals: 20 percent of connected terminals, but not less than 10.
 - 2. General: Group to keep 120V ac circuits separate from 24V dc circuits.
 - a. Connection Type: Screw clamp with pressure plate.
 - b. Compression Clamp: Guides strands of wire into terminal.
 - c. Screws: Captive and self-locking.
 - d. Current Bar: Copper or treated brass.
 - e. Mounting:
 - 1) DIN rail.
 - 2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
 - 3) End Stops: One at each end of rail, minimum.
 - f. Wire Preparation: Stripping only.
 - g. Jumpers: Allow jumper installation without loss of space on terminal or rail.
 - h. Marking System:
 - 1) Terminal number shown on both sides of terminal block.
 - 2) Allow use of preprinted and field marked tags.
 - 3) Terminal strip numbers shown on end stops.
 - 4) Mark terminal block and terminal strip numbers as shown.
 - 3. Terminal Block, 120-Volt Power:
 - a. Rated Voltage: 600V ac.
 - b. Rated Current: 20 amp.
 - c. Wire Size: 22-12 AWG.

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- d. Spacing: 0.25 inch, maximum.
- e. Finger safe.
- 4. Terminal Block, Ground:
 - a. Wire Size: 22-12 AWG.
 - b. Spacing: 0.25 inch, maximum.
 - c. Grounding: Ground terminal blocks electrically grounded to the mounting rail.
- 5. Terminal Block, Fused, 24V dc:
 - a. Rated Voltage: 600V dc.
 - b. Rated Current: 6.3 amp.
 - c. Wire Size: 22-12 AWG.
 - d. Fuse: 5 by 20 GMA fuses.
 - e. Fuse Marking: Fuse amperage rating shown on top of terminal block.
 - f. Indication: LED diode 24V dc.
 - g. Leakage Current: 5.2 mA, maximum.
 - h. Spacing: 0.32 inch, maximum.
 - i. Finger safe.
- 6. Terminal Block, Fused, 120V ac:
 - a. Rated Voltage: 600 V ac.
 - b. Rated Current: 6.3 amp.
 - c. Wire Size: 22-12 AWG
 - d. Fuse: 5 by 20 GMA fuses.
 - e. Fuse Marking: Fuse amperage rating shown on top of terminal block.
 - f. Indication: Neon lamp 110V ac.
 - g. Leakage Current: 1.8 mA, maximum.
 - h. Spacing: 0.32 inch, maximum
 - i. Finger safe.
- E. Grounding: Internal copper grounding bus for ground connections on panels, consoles, racks, and cabinets.
- F. Relays:
 - a. Not Used
- G. Intrinsic Safety Barriers:
 - a. Not Used
- H. Programmable Controllers:
 - 1. Contractor shall provide fully assembled, fully programmed, and fully functional system, including all items required whether they are specifically called out or not.
 - 2. Wire the datahighway/network as indicated on the drawings.
 - 3. Provide additional hardware as indicated on the Drawings.
- I. Application Software

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1. Provide documented application software for a fully operational system except where otherwise indicated.
- J. Human Machine Interface (HMI)
1. The Contractor shall supply a computer based HMI system including:
 - a. Industrial PC including:
 - 1) 15" 1024 x 768 Rack Mount PPC
 - 2) Intel Atom N270 1.6GHz, 2GB RAM
 - 3) 3.5" 320GB HDD
 - 4) 5W Resistive Touch Screen.
 - 5) Dual Realtek RTL8111B Gigabit Ethernet
 - 6) Pentium II 300 MHz with 128 MB RAM minimum.
 - 7) WIN7 PRO (embedded version) operating system TTX Canada Inc. model R15IA7T-RKC3 or approved equal in accordance with B6.
 - b. HMI software
 - 1) The system shall utilize ISaGRAF software as a graphical interface to the control system as well as collecting, storing and reporting process, alarm and historical data.
 - c. Custom Programming
 - 1) Program all status, control, alarm and trending screens for parameters, status and control points identified in P&IDs and individual package specifications. Submit all screen design for Contract Administrator's approval.
- K. Front-of-Panel Devices:
1. Indicating Lights:
 - a. LED, push-to-test type, oiltight, industrial type with integral transformer for 120V ac applications.
 - b. Screwed on prismatic glass lenses in colors noted and factory engraved legend plates for service legend.
 - c. Manufacturers and Products: Allen-Bradley 800E.
 2. Pushbutton, Momentary:
 - a. Heavy-duty, oiltight, industrial type with full guard and momentary contacts rated for 15 amperes continuous at 120V ac.
 - b. Standard size legend plates with black field and white markings for service legend.
 - c. Manufacturers and Products: Allen-Bradley 800E.
 3. Selector Switch:
 - a. Heavy-duty, oiltight, industrial type with contacts rated for 120V ac service at 15 amperes continuous.
 - b. Standard size, black field, legend plates with white markings, for service legend.
 - c. Operators: Lever.
 - d. Single-hole mounting, accommodating panel thicknesses from 1/16 to

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1/4 inch.

2.05 INSTRUMENT TAG NUMBERS

- A. As shown on Drawings.

2.06 NAMEPLATES, NAMETAGS, AND SERVICE LEGENDS

- A. Nametags: Permanently mounted bearing tag number.
1. Panel Mounted: Plastic, located adjacent instrument, outside and inside panel.
 2. Field Mounted: Engraved Type 316 stainless steel, 22-gauge minimum thickness, attach with stainless steel screws.
- B. Service Legends (Attached to Instrument) and Nameplates:
1. Engraved, rigid, laminated plastic type. Provide service legends and nameplates to adequately describe functions of panel face mounted instruments. Attach with high-strength industrial glue or adhesive. Adhesive-back not allowed.
 2. Color: White with black letters. Letter height 1/8 inch.
 3. For each panel, face mounted laminated nameplate inscribed with the panel name and tag number. Color shall be white with black letters 1/2-inch high.
- C. Standard Light Colors and Inscriptions: Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

Tag	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Amber
FAIL	FAIL	Amber
HIGH	HIGH	Amber
AUTO	AUTO	White
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	White
REMOTE	REMOTE	Yellow
FORWARD	FORWARD	Red
REVERSE	REVERSE	Blue

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1. Standard Pushbutton Colors and Incriptions:
 - a. Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

Tag	Inscription(s)	Color
OO	ON OFF	Red Green
OC	OPEN CLOSE	Red Green
SS	START STOP	Red Green
FR	FORWARD REVERSE	Red Blue
RESET	RESET	Black
OCA	OPEN CLOSE AUTO	Red Green White
OOA	ON OFF AUTO	Red Green White
MA	MANUAL AUTO	Yellow White
EMERGENCY STOP	EMERGENCY STOP	Red

- b. Unused or noninscribed buttons shall be black.

2.07 ELECTRICAL SURGE AND TRANSIENT PROTECTION

- A. General: Equip control panels with surge-arresting devices to protect equipment from damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical devices.
- B. Suppressor Locations:
 1. At point of connection between each equipment item, including ac powered transmitters and its power supply conductors (direct wired equipment).
 2. On analog pairs at each end when the pair travels outside of building.
 3. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to design of equipment.
- C. Power Supply Suppressor Assemblies:
 1. Suitable for connection to 120-volt, single-phase power supplies EDCO "HSP SERIES."

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- D. Analog Signal Cable Suppressor Assemblies:
 - 1. Epoxy encapsulated within a phenolic enclosure.
 - 2. Flame retardant.
 - 3. Four lead devices; include a threaded mounting/grounding stud.
 - 4. Manufacturers and Products:
 - a. EDCO; SRA-64 Series.
 - b. Joslyn; Series 1800 and 1669.
- E. Grounding: Coordinate surge suppressor grounding in field panels and field instrumentation and suppressor manufacturer's requirements. Provide control panels with an integral copper grounding bus for connection of suppressors and other required instrumentation.

PART 3. EXECUTION

3.01 ELECTRICAL POWER AND SIGNAL WIRING

- A. Restrain control and signal wiring in control panels by slotted wiring ducts with cover.
- B. Install wiring crossing hinge so that the opening and closing of the door twists the wire without bending it. Protect bend area with a sleeve.
- C. Arrange wiring neatly, cut to proper length, and remove surplus wire. Install abrasion protection for wire bundles passing through holes or across edges of sheet metal.
- D. Use manufacturer's recommended tool with sized anvil for crimp terminations. No more than one wire may be terminated in a single crimp lug. No more than two lugs may be installed on a single screw terminal.
- E. Do not splice or tap wiring except at device terminals or terminal blocks.

3.02 PROTECTION

- A. Protect enclosures and other equipment containing electrical, instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules.
- B. During Work, periodically replace capsules in accordance with capsule manufacturer's recommendations. Replace capsules at Substantial Completion.

END OF SECTION

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1. LOOP DESCRIPTIONS

- A. The Process Instrumentation and Control System (PICS) will provide the function described hereinafter for each loop. These loop descriptions supplement the information presented on the Process & Instrumentation Diagrams (P&IDs) and in the specifications found in the Contract Documents.
- B. Refer to the PICS specification sections for details of the control functionality.

2. PROCESS INSTRUMENTATION AND CONTROL SYSTEM DESCRIPTION AND CONFIGURATION

- A. The supervisory control and data acquisition (SCADA) system for this Project consists of one new PLC and an HMI computer. The following is a brief description control systems.
 - 1. The new PLC will be located in the Main Control Panel (CP-100) at the location shown on the Contract drawings. The I/O signals related to the processes are shown on Drawings A-602. The interface between the Remote I/O module and the PLC will be via an Ethernet Network. The data is thus available to the PLC for feedback control and trending.
 - 2. A human-machine interface (HMI) computer complete with an Ethernet switch will be located in the facility's Mixing and Receiving Building as shown on Drawings A-603 and E-201. The HMI computer and associated HMI (ISAGRAF) software will be used by the operators to monitor and control facility's process equipment. Mount the HMI computer in a METAL Wall-Mount Laptop Computer Cabinet (ATLANTIC item number 4731000).

3. STANDARD CONTROL SYSTEM FEATURES AND FUNCTIONS

- A. These items are general in nature and describe the overall control philosophy for the facility. These features and functions will be provided for all unit processes and control loops:
 - 1. All control logic will be performed in the PLC
 - 2. Operator interface will be through process computer running the HMI software.
 - 3. All alarms will be logged and stored in the HMI database.
 - 4. All analog signals transmitted to the control system shall be scaled in the PLC and displayed on appropriate graphic screens in engineering units. All analog signals shall be trended. The trends shall be displayed on trend screens. If analog signals are used in computations (e.g. addition of individual flows to calculate total flow, flow totalization to compute volume, etc.), the results of the computations will be displayed on graphic screens in appropriate engineering unit . From the analog signals, the PLC will generate internal discrete signals (high high, high, low, low low, etc.), as required for alarming and control.
 - 5. Discrete alarm and status signals transmitted to, or generated by, the PLC will be

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- displayed on the appropriate graphic screens.
6. All timer settings, setpoints, and miscellaneous adjustments will be finalized during application software development or plant startup. All settings shall be easily adjustable from the HMI console.
 7. Motors will normally be operated remotely from the PLC. Local operation will only be used for startup, troubleshooting, and testing. Based on the specific conditions for starting and stopping a motor remotely, the PLC will provide a discrete maintained contact RUN signal to the motor control center or the motor starter. When the motor is operating in the remote mode, the PLC shall generate a MOTOR FAIL alarm for the following conditions:
 - a. Fail to Start: The motor is requested to run by the PLC. After a preset time delay following the motor run request, a motor ON status is not received from the motor control center.
 - b. Fail while Running: The motor is running based on a RUN request from the PLC. While the RUN request is present, the motor stops running. No time delay shall be included for this condition.
 8. When a MOTOR FAIL alarm occurs, the PLC shall de-energize the motor RUN signal. Before the motor can be re-started, the failure condition must be corrected, and the alarm must be acknowledged.
 9. As described herein, the PLC will provide two control modes for each PLC controlled device: MANUAL and AUTOMATIC. In AUTOMATIC mode, the PLC shall perform all control actions based upon programmed algorithms, the state of Input/Output (I/ O), and operator inputs. This mode will be the normal operating mode. In MANUAL mode, the operator will be able to manipulate the individual PLC outputs from the operator consoles. This mode will generally be used only when resting or repairing the control system equipment. Provide graphical AUTO/MANUAL, START /STOP, and OPEN/CLOSE function switches at the operator consoles to accomplish the above features. All necessary logic to ensure bumpless transfer between the MANUAL and AUTOMATIC modes will be provided. Please note that not all process equipment will be controlled through the PLC system.

4. LOOP DESCRIPTION FORMAT

- A. The loop descriptions are organized on a unit process basis. Each Loop Description is written with the following subheading: IPS FUNCTIONS, PLC FUNCTIONS, and HMI FUNCTIONS. The subheadings are defined as follows:
 1. IPS FUNCTIONS:
 - a. Instruments and Panels Subsystem (IPS) functions: These functions are performed by the field panels, instruments, sensors, hand switches, control valves, and local controls.
 2. PLC FUNCTIONS:
 - a. Programmable Logic Controller (PLC) functions: These functions are performed by new PLC installed under this Contract.

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3. HMI FUNCTIONS:
 - a. Human Machine Interface (HMI) functions: These functions are performed by the new computer running ISAGRAF software.

5. UNIT PROCESS – PROCESS FANS AND BIOFILTER

- A. The compost area for the Aerated Static Piles and the Biofilter consists of four compost fans (CF-101 through CF-104), one biofilter fan (BF-110), three pressure transmitters (PIT-110, PIT-120 and PIT-130), eleven temperature transmitters (TE/TIT-101A, TE/TIT-101B, TE/TIT-102A, TE/TIT-102B , TE/TIT-103A, TE/TIT-103B, TE/TIT-104A, TE/TIT-104B, TE/TIT-110, TE/TIT-120 and TE/TIT-130). The compost and biofilter fans, each will be adjustable speed controlled by a variable frequency drive.
- B. Compost Process Fan Loop Description
 1. The temperature of the compost piles located downstream of each compost fans will be monitored in two different locations via a wired temperature monitoring system and data transmitted to the PLC for monitoring and control purposes.
 2. There will be three modes of operation (i.e., PHASE I through PHASE III) associated with each compost process and associated compost fan as described below:
 - a. PHASE I (Pile Start)
 - 1) Step1. Condition: Initiate pile start.
Operation: Zero pile, vector attraction reduction (VAR), and process to further reduce pathogens (PRFP) Day Counts
 - 2) Step 2. Condition: Initiate pile start.
Operation: Begin pile Day Count.
 - 3) Step 3. Condition: Initiate pile start.
Operation: Pile process fan operates at 50 percent speed (operator-adjustable).
 - 4) Step 4. Condition: Start VAR Day Count when both temperature probes (TE/TIT-101A through TE/TIT-101B) measure greater than 45degrees C.
 - b. PHASE II (Regulatory Tracking)
 - 1) Step 1. Condition: Phase II initiated automatically or by Operator.
Operation: Pile process fan operates at 50 percent speed (operator adjustable).
 - 2) Step 2. Condition: Average temperature of three pile probes measures greater than 45degrees C.
Operation: Continue VAR day count.
 - 3) Step 3. Condition: Average temperature of three probes between 45 and 65 degrees C.
Operation: Pile process fan operates at 50 percent speed (operator-adjustable).

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- 4) Step 4. Start PFRP Day Count when the temperature of each temperature probe (TE/TIT-101A and TE/TIT-101B) measure greater than 55 degrees C.
- 5) Step 5. Increase Compost Fan No. 101 speed by 10 percent for each 30-minute interval when the average temperature of the temperature probes (TE/TIT-101A and TE/TIT-101B) is greater than 65 degrees C.
- 6) Step 6. Decrease Compost Fan No. 101 speed to minimum (i.e. 20 Hertz, operator-adjustable) when both temperature probes (TE/TIT-101A and TE/TIT-101B) measures less than 45 degrees C.
- 7) Step 7. Complete PFRP Day Count when both temperature probes measure greater than 55 degrees C for 72 hours.
- 8) Step 8. Switch to PHASE III after fourteen (14) days when both temperature probes (TE/TIT-101A through TE/TIT-101C) measure greater than 45 degrees C. Notify operator.
- c. PHASE III (Drying)
 - 1) Step 1. Decrease Compost Fan No. 101 speed to minimum (i.e. 20 Hertz) when average of both temperature probes (TE/TIT-101A and TE/TIT-101B) measure less than 45 degrees C.
 - 2) Step 2. Increase Compost Fan No. 101 speed by 10 percent for each 30 minutes interval when the average temperature of the three temperature probes (TE/TIT-101A and TE/TIT-101B) is greater than 55 degrees C (Operator-adjustable).
3. For all modes of operation listed above the following listed data will be read, recorded, or displayed as appropriate.
 - a. READ: Each probe temperature every 15 minutes.
 - b. RECORD:
 - 1) Each probe every 60 minutes.
 - 2) Daily average of each probe and both probes.
 - c. DISPLAY:
 - 1) Each Phase.
 - 2) Day Count from Pile Start.
 - 3) Day Count for temperature reading greater than 55°C.
 - 4) Day Count for temperature reading greater than 45°C.

6. LOOPS 10X (X= 1 THROUGH 4) – COMPOST FANS NO. 101 THROUGH 104:

6.01 IPS FUNCTIONS:

- A. Each compost fan is equipped with a variable frequency drive unit (VFD).
- B. The VFD panel provides for local manual control of the fan.

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- C. Transmit ON, IN REMOTE, FAIL status signals and also SPEED indication from VFD to PLC.
- D. Receive RUN signal and SPEED commands from PLC.

6.02 PLC FUNCTION:

- A. Receive and process ON, FAIL, IN REMOTE status signals and SPEED indication from drive panel.
- B. Provide RUN command and SPEED command signals to each drive.
- C. In REMOTE mode, provide controls as listed above under UNIT PROCESS – PROCESS FANS AND BIOFILTER:

6.03 HMI FUNCTION

- A. Display pump “ON” and “IN REMOTE” status, FAIL alarm and SPEED indication
- B. Provide for MANUAL and REMOTE control of the fan as listed above under Process Fans and Biofilter.

7. LOOP 110A – BIOFILTER FAN NO. 110:

7.01 IPS FUNCTIONS:

- A. Biofilter fan is equipped with a variable frequency drive unit (VED).
- B. The VFD panel provides for local manual control of the fan.
- C. Transmit ON, IN REMOTE, FAIL status signals and also SPEED indication from VFD to PLC.
- D. Receive RUN signal and SPEED commands from PLC.

7.02 PLC FUNCTIONS:

- A. Receive and process ON, FAIL, IN REMOTE status signals and SPEED indication from drive panel.
- B. Provide RUN command and SPEED command signals to each drive, In REMOTE mode, provide controls as listed above under Unit Process - Process Fans and Biofilter.
- C. The biofilter fan shall shutdown on high discharge pressure set-point by associated discharge pressure transmitter.

7.03 HMI FUNCTION:

- A. Display pump ON, IN REMOTE status, FAIL alarm and SPEED indication

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- B. Provide for MANUAL and REMOTE control of the fan as listed above under Unit Process - Process Fans and Biofilter

8. LOOP 110B– BIOFILTER FAN NO. 110 DISCHARGE PRESSURE AND FLOW

8.01 IPS FUNCTIONS:

- A. Measure and transmit pressure signal to PLC.

8.02 PLC FUNCTIONS:

- A. Receive pressure signal.
- B. Provide controls as listed above under Unit Process - Process Fans and Biofilter and also biofilter fan controls.

8.03 HMI FUNCTIONS:

- A. Display pressure.

9. LOOP 110C – BIOFILTER FANS COMMON DISCHARGE TEMPERATURE:

9.01 IPS FUNCTIONS:

- A. Measure and transmit temperature signals to PLC.

9.02 PLC FUNCTIONS:

- A. Receive and process temperature signal.
- B. Provide controls as listed above under Unit Process - Process Fans and Biofilter.

9.03 HMI FUNCTIONS:

- A. Display temperatures.