SECTION 44 31 21

BIOFILTER ODOUR CONTROL SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Specification covers the design, fabrication, assembly, delivery, installation, inspection, testing and commissioning of one (1) odour control biofilter system for the Winnipeg South End Water Pollution Control Centre (SEWPCC).

B. The odour control biofilter system broadly includes media and modular fiberglass media support system, humidification system, air heater (winterization) system and irrigation system components for a biofilter.

C. Contract Drawings show one potential equipment layout. Manufacturer may propose a different layout to suit the proposed equipment. Equipment arrangement shall not interfere with other system, equipment, operator access, etc. Manufacturer equipment layout shall be acceptable to the Contract Administrator. Any changes shall be at no additional cost to the City.

D. Like items of equipment specified hereunder shall be the end product of one manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's services.

E. A single manufacturer who, as a Subcontractor to the Contractor shall have sole-source responsibility for the design, testing, delivery and performance verification of the system and shall provide all components of the biofilter odour control system included in this section. Such manufacturer shall be referred to herein as the Biofilter System Manufacturer or Manufacturer. The Manufacturer shall furnish all components and accessories of the biofilter odour control system as necessary to ensure compatibility, ease of operation and maintenance and to place the system into operation in conformance with the specified performance, features, and functions.

1.2 REFERENCE CODES AND STANDARDS

A. ABMA Std. 9, Load Ratings and Fatigue Life for Ball Bearings.

B. ABMA Std. 11, Load Ratings and Fatigue Life for Roller Bearings

C. Air Movement and Control Association (AMCA): 300, Reverberant Room Method for Sound Testing of Fans.

D. American National Standards Institute (ANSI):
   1. ANSI B1.1, Unified Screw Threads.
   2. ANSI B1.20.1, Pipe threads, General Purpose.
   3. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800

4. ANSI B16.5, Pipe Flanges and Flanged Fittings.
5. ANSI B.18.2.1, Square and Hex Bolts and Screws, including Askew Head Bolts, Hex Cap Screws, and Log Screws.
6. ANSI B18.2.2, Square and Hex Nuts.

E. American Society for Testing and Materials (ASTM):
1. ASTM A276 Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
2. ASTM A307, Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
3. ASTM A320, Alloy-Steel Bolting Materials for Low Temperature Service.
4. ASTM A380, Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
5. ASTM A967, Specification for Chemical Passivation Treatment for Stainless Steel Parts.
6. ASTM C117, Test Method for Material Finer Than 75-□m (No. 200) Sieve in Mineral Aggregates by Washing.
7. ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.
8. ASTM D422, Test Method for Particle-Size Analysis of Soils.
9. ASTM D2563, Standard Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts.
10. ASTM D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
11. ASTM D2584, Standard Test Method for Ignition Loss of Cured Reinforced Resins.
12. ASTM D2996, Standard Specification for Filament Wound Fiberglass ("Glass-Fibre Reinforced Thermosetting Resin") Pipe.
13. ASTM D2997, Standard Specification for Centrifugally Cast Fiberglass ("Glass-Fibre Reinforced Thermosetting Resin") Pipe.
14. ASTM D4167, Standard Specification for Fiber-Reinforced Plastic Fans and Blowers.
15. ASTM E679, Standard Practice for Determination of Odor and Taste Thresholds By a Forced-Choice Ascending Concentration Series Method of Limits
16. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs for General Use.
17. ASTM F594, Specification for Stainless Steel Nuts.

F. American Welding Society (AWS)
1. AWS D1-6, Structural Welding Code – Stainless Steel.

G. European Committee for Standardization (CEN):
1. EN13725, Air Quality-Determination of Odour Concentration by Dynamic Olfactometry.

H. 2010 National Building Code of Canada (NBC) with 2011 Manitoba Amendments.

I. National Building Code of Canada.

J. National Fire Protection Association (NFPA)
1. NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

K. Specialty Steel Industry of North America (SSINA):
1. Specifications for Stainless Steel.

2. Design Guidelines for the Selection and Use of Stainless Steel.
3. Stainless Steel Fabrication.
4. Stainless Steel Fasteners.

L. The Canadian Standards Association (CSA).

M. Underwriters Laboratories Inc. of Canada (ULC).

N. All Work and materials shall comply with the Canadian Electrical Code and all applicable local regulations and ordinances. All panels and enclosures shall be provided with labels from either the Canadian Standard Association (CSA) or the Underwriter Laboratories of Canada (ULC or cUL).

1.3 DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

A. H_2S: Hydrogen sulphide

B. FRP: Fiberglass reinforced plastic

C. HDPE: High density polyethylene

D. OU: Odour Units (as quantified using CEN-EN13725), also referred to as OU/m^3

E. EBRT: Empty Bed Residence Time = volume that media occupies/air flow

F. OU/s: Odour emission rate

G. DT: Detection threshold

H. PLC: Programmable logic controller

I. ppmv: Parts per million by Volume

J. TSS: Total suspended solids

K. RSC: Reduced sulphur compound

L. RH: Relative humidity

M. Nm^3/hr: Air flow – normal cubic metre per hour (at absolute pressure of 1 bar and temperature of 20 degrees Centigrade

1.4 WORK INCLUDED

A. The Work of this Section includes providing the odour control (biofilter) system as specified in this Section.

B. See P&ID and layout drawings for additional information.

C. Unit Responsibility and Scope of Supply:
   1. The Work requires that the Biofilter System Manufacturer furnish items that include but are not limited to the following:
      a. Humidification system
         1) humidifier vessel(s) and internal structural members,
         2) media and media supports,
         3) mist eliminator(s)
         4) irrigation spray nozzle systems,
         5) recirculation pump(s),
         6) sampling points, associated piping (recirculation piping, blowdown piping and all ducting and piping marked on the associated Drawings).
      b. Foul air heater (winterization) system including heating coil and air filter
      c. Biofilter
         1) Media and media supports suitable for retrofit in existing structures (see Drawings)
         2) Spray nozzles and piping as required for irrigation of the media
      d. Instrumentation and control systems
         1) Complete with all accessories and appurtenances.
         2) P&IDs show minimum instrumentation and equipment required. The Biofilter Manufacturer shall provide any additional instruments or control devices, which may be required for the satisfactory operation of the whole system.
      e. Special Instrumentation
         1) Provide two (2) portable hydrogen sulphide meters (Type MSA ALTAIR) complete with data logger and software, field sensor calibration function, field carrying cases, and maintenance kits. Provide two Pitot tube sampling adapters and install on piping upstream the humidifier towers.
      f. See Drawings for additional information.
   2. The system shall be the end product of one responsible system manufacturer - the Biofilter System Manufacturer as defined above.
   3. The Biofilter System Manufacturer shall provide media and components suitable for the service conditions listed herein.
   4. The Biofilter System Manufacturer shall provide and guarantee the required performance listed herein.
   5. The Biofilter System Manufacturer shall furnish all components and accessories of the system to enhance compatibility, ease of operation and maintenance, and as necessary to place the equipment in operation in conformance with the specified performance, features and functions.
   6. The Biofilter System Manufacturer shall be responsible for the humidifier vessel design including all structural design requirements and material and component sizing.
   7. The Biofilter System Manufacturer shall provide all dampers, equipment, ductwork, piping and wiring within the package boundary as indicated in the Specifications and the Drawings.
   8. The Biofilter System Manufacturer shall review the specification and performance of Biofilter Exhaust Fans EF-T301 and EF-T302 specified under section 23 34 00 HVAC Fans and provide comments and design input as necessary for design coordination.

D. All electrical equipment shall be CSA/ULC listed explosion proof for use in Class 1, Zone 2, Group IIA.

1.5 SUBMITTALS

A. Consistent with Section 01 33 00, Submittal Procedures, and including:
   1. Detailed structural and mechanical layout drawings showing system fabrication, dimensions, size and locations of connections to other work and fully describing the humidification and surface irrigation systems. Include dry and operating weight of the system and concrete pad support requirement including anchoring requirement. Stamp the layout drawings by a Professional Engineer licensed in the Province of Manitoba.
   2. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.
   3. Provide process calculations showing that the media (s) as provided will meet the required performance criteria.
   4. A structural calculation of the system components including anchors.
   5. Manufacturer's information on the biofilter media, such as:
      a. Pressure drop data through media (s).
      b. Biofiltration media physical characteristics, including:
         1) Media Volume.
         2) Media Depth.
         3) Empty Bed Residence Time.
      c. Information on expected settling and compaction rates of the media per year.
      d. Biofilter pressure drop calculations.
      e. Operating data from previous installations to substantiate media performance claims.
   6. Pressure drop calculations of all systems components (filter and heating coil, humidifiers, biofilter, etc.)
   7. External utility requirements.
   8. Operation and Maintenance manuals in accordance to Section 01 78 23, Operation and Maintenance Data.
   9. Laboratory analysis of the media supplied.
   10. Process flow diagrams and process narrative.
   11. Wiring diagrams including point to point connections and terminal locations.

B. Control diagrams and instrumentation according to Section 40 99 90, Custom Package Control Systems.

C. Test Submittals:
   1. Submit a Detailed Performance Testing Plan which Includes:
      a. Test equipment and apparatus.
      b. Calibration and setup procedures.
      c. The specific testing methodology to be used.
      d. The sampling and analysis procedures.
   2. Submit a final report that provides a narrative of the sampling activities, a copy of the original sampling log, photographs showing locations of velocity and pressure measurements, tabular summary of velocity, pressure, H_2S and odour removal data, calculated results, and conclusions of these results.
   3. Revise the report according to the Contract Administrator's written comments, and resubmit.

1.6 QUALITY ASSURANCE SUBMITTALS

A. Manufacturer's Certification of Compliance that the factory finish system is identical to the requirements specified in Section 09 90 00, Painting and Coating or as required in this Specification.

B. Submit written certification from a Professional Engineer licensed in the Province of Manitoba stating that support systems, anchorage, and equipment have been designed according to requirements of the NBC for post-disaster structures at time of Shop Drawing submittal.

C. Resin manufacturer's certificate listing resin nomenclature, composition, and characteristics for humidifier (if applicable).

1.7 QUALITY CONTROL SUBMITTALS

A. Manufacturer's Certificate of Proper Installation.

B. Manufacturer's Training Program.

C. Equipment Testing and Field Startup Report.

D. Operation and Maintenance Manuals.

E. Operation and Maintenance Data.

F. Test Results (shop test): Control panels for proper operation.

1.8 QUALIFICATIONS

A. The proposed media type shall be proven and in service at other similar facilities for at least 5 years. Provide a list of at least three (3) successful installations of 8,500 Nm^3/hr capacity or larger that have been in operation for 10 years using the proposed media, with references. References must include names and phone contact numbers that can be verified.

B. The Biofilter System Manufacturer shall have personnel to provide training and monitoring support service available during the first year of operation.

C. The Odour Control System Manufacturer must be able to respond to any service requirement involving the biofilter within 24 hours.

1.9 STANDARD PERFORMANCE GUARANTEE

A. Biofilter System Manufacturer shall guarantee that the biofilter media as described in Clause 2.3.D. shall provide consistent foul air odour and H_2S removal in accordance with the specified removal efficiencies on a continuous basis for a period of 10 years from the date of a successful performance test at substantial completion. This performance guarantee is valid only if the biofilter is operated substantially within the service conditions as detailed in Clause 2.3, Service Conditions. If the biofilter media causes performance standards to not be met

within the guarantee period, the biofilter media system shall be replaced or modified per the following schedule:

1. 0 to ≤ 5 years: No cost to the City by the Biofilter System Manufacturer.
2. > 5 to ≤ 10 years: the City is to pay 50 percent of cost of media including transportation and installation.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Biofilter System Manufacturer shall provide explicit instructions and supervision, as necessary, to assure no damage occurs during delivery, handling and storage. Product delivery, storage, and handling shall be carried out by the Contractor as directed by the Biofilter System Manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Materials, equipment, components and accessories specified in this Section shall be products of:
   1. BIOREM Environmental, Inc with Biosorbens or XLD media.
   2. ECS Environmental Solutions with ECS BioPure media.

B. The Drawings show the layout and general arrangement of the biofilter and associated interfaces. The Manufacturer shall coordinate with the Contractor to provide all modifications to piping, mechanical layouts, sitework, structural, electrical, and controls to accommodate the equipment furnished and to meet the stated performance requirements.

2.2 DESIGN CRITERIA

A. The Biofilter System Manufacturer shall be responsible for incorporating any design modifications and upgrades as necessary to meet the performance criteria specified at no additional cost.

B. Dimensional Constraints: Refer to Contract Drawings. The Biofilter media shall be housed in three (3) equal sized existing concrete rectangular structures as identified on the Drawings. The humidifier(s) and foul air heating system shall be accommodated in an existing concrete structure as identified and dimensioned on the Drawings. All civil and structural work identified for these structures shall be completed by the Contractor, including but not limited to cleaning the vessels, providing access and duct penetrations and new cast in place concrete walls and structures, concrete restoration and protective coating, and other work as identified on the Drawings.

C. The system shall be designed to eliminate odorous compounds from the airstream from a wastewater treatment facility. The biofilter system will receive and treat a fouled air stream continuously from the following process areas in the facility:
   1. Rotary drum thickeners (RDT) servicing waste activated sludge, fermented primary sludge and sludge from a high rate clarifier
   2. Primary sludge fermenters

3. Raw sewage pump station wet wells
4. Screening channels
5. Aerated grit tanks
6. Vortex grit tanks
7. Primary clarifier scum hoppers and effluent weirs

D. The primary odorous compounds expected in the foul air stream are hydrogen sulphide and other reduced sulphur compounds, with smaller amounts of volatile organic compounds. Total reduced sulphide compounds include, but are not limited to, methyl mercaptan, ethyl mercaptan, carbonyl sulphide, carbon disulphide, dimethyl sulphide, and dimethyl disulphide.

2.3 SERVICE CONDITIONS

A. The Biofilter shall be designed to remove odorous constituents from process air stream under the following operating conditions:

Process Parameter	Value
Duty	Continuous
Air Flow	43600 Nm^3/hr
Elevation	approx. 230 metres above sea level
Inlet Process Air Temperature (prior to winterization system)	-5 to +38 degrees C
Foul air heater (Winterization) System outlet temperature (minimum)	+10 degrees C
Ambient Air Temperature:	-40 to +38 degrees C
Inlet RH (upstream of humidification system)	<30 to 70%
Odour Inlet	Average - 5,000 OU
	Peak - 10,050 OU
Organic Sulphide Inlet	Average – 1 ppm
	Peak – 5 ppm
H_2S inlet	Average – 11 ppm
	Peak – 80 pmm

Process Parameter	Value
Service water	**Normal source** Plant effluent (200 microns screened secondary treated wastewater from an integrated fixed film activated sludge plant, 5 to 25 degrees C, minimum 270 kPa) **Alternative Source** City Water (2 to 25 degree C, approx. 450 kPa) Service water residual chlorine is between 0.5 and 2 mg/L

B. The Biofilter design shall conform to the following parameters:

Design Parameter	Value
Minimum Empty Bed Residence Time	30 seconds.
Removal Required	H_2S: 99% removal. Odour: 90% removal for inlet odour concentration of greater than 6000 OU or discharge odour less than 600 OU. (Odour concentrations to be determined using ASTM E679 with a 20 litre/per minute odour panel presentation rate)

C. Allowable pressure drop through the biofilter cell shall be a maximum of 1000 Pascals at startup and shall not exceed 1250 Pascals over time.

D. Media Life: The engineered media shall have a minimum useful life of ten years. “Useful life” shall be defined to mean operation under the following conditions:
   1. No detectable degradation in the biofilter odour removal performance described in Clause 2.3B when operated and maintained in accordance with the Biofilter System Manufacturer’s written operations and maintenance requirements.
   2. An increase in air pressure drop that does not exceed the maximum allowable pressure drop specified above.
   3. The media life warranty is per Clause 1.9.

2.4 SYSTEM COMPONENTS

A. Biofilter
   1. Media:
      a. Media shall consist of inorganic, inert hydrophilic cores uniform in shape. The media shall be formulated with nutrients, buffering agents and adsorbents.
      b. Media shall not shrink or swell with varying moisture content.
      c. Supply media in super sacs or equivalent in order to facilitate media installation inside the biofilter structure using existing tank penetrations as shown on the Drawings.
   2. Media Support:
      a. The biofilter media support bed shall be a perforated flat floor type covering the entire air distribution plenum space for adequate and uniform air distribution of air.
      b. The biofilter media support shall be pultruded FRP from Fibergrate or approved equal in accordance with B8. All structural support elements shall be in FRP. The distance between the underside of media support floor and the concrete floor shall be 600 mm minimum.
      c. All anchors and bolting shall be stainless steel 316.
      d. Any modifications to the media support flooring system as required to fit in the confines of the biofilter structure shall be by the Contractor and shall be approved in writing by the media support manufacturer.
      e. Perforated circular duct buried in the media for air distribution is not acceptable.

B. Humidification System
   1. Humidifier Vessel:
      a. The biofilter manufacturer shall supply humidification vessel(s) to humidify the odourous air prior to treatment in the biofilter. The vessel(s) shall be assembled to the maximum extent possible at the manufacturer's facility to minimize field assembly.
      b. Vessels shall be suitably sized and ducting and piping/ducting shall be designed by the Manufacturer to allow for installation, operation and maintainability in the existing structure designated for housing this equipment (see Drawings). Equipment shall not restrict access to doors and openings.
      c. Construct humidification vessel(s) using FRP.
         1) Resin:
            a) Suitable for intended service.
            b) Liner Resin: Premium grade and corrosion resistant.
            c) Use the same resin throughout the vessel wall.
            d) Where vessel is exposed to sunlight add ultraviolet absorbers to surfacing resin to improve weather resistance.
            e) No dyes, pigments, or colorants except in exterior gel coat.
            f) No fillers or thixotropic agents.
         2) Curing System:
            a) Use resin manufacturer's currently recommended cure system.
            b) Apply gel coat after inspection of the laminate has been completed. Gel coat color shall match connected FRP ductwork.
            c) Cure all products to a minimum of 90 percent of the minimum Barcol hardness specified by resin manufacturer.

d) Measure Barcol hardness according to ASTM D2583
e) Post-cure the vessel and appurtenances in accordance with resin manufacturer's recommendation for time and temperature. Post-curing should be completed with warm-to-hot dry air, free of combustion products. Hot spots shall be avoided.
f) No MEKP cobalt catalyst system will be allowed. Cure both liner and structural wall with benzoyl peroxide-dimethyl aniline throughout.

3) Reinforcement:
a) Veil: Chemical surfacing mat, polyester fabric, 0.3 to 0.4 mm thick, with a finish and a binder compatible with the lay-up resin.
b) Corrosion Barrier: Resin-rich interior surface of nominal 2.5 to 3 mm using chopped strand mat backing the veil. Use no additive in the corrosion barrier.
c) Chopped Strand Mat: Type E glass, minimum 0.46kg/square meter, with silane finish and styrene soluble binder.
d) Continuous Roving Used in Chopper Gun for Spray-Up: Type E glass.
e) Woven Roving: Type E glass, nominal 0.82 kg/square meter, 4 by 5 weave, with silane type finish.
f) Continuous Roving Used for Filament Winding: Type E glass with a silane type finish, with a nominal yield of at least 242 strand yards per kg.

4) Laminate:
a) Use Hetron 922 with Nexus surface veil. C-veil is not acceptable.
b) Laminate: an inner surface (corrosion barrier), an interior layer, and an exterior layer.
c) Satisfy requirements of the mechanical properties and visual acceptance criteria in ASTM C582 and ASTM D2563, Level II for interior surface and Level III for exterior surfaces.
d) Reinforce inner surface with a resin-rich surfacing veil of 0.25 to 0.5 mm thick.
e) Resin content of the inner surface: a minimum of 80 percent by weight.
f) Construct interior layer of resin reinforced with at least two plies of chopped strand mat. Interior layer thickness: at least 2.5 mm.
g) Glass content of combined inner surface and interior layer shall be 27 percent plus or minus 5 percent.
h) Filament wound the exterior or structural layer. Make filament winding continuous strand roving to provide a glass content of 50 to 80 percent.

d. Hatches:
1) Provide access to the media for inspection and replacement, and liquid distribution nozzles for inspection and maintenance.
2) Vessel shall be fabricated with side access hatches to allow for media sampling and inspection of irrigation nozzles, and humidification packing and nozzles. The side access hatches shall be on the side of the wall where there is at least 1.2 m of access between any obstructions and the wall.

e. Gaskets:
1) If gaskets are required, use neoprene gaskets suitable for exposure to sewer gases.

2. Allowable pressure drop through the humidifier unit shall be a maximum of 400 Pascals at startup and shall not exceed 500 Pascals over time.

3. Media Support for Humidifier Vessel:
   a. FRP grating or suitable corrosion resistant material.
   b. Use operating size that prevents passage of humidifier media.
4. Media Irrigation System:
   a. Media irrigation water shall be provided by schedule 80 PVC pipe and/or polyethylene hose.
   b. Media irrigation system shall include:
      1) Manifold
      2) Media spray nozzles.
      3) Water supply totalizers.
      4) Normally-closed explosion proof solenoid valve.
      5) Water pressure indicators.
      6) Isolation ball valves.
      7) Water Y-strainer for water supply.
5. Recirculation System:
   a. Provide one (1) duty and one (1) standby pump for each humidification vessel to recirculated water from the humidifier sump to the irrigation system and waste excess water as necessary to maintain the liquid level, pH and other process conditions as determined by the Biofilter Manufacturer to maintain a fully functioning system.
   b. Pump shall be a horizontal end suction centrifugal pump. Magnetic drive. Materials suitable for the corrosive service of the system.
   c. The pump shall be of open impeller design capable of passing a 9.5 mm (3/8") diameter solid.
   d. Pump motor shall be 3 Phase/60 Hz/575 V and suitable for operation in a Class 1, Division 2, Group D environment. Pump motor shall be TEFC and inverter duty conforming to the applicable portion of Section 26 20 00, Low Voltage AC Induction Motors.
   e. The pump and its components shall be designed for continuous operation for the entire life of the odour control system.
   f. Provide motor starter for pumps in control panel
6. Mist Eliminator
   a. The humidifier vessel(s) shall house a mist eliminator pad, rated for 99.5% removal efficiency for droplets at 10 microns or larger.
   b. The mist eliminator pad shall be no less than 50 mm in thick.
   c. Manufacturer shall design and install a wash spray header with nozzles to flush the mist eliminator as necessary to minimize the pressure drop and maintain proper functioning of the mist eliminator.
   d. A differential pressure gauge shall be provided to measure the pressure drop across the unit. The gauge shall be located to be easily accessible and readable.
      1) Manufacturer: Ashcroft, Wika, Ametek
7. All manually operated valves shall be accessible from floor level.

C. Foul Air Heater (Winterization System):
   1. The biofilter manufacturer shall supply a foul air heating system to heat the odourous air during cold weather prior to humidification and treatment in the biofilter. The system shall utilize indirect heating (glycol loop) and shall be assembled to the maximum extent possible at the manufacturer's facility to minimize field assembly.

2. Provide local natural gas fired hot water boiler system including all control elements, instrumentation, piping, ducting, valves, expansion tank, intake and exhaust stacks, pumps and equipment necessary to make a complete operating system. Electric actuated valves shall be Rotork.
3. The boiler unit shall be condensing type and shall be installed in the humidifier room. Equipment shall conform to the requirements of NPFA 820. Areas within 0.9 m (3 ft) of leakage sources such as fans, dampers, flexible connections, flanges, pressurized unwelded ductwork, and odor-control vessels shall be shall be CSA/ULC approved and suitable for use in a Class 1, Zone 2, Group C hazardous area. The boiler shall be Lochinvar (no or equal will be accepted) as supplied by Wolseley Mechanical, 1300 St Matthews Ave, Winnipeg, Manitoba, or equivalent local supplier based in Winnipeg.
4. Provide heating coil including all flanged connections, necessary fittings and duct expansions required to form a complete system. Insert in duct system upstream of humidification system as shown on Drawings. The heating coil shall be preceded by a filter to protect the heating coil fins from undesirable air born solids.
5. Pressure gauges shall be insulated and heat traced.
6. Allowable pressure drop through the filter and heating coil shall be a maximum of 400 Pascals at startup and shall not exceed 500 Pascals over time.
7. Provide a glycol system including recirculation pumps and piping, expansion tank and 50/50 ethylene glycol mix.
8. All material exposed to foul air, such as the heating coil, shall be corrosion resistant and constructed of 316 Stainless steel
9. See Drawings for additional information.

D. Ductwork:
1. The Biofilter System Manufacturer shall provide type 316 stainless steel ducting as shown within the package boundary on the Drawings. Coordinate with the Contractor to provide flanged duct connections at package boundary for external ductwork connection.
2. The ductwork shall be designed for a full vacuum of the fan maximum suction pressure of 8000 pascals.

E. Nozzles:
1. Provide all flanged nozzles, threaded half and full coupling nozzles, and bottom drain nozzle as required.
2. All flanged nozzles for liquid service and both flanged nozzles for the liquid level indicator: ANSI B16.5, drilled for class 150, 520 kPag rated. All other nozzles: ASTM D3982 standard. Finish nozzles flush with the inside surface of the tank unless otherwise indicated.
3. Conically gusset all nozzles less than or equal to 150 mm in diameter (gussets to nozzle neck and plate type gussets are not acceptable).

2.5 ELECTRICAL COMPONENTS AND ACCESSORIES

A. General: Provide all necessary electrical components and wiring for a complete, functional system. Electrical components shall be provided in accordance with requirements of Division 26, Electrical.

B. Wiring: All wiring shall meet requirements of Section 26 05 21, Wires and Cables (0-1000V) - Electrical, and CEC. All insulation shall be rated 600V, minimum. Twisted shielded pair cable shall be used for all low-voltage (24V dc) signals.

C. Electrical Raceways: All electrical wiring shall be installed in conduit meeting requirements of Section 26 05 34, Conduits, Conduit Fasteners, and Conduit Fittings. All raceways shall be installed in accordance with Section 26 05 34, Conduits, Conduit Fasteners, and Conduit Fittings, and CEC.

D. Motors: Provide squirrel-cage AC induction motors meeting requirements of Section 26 20 00, Low-Voltage AC Induction Motors, and as specified herein.

E. Electrical Responsibilities: Manufacturer/supplier shall be responsible for all electrical conduits, wiring, and electrical appurtenances located on equipment, including terminal junction boxes for power and control circuits.

F. Motor Starters: In accordance with Section 26 29 10, Motor Starter to 600 V, supplied by equipment manufacturer and factory installed, connected, configured, and tested inside package control panels.

2.6 INSTRUMENTATION AND CONTROLS

A. General:
1. All controls and control panels shall be in accordance with requirements of Section 40 99 90, Package Control Systems.
2. Provide complete and functional system, including interfaces with plant PCS.
3. Provide variable frequency drives and full-voltage starters in package control panels for package system components. Each motor starter shall be equipped with electronic overloads in all three phases. Overloads shall be resettable without opening panel.
4. Segregate analog wiring in dedicated raceways.
5. Control components shall operate on 24 VDC or 120V ac power.
6. Provide instruments in accordance with Section 40 99 90, Package Control Systems and Section 40 91 01, Instrumentation and Control Components, unless specified otherwise. Provide industrial grade instruments suitable for intended service and environment.
7. Instrumentation and controls specified herein are minimum requirements. Equipment manufacturer shall provide additional components and features necessary to achieve intended function and provide safe and reliable operation of equipment supplied.

B. Control Panels:

Panel No.	Name	NEMA 250 Rating	Enclosure Material	Mounting
CP-T100	Winterization System Control Panel	4	Steel	Wall
CP-T200	Biofilter System Control Panel	4	Steel	Wall

1. Winterization System Control Panel Requirements:
   a. Main disconnect switch for 600V power supply, with lockable handle and interlocked with panel door.
   b. Control power transformer.
   c. Power Supply to Panel: Single 600V, 3-phase, 60 Hz supply. Power supply to all associated motors shall be obtained from associated panel.
   d. Operator Controls and Indicators including, but not limited to:
      1) System Running Indicating Light
      2) System Fault Indicating Light
      3) Glycol circulation pumps HAND/OFF/AUTO selector switches.
      4) System Temperature Alarms.
      5) Glycol Flow Alarms
   e. Process Control System Interface:
      1) Provide clearly labeled terminals for interface to the Plant Control System, including but not limited to the following:
         a) Dry contact with less than 2 mA minimum switching current at 24 VDC for Plant Control System discrete intput signals:
            (1) System Running
            (2) System Fault
            (3) Outlet Air Temperature High Alarm
            (4) Outlet Air Temperature Low Alarm
         b) Isolated Analog output signals to PLC Plant Controls System:
            (1) Inlet Air Temperature
            (2) Outlet Air Temperature
2. Biofilter System Control Panel Requirements:
   a. Main disconnect switch for 600V power supply, with lockable handle and interlocked with panel door.
   b. Control power transformer.
   c. Power Supply to Panel: Single 600V, 3-phase, 60 Hz supply. Power supply to all associated motors shall be obtained from associated panel.
   d. Operator Controls and Indicators:
      1) Touchscreen human-machine interface (HMI).
      2) System RESET pushbutton.
   e. Process Control System Interface:
      1) Provide clearly labeled terminals for interface to the Plant Control System, including but not limited to the following:
         a) Dry contact with less than 2 mA minimum switching current at 24 VDC for Plant Control System discrete intput signals:
            (1) System Running
            (2) System Fault
      2) Provide a single Modbus TCP interface for monitoring of all statuses and alarms, including but not limited to:
         a) Pump Statuses
         b) Valve Statuses
         c) Humidifier Towers Pressures, Flows, and Alarms
         d) Water Panel Flow Alarms
         e) Biofilter Temperatures and Pressures

f. Control System Requirements:
   1) PLC to be Schneider M580 PLC, no exceptions.
   2) OIT to be a Schneider XBT or GTO with a size of 12 inch or greater, no exceptions. OIT graphics to be consistent with the City document 612620-0015-40ER-0001 "HMI Layout and Animation Plan" and 612620-0014-40ER-0001 "Tagname Identification Standard".
   3) The panel mounted OIT will be fully replicated in the Plant HMI. Coordinate with the Systems Integrator to provide full replication of the OIT on the Plant HMI. Provide a means for operators to select either the local OIT or the Plant HMI as the active system.
   4) PLC and HMI programs shall have full read/write functionality when turned over to the City.

C. Instrumentation:
   1. Instrumentation shall include instrumentation shown on Drawings including, but not limited to:
      a. Winterization System
         1) Inlet and outlet temperature transmitters.
         2) Glycol system temperature transmitters.
         3) Temperature and Pressure Gauges
      b. Biofilter System
         1) Media temperature transmitters.
         2) Media differential pressure indicating transmitters.
         3) Water flow meters.
   2. As much as practical, instruments, solenoids, and other electrical devices shall be pre-mounted prior to shipment. Provide junction boxes for field terminations as required for all devices without terminals internal to the device.
   3. All electrical equipment shall be CSA/ULC approved and suitable for use in a Class I, Zone 2, Group D hazardous area.

2.7 ACCESSORIES

A. Lifting Lugs: Equipment weighing over 45 kg shall be equipped with stainless steel lifting lugs. Provide humidifier vessel(s) with a minimum of four lifting points located as recommended by the manufacturer.

B. All metal hardware: Type 316 stainless steel.

C. Design all internals to be easily removable through access hatches as shown on Drawings.

D. The back face of all flanges: Spot-faced, flat, and parallel to the flange face of sufficient diameter to accept an SAE metal washer under the bolt head or nut.

E. Press molded flanges are not acceptable.

F. Marking:
   1. Identify the humidifier tower(s) with the fabricator's name, maximum temperature, design pressure/vacuum, minimum thickness, vessel number, vessel name, and date of manufacture.

2. Seal decals, labels, etc. into the laminate exterior with clear resin.

G. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer.

H. Provide equipment tags for biofilter and all ancillary equipment including control panel.

I. Spare Parts:
1. Provide a list of recommended spare parts for the first year of operation and for the first five years of operation, including a price list and location of the nearest facility from which all spare parts can be obtained.
2. Provide the following spare parts:
a. Nozzle assembly for the internal irrigation system: One complete set for each internal irrigation system.
b. Nozzle assembly for the humidification vessel: One complete set for each humidification vessel.
c. Heating coil filter: 10 filters.

J. Provide sufficient pressure indicators to measure pressure differential across biofilter, foul air heating (winterization) and humidification systems.

K. Provide any special tools required for the maintenance of the equipment supplied. Special tools are defined as tools which are not normally available in mechanic's or millwright's tool kit and which are peculiar to the equipment supplied and not applicable to a range of equipment available from different Contractors.

2.8 FACTORY FINISHING

A. Manufacturer's standard coating and finish for corrosive and wet environment.

PART 3 EXECUTION

3.1 GENERAL

A. Packaged Equipment: When any system is provided as prepackaged equipment, coordination shall include space and structural requirements, clearances, utility connections, signals, outputs and features required by the manufacturer including safety interlocks.

3.2 INSTALLATION

A. General: The biofilter system to be supplied shall have most components installed in the factory with minimal requirements for field modifications to the system internals. The Biofilter System Manufacturer shall provide field supervision for the construction and installation of the system. The equipment will be installed by the Contractor.

B. Anchor Bolts: Provide accurate placement drawings or templates for anchor bolt and any other mounting details.

C. The Biofilter System Manufacturer shall ensure the equipment is installed as required to provide satisfactory service.

D. The Biofilter System Manufacturer shall instruct the Contractor in the methods and precautions to be followed in the installation of the equipment.

E. The Biofilter manufacturer shall supervise and cooperate with the installer as necessary.

F. Biofilter System Manufacturer to provide written instructions to the Contractor on method of handling and installation of the biofilter media.

G. Media Placement:
   1. Before placing support layer or media, remove any debris.
   2. Do not permit workers to walk or stand directly on media or media support layers. Use boards that will sustain worker's weight without displacing media.
   3. Do not compact layers media layers during placement.
   4. Use placement devices (for example, chutes, pouring spouts, and conveyors).
   5. Limit vertical free fall drop to final placement: Less than 1.5 m onto previous layer.
      a. For placements where drops are greater than specified, use placement device such that free fall below the device conforms to required distance.
      b. Limit free fall to prevent segregation of media fines and compaction.
   6. Finish top surface to prevent bed irregularities.
   7. Provide water spray as needed to keep media moist.
   8. Conveyors and Chutes:
      a. Design and arrange these systems such that media does not become segregated.

3.3 FIELD FINISHING (AND/OR CORROSION PROTECTION)

A. Field touchup coating systems as required.

3.4 FIELD QUALITY CONTROL

A. Provide Field Quality Control Tests:
   1. Conduct performance test on biofilter under actual or approved simulated operating conditions as follows:
      a. Test only after supplier approved acclimation period for the biofilter. Acclimation is not to exceed 3 weeks.
      b. Use portable hydrogen sulfide analyzer approved by Contract Administrator. Record inlet and outlet concentrations at least 15-minute intervals, or less.
      c. Biofilter media supplier to provide bottled hydrogen sulfide to augment natural concentration as necessary.
      d. Test under average loading conditions (11 ppm) for 4 continuous hours.
      e. Collect inlet and outlet tedlar bag samples once per hour for analysis by ASTM Standard of practice E-679.

3.5 MONITORING AND SERVICE:

A. For a period of 2 years following the date of commissioning of the biofilter systems, the Biofilter System Manufacturer shall provide a system monitoring package.

B. The monitoring package shall consist of, but not limited to, the following:
   1. Perform monitoring and service for a period of 2 years following the date of commissioning of the biofilter systems. The monitoring package should consist of, as a minimum, the following:
      a. Bacterial Enumeration
      b. Media pH
      c. Media Moisture Content
      d. Particle Size Analysis
      e. Nutrient Characterization
      f. Mineral Deposit Quantification
      g. Other parameters as required (application dependant)
   2. As a part of this service, data to be collected by the City would include:
      a. Inlet Air Temperature
      b. Media Differential Pressure
      c. Media Temperature
      d. Inlet Air Relative Humidity
      e. Flow Rate

C. The package shall include this service at a frequency of every three months. A quarterly report will summarize the collected and analytical data and will list deficiencies, recommendations and corrective actions.

D. The Biofilter System Manufacturer shall be familiar with the intricacies of providing long term service and monitoring contracts.

3.6 MANUFACTURERS' SERVICES

A. A representative for the Biofilter System Manufacturer shall be present at the job Site for the minimum person-days listed for the services hereunder, travel time excluded (a minimum of four separate trips to Site shall be provided):
   1. Two person-days for installation assistance, inspection, and certification of the installation. Provide certificate.
   2. Two person-days for start-up, commissioning and functional testing.
   3. Two person-days for performance testing.
   4. Two person-days for training
   5. One person-day for post-construction consultation to the Contract Administrator in order to assure the effective operation of the biofilter.

B. The manufacturer shall provide two training sessions, one for the City's operations staff and one for maintenance staff.

C. Attend during commissioning of the process systems, which include the equipment specified in this section and to ensure the equipment functions as intended in the process system.

END OF SECTION

SECTION 44 42 56.14

ROTARY LOBE PUMPS

EQUIPMENT AND COMPONENT NUMBERS

ID No.	Equipment Description
P-R301	WAS RDT Feed Pump
P-R302	WAS RDT Feed Pump
P-R303	WAS RDT Feed Pump
P-D405	TWAS Pump
P-D406	TWAS Pump
P-D411	FSL RDT Feed Pump
P-D412	FSL RDT Feed Pump
P-D413	FSL RDT Feed Pump
P-D414	FSL RDT Feed Pump
P-D418	TFS Pump
P-D419	TFS Pump
P-D420	TFS Pump
P-S401	Sludge Transfer Pump
P-S402	Sludge Transfer Pump

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Bearing Manufacturers Association (ABMA).
   2. American Iron and Steel Institute (AISI).
   3. American National Standards Institute (ANSI).
   4. ASTM International (ASTM):
      a. A48/A48M, Standard Specification for Gray Iron Castings.
      b. D2240, Standard Test Method for Rubber Property – Durometer Hardness.
   5. Hydraulic Institute Standards (ANSI/HI):
      a. 3.1-3.5, Rotary Pumps for Nomenclature, Definitions, Application and Operation.
      b. 3.6, Rotary Pump Tests.
   6. International Standards Organization (ISO):
      a. 10816-3, Mechanical Vibration – Evaluation of Machine Vibration by Measurements on Non-rotating Parts – Part 3: Industrial Machines with Nominal Power Above 15 kW and Nominal Speeds Between 120 r/min and 15000 r/min When Measured in Situ.
   7. National Electrical Manufacturers Association (NEMA): MG 1, Motors and Generators.
   8. 2010 National Building Code of Canada, with 2011 Manitoba Amendments (NBC).

1.2 DEFINITIONS

A. Terminology pertaining to pumping unit performance and construction shall conform to ratings and nomenclature of the Hydraulic Institute Standards.

1.3 SUBMITTALS

A. Furnish submittals in accordance with Section 01 33 00, Submittal Procedures.

B. Action Submittals:
   1. Shop Drawings:
      a. Make, model, weight, and horsepower of each equipment assembly.
      b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
      c. Performance data curves showing capacity vs. head, shaft power, and pump efficiency over entire operating range of pump, from shutoff to maximum capacity. Indicate separately head, shaft power, and efficiency at rated capacity.
      d. Detailed drawings showing equipment dimensions, arrangement, size and locations of connections, and weights of major equipment and components.
      e. Power and control wiring diagrams, including terminals and numbers.
      f. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including motor modifications.
      g. Factory finish system.

C. Informational Submittals:
   1. Certificates:
      a. Manufacturer’s Certificate of Compliance, in accordance with Section 01 43 33, Contractor Field Services, certifying that factory finish system is identical to requirements specified herein.
      b. Manufacturer’s Certificate of Proper Installation, in accordance with Section 01 43 33, Contractor Field Services.
   2. Manufacturer’s Instructions:
      a. Special shipping, storage and protection, and handling instructions.
      b. Manufacturer’s printed installation instructions.
      c. Suggested spare parts list to maintain equipment in service for period of 1 year and 5 years.
      d. List of special tools, materials, and supplies furnished with equipment for use prior to and during startup and for future maintenance.
   3. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
   4. Test and Inspection Reports:
      a. Factory Functional and Performance Test Reports.
      b. Field Functional and Performance Test Reports.

1.4 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following extra materials for each set of pumps of the same make and model:

Item	Quantity
Bearings	One complete set
Gaskets and O-ring seals	One complete set
Keys, dowels, pins, etc.	One complete set
Shaft sleeve	One
Mechanical seal	One
Rotors	One complete set
Wear plates	One complete set
Housing segments or radial liners	One complete set
Lubricants	One year supply
Any special tools required for routine maintenance	One complete set

B. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Pumps shall be of a standard and industry proven design, designed and sized for the full range of operating duties and conditions specified, and the selected units shall meet the specified requirements of minimum service life.

B. Coordinate pump requirements with motor manufacturer and be responsible for pump and motor requirements.

C. Where adjustable speed drives are required, coordinate pump and motor requirements with adjustable speed controller. Refer to Section 26 29 23, Variable Frequency Drives.

D. Design equipment, anchorage, and support systems for vertical and lateral loading in accordance with NBC.

2.2 MANUFACTURERS

A. Refer to Pump Data Sheets and Motor Data Sheets at end of section.

B. No “or-equal” or substitute products will be considered.

2.3 CONDITIONS OF SERVICE

A. Refer to Pump Data Sheets and Motor Data Sheets at end of section.

2.4 PERFORMANCE REQUIREMENTS

A. Refer to Pump Data Sheets and Motor Data Sheets at end of section.

B. Specified operating range of each pump shall be entirely within manufacturer's recommended allowable operating region of pump performance curve.

C. Pump and motor shall be suitable for continuous operation at any flow-head point within specified operating range.

D. Maximum required shaft power at any point on pump performance curve at maximum speed shall not exceed 90 percent of motor rated (nameplate) power, excluding motor service factor.

2.5 PUMP DESIGN

A. General:
1. Designed and fabricated for 24-hour continuous duty at any and all points within specified range of operation, without overheating and without excessive vibration or strain.
2. Parts shall be designed and proportioned to have liberal strength, stability, and stiffness and be especially adapted for service intended. Provide adequate space for inspection, repairs, and adjustment.
3. Working parts of pumps and motors, such as bearings, wearing rings, shaft, and shaft sleeves, shall be interchangeable between like units and such that the City may, at any time in future, obtain replacement and repair parts for those furnished in original equipment.
4. Nameplate ratings of motors shall not be exceeded, nor shall design service factor be reduced, when pump is operating at point on its characteristic curve up to maximum flow specified herein.
5. Provide mechanical equipment, including drives and electric motors in accordance with applicable OHSA regulations. Unless otherwise specified, provide rigid painted steel or stainless steel guards on rotating assemblies. Guards shall be removable only by use of a tool.
6. Noise level of pump system, unless otherwise noted, shall not exceed limits established by ANSI/HI 3.1-3.5, paragraph 3.3.17.3.
7. Lubrication fittings shall be brought to outside of equipment such that they are readily accessible from outside without necessity of removing covers, plates, housings, or guards.
8. Mechanical seals, wear plates, and rotors shall be replaceable by removing front cover of rotor housing without requiring disassembly of pump unit or pipe system.

B. Pump Casings:
1. Fabricated of ASTM A48, Class 30 or higher cast iron.
2. Pump Rotor Housing: Multi-piece to allow adjustment of rotor running clearance at least twice or shall include radial liners that can be replaced to restore running clearance.

C. Wear Plates:
   1. Rear of pump rotor casing and front cover shall be protected with replaceable wear plates having minimum Brinell hardness of 500.
   2. Front cover wear plate shall be reversible.
   3. Wear Plate Bolts: Bolts that secure wear plates to castings inside pump assembly shall be stainless steel, hex head type.

D. Rotors:
   1. Driven through positive timing gears running in oil.
   2. Solid cast-iron rotor cores shall be covered with layer of Buna-N having average durometer hardness of 70 per ASTM D2240. Alternatively, pump may utilize rotors with replaceable Buna-N 70 durometer tips.
   3. Geometry:
      a. Rotor core shall be same as that of finished rotor.
      b. Helical with three or four lobes to provide near pulse-less flow.
   4. Designed specifically for pumping wastewater sludge containing organic solids, small inorganic particles, and grit.

E. Shafts:
   1. Fabricated from alloy steel AISI 4140.
   2. Protected from wetting by fluid being pumped or fabricated of carbon steel with ceramic coated stainless steel sleeves through seal area.

F. Mechanical Seals:
   1. Mechanical style with silicon carbide or tungsten carbide seal faces. Cartridge style or component type mechanical seals that use bushings to permanently place seals are acceptable.
   2. Seal Holders: Fabricated of materials that are suitable for prolonged corrosion and chemical resistance.
   3. Pumps that utilize packing glands or require external flushing for lubrication and cooling are not acceptable.

G. Quench/Blocking Chamber:
   1. Oil-filled quench/blocking chamber located behind mechanical seal, and in front of bearing housing lip seal shall be molded into casting of pump.
   2. Chamber shall be suitable for fill, from side of pump, through nipples and have an external sight glass or oil bottle for visual inspection of status of mechanical seal operation.
   3. Oil shall provide lubrication and cooling of seals.

H. Inlet and Outlet Flanges:
   1. Port Connection: ANSI Class 150 flanges.
   2. Inlet and outlet ports shall be constructed of Type 316 stainless steel, fittings and flanges bolted to rectangular ports on pump casting.
   3. Ports shall be oriented horizontally without offset unless otherwise shown on Drawings.

I. Pump Front Cover:
   1. Provide access to pump chamber without requiring disconnecting pipe work or bearings.
   2. When opened, shall provide unhindered access to rotors, wear plate, and mechanical seals.

J. Bearings:
   1. Sized to withstand maximum radial or axial load carried by shafts for continuous duty.
   2. Bearing Life: Minimum ABMA L10 of 100,000 hours.

K. Timing Gears and Gear Housing:
   1. Meet AGMA Class 8 quality minimum.
   2. Keyed and timed to prevent contact between rotors and provide smooth and quiet transmission of load.
   3. Located in separate oil-filled, cast-iron gear box fitted with built-in sight glass to monitor oil level.

L. V-Belt Drive:
   1. Motor shall be mounted above pump on adjustable base that allows adjustment of belt tension.
   2. Drive shall consist of pulleys with separate hubs attached to shafts with keys.
   3. For motors larger than 2.2 kW, provide a minimum of two belts.
   4. Belts and pulleys shall be enclosed in removable metal guard that meets OHSA requirements. Guard shall allow measurement of pump rpm with strobe or contact meter without removing guard.

M. Structural Base: Pump shall be mounted on structural steel baseplate with structural channel supports as necessary, complete with couplings, guards, and mounting hardware.

2.6 ELECTRIC MotorS

A. Squirrel cage induction motor suitable for continuous duty.

B. Comply with requirements of Section 26 20 00, Low-Voltage AC Induction Motors.

C. For pumps with variable frequency drives, inverter duty rated suitable for operation with variable frequency drive specified in Section 26 29 23, Variable Frequency Drives.

D. Where required, provide motors with auxiliary external cooling fan to prevent overheating at low operating speeds. Provide all necessary transformers, wiring, and controls to operate fan when motor is running.

E. Refer to Motor Data Sheets at end of section for additional requirements.

2.7 VARIABLE FREQUENCY DRIVES

A. Provide variable frequency drives (VFDs) in accordance with the requirements of Section 26 29 23, Variable Frequency Drives. Equipment supplier is responsible for coordination of pumps, motors, and VFDs supplied.

2.8 ACCESSORIES

A. Lifting Lugs: Provide suitably attached for equipment assemblies and components weighing over 45 kg.

B. Equipment Identification Plates: In accordance with Section 40 05 53, Identification Labels for Equipment, Fabricated Tanks, Valves and Piping Systems.

C. Anchor Bolts: Type 316 stainless steel, sized by equipment manufacturer, and as specified in Section 05 50 00, Metal Fabrications (Basic).

2.9 FACTORY FINISHING

A. Manufacturer to prepare, prime, and finish coat in accordance with Section 09 90 00, Painting and Coating.

2.10 SOURCE QUALITY CONTROL

A. Functional Tests:
   1. Test all pumps actually furnished.
   2. Test in accordance with latest edition of Hydraulic Institute Standards.
   3. Hydrostatic Test:
      a. Test liquid-containing components of pump including, as a minimum, pump casing, inlet and outlet ports, and front cover.
      b. Test pressure to be 150 percent of maximum allowable working pressure. Maintain test pressure for not less than 10 minutes.
      c. No visible leakage is allowed.
   4. Operating Temperatures: Temperature of bearing housing surfaces at rated speed shall not exceed manufacturer’s recommendations.
   5. Leakage: No visible leakage from mechanical seals, gaskets, and oil chambers is allowed.
   6. Pump Vibration Test:
      a. Test pump at rated speed in accordance with ISO 10816-3.
      b. Statically and dynamically balance rotating assembly prior to final assembly.
      c. Limits:
         1) Driving Unit Alone: Less than 80 percent of NEMA MG 1 limits.
         2) Complete Rotating Assembly Including Motor and Drive: Less than limits established in ISO 10816-3, Category A.
   7. Test Records and Report: Prepare and submit complete test report along with test records, certified correct by authorized representative of pump manufacturer, for each test performed.

B. Performance Tests:
   1. Test all pumps actually furnished.
   2. Test in accordance with ANSI/HI 3.6, Type IV.
   3. Flow, Head, Power, and Efficiency:
      a. Perform test at rated speed.
      b. Test results shall be evaluated against rated capacity, head, power, and efficiency shown on accepted Shop Drawings.
      c. Acceptance Criteria: ANSI/HI 3.6 Acceptance Level A.
      d. Make any necessary modifications and adjustments and retest to bring pumps into compliance with acceptance criteria.
   4. Test Records and Report: Prepare and submit complete test report along with test records, certified correct by authorized representative of pump manufacturer, for each test performed.

C. Motor Tests: In accordance with Section 26 20 00, Low-Voltage AC Induction Motors.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in strict accordance with manufacturer's printed instructions.

B. Level base by means of steel wedges (steel plates and steel shims). Wedge taper not greater than 1 in 50. Use double wedges to provide level bearing surface for pump and driver base. Accomplish wedging so there is no change of level or springing of baseplate when anchor bolts are tightened.

C. Adjust pump assemblies so driving units are properly aligned, plumb, and level with driven units and interconnecting shafts and couplings. Do not compensate for misalignment by use of flexible couplings.

D. After pump and driver have been set in position, aligned, and shimmed to proper elevation, grout space between bottom of baseplate and concrete foundation with a poured, nonshrinking grout of the proper category, as specified in Section 03 60 00, Grouting. Remove leveling wedges after grout is set and pack void left with grout.

E. Connect suction and discharge piping without imposing strain to pump flanges.

F. Anchor Bolts: Accurately place using equipment templates and as specified in Section 05 50 00, Metal Fabrications.

3.2 FIELD FINISHING

A. Equipment as specified in Section 09 90 00, Painting and Coating.

3.3 FIELD QUALITY CONTROL

A. Conduct testing as specified in Section 01 91 14, Equipment Testing and Facility Startup.

B. Functional Tests:
   1. Conduct on each pump.
   2. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
   3. Operating Temperatures and Vibration: Monitor bearing areas on pump and motor for abnormally high temperatures or vibrations.
   4. Pump Vibration Test:
      a. Test fully assembled pump at rated speed and specified rated capacity in accordance with ISO 10816-3.
      b. Test with unit installed and in normal operation and discharging to connected piping system, and with actual building structures and foundations provided.
      c. Vibration shall not exceed limits specified in ISO 10816-3, Category A.
      d. If units exhibit vibration in excess of the limits specified, adjust or modify as necessary to bring units into compliance. Units that cannot be adjusted or modified to conform as specified shall be replaced at no cost to the City.

e. Provide instrumentation in current calibration to measure pump vibration at locations outlined in Hydraulic Institute Standards.

5. Test Records and Report: Prepare and submit complete test report along with test records.

C. Performance Test:

1. Conduct on each pump.
2. Perform under normal operating conditions at rated speed.
3. Test for continuous 3-hour period without malfunction.
4. Flow, Head, Power, and Efficiency:
   a. Measure and record pump flow rate, pump suction and discharge pressures (corrected for gauge elevation and velocity head), motor amperage, and voltage.
   b. Calculated differential head at rated capacity shall meet or exceed rated head specified.
   c. Calculated shaft power at rated capacity shall not exceed power shown on accepted factory test results.
5. Use of plant instrumentation is allowed for tests. Provide additional instrumentation as required to obtain required test data.
6. Test Records and Report: Prepare and submit complete test report along with test records.

3.4 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by the City, for minimum person-days listed below, travel time excluded:

1. Two person-days for installation assistance and inspection.
2. Two person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
3. Two person-days for pre startup classroom or Site training.
4. Two person-days for facility startup.
5. Two person-days for post-startup training of the City's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by the City.

B. See Section 01 43 33, Contractor Field Services and Section 01 91 14, Equipment Testing and Facility Startup.

3.5 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification.

1. Pump Data Sheets.
2. Motor Data Sheets.

END OF SECTION

PUMP DATA SHEET NO. 1
WAS RDT FEED PUMPS P-R301, P-R302, P-R303

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Bioreactors

Service: Waste Activated Sludge

Pump Name: WAS RDT Feed Pumps

Equipment Tag Number(s): P-R301, P-R302, P-R303

Manufacturer and Model: (1) Vogelsang; VX136-280QD
(2) Borger; FL 518
(3) _____

Number of Pumps Required: 3	Pump Type: Rotary lobe

Drive Type: ☐ Constant Speed ☐ Two Speed ☒ Variable Speed

LIQUID PROPERTIES	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: Waste activated sludge	Capacity (m^3/hr): Rated: 80 2nd: 32 3rd: _____	Ambient Temperature (°C): Min: 5 Max: 40
Fluid Temperature (°C): Min: 5 Normal: 10-20 Max: 25	Differential Pressure (kPa): Rated: 275 2nd: 60 3rd: _____	Relative Humidity (%): Min: 0 Max: 100
Specific Gravity: 1.0-1.01 @ 20 °C		
Vapour Pressure (kPa): 2.5 @ 20 °C	Suction Pressure (kPa): Rated: 10 2nd: 40 3rd: _____	Altitude (m): 227.8
Viscosity (cp): 1-10 @ 20 °C		☒ Indoor ☒ Heated
pH: 6.5-7.5	Discharge Pressure (kPa): Rated: 285 2nd: 100 3rd: _____	☐ Outdoor ☐ Unheated
Total Suspended Solids (% by wt.): 0.5-2.0		Electrical Area Classification: Unclassified
Corrosion/Erosion/Abrasion Caused By: Small amounts of suspended grit and sand	NPSH Available (m): Rated: 11.2 2nd: 14.2 3rd: _____	
Remarks: _____	Remarks: _____	Remarks: _____

PERFORMANCE REQUIREMENTS		
Max. Pump Speed (rpm): 300	Min. Solids Passage (mm): 40	Factory Testing:
Min. Pump Speed (rpm): TBD by mfr.	Min. NPSH Margin Ratio: 1.5	☒ Functional ☒ Performance
Speed at Rated Capacity (rpm): TBD by mfr.		Field Testing:
Max. Power at Rated Capacity (kW): 10.0		☒ Functional ☒ Performance
		Hydrostatic Test Pressure (kPag):
		150% of MAWP

Remarks: _____

PUMP DATA SHEET NO. 1 (cont'd)
WAS RDT FEED PUMPS P-R301, P-R302, P-R303

PUMP CONSTRUCTION DETAILS

Nozzles						Miscellaneous Connections		
	NPS (mm)	ANSI Class	Facing	Location			Size (mm)	Location
Suction	150	150	FF	Side		Drain		
Discharge	150	150	FF	Side		Vent		

Rotors:
Type: Three or four lobe
Size: TBD by mfr.

Suction Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Discharge Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Motor Coupling:
☐ In-line ☒ V-belt (overhead)

Packing:
Type: n/a
Manufacturer: n/a
Size/No. of Rings: n/a

Mechanical Seal:
Type: As specified
Manufacturer: Mfr.'s std.
Model: Mfr.'s std.
Lubrication: Oil

Bearings:
Radial (type/no.): Mfr.'s std.
Thrust (type/no.): Mfr.'s std.
Min. ABMA B-10 Life: 100,000 hrs
Lubrication: ☐ Grease ☒ Oil

Shaft Coupling:
Type: n/a
Manufacturer: n/a
Model: n/a

Remarks: _____

MATERIALS OF CONSTRUCTION

Pump Casing: Cast iron, ASTM A48	Wear Plates: Hardened steel	Shaft: AISI 4140
Cover Plates: Cast iron, ASTM A48	Baseplate: Fabricated steel	Shaft Sleeve: Stainless steel
Ports: Type 316 stainless steel	O-rings and Seals: Buna-N	
Rotors: Cast iron, ASTM A48		
Rotor Coating: Buna-N		

Remarks: _____

ADDITIONAL REQUIREMENTS

_____

MOTOR DATA SHEET NO. 1
WAS RDT FEED PUMPS P-R301, P-R302, P-R303

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Bioreactors

Service: Waste Activated Sludge

Pump Name: WAS RDT Feed Pumps

Equipment Tag Number(s): P-R301, P-R302, P-R303

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 11.2 ☐ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Per CAN/CSA-C390 Table 3
Voltage: 575	Guaranteed Minimum Power Factor at Full Load (%): Mfr.'s std.
Phase: 3	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1200	Mounting Type: ☒ Horizontal ☐ Vertical
☐ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☒ Multi-speed Speed (rpm): Min. 120 Max. 1200	☒ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: 10 to 100 % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☒ Constant Torque ☐ Constant Power	☒ Thermal Protection: Thermistors, one per phase ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low Voltage AC Induction Motors.

PUMP DATA SHEET NO. 2
TWAS PUMPS P-D405, P-D406

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Thickening

Service: Thickened Waste Activated Sludge

Pump Name: TWAS Pumps

Equipment Tag Number(s): P-D405, P-D406

Manufacturer and Model: (1) Vogelsang; VX136-105QD

(2) Borger; PL 200

(3) _____

Number of Pumps Required: 2	Pump Type: Rotary lobe

Drive Type: ☐ Constant Speed ☐ Two Speed ☒ Variable Speed

LIQUID PROPERTIES	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: Thickened waste activated sludge	Capacity (m^3/hr): Rated: 16 2nd: 1.6 3rd: _____	Ambient Temperature (°C): Min: 5 Max: 40
Fluid Temperature (°C): Min: 5 Normal: 10-20 Max: 25	Differential Pressure (kPa): Rated: 862 2nd: 15 3rd: _____	Relative Humidity (%): Min: 0 Max: 100
Specific Gravity: 1.0-1.05 @ 20 °C		
Vapour Pressure (kPa): 2.5 @ 20 °C	Suction Pressure (kPa): Rated: -10 2nd: 10 3rd: _____	Altitude (m): 234.0
Viscosity (cp): 100-2500 @ 20 °C		☒ Indoor ☒ Heated
pH: 6.5-7.5	Discharge Pressure (kPa): Rated: 852 2nd: 25 3rd: _____	☐ Outdoor ☐ Unheated
Total Suspended Solids (% by wt.): 3-7		Electrical Area Classification: Unclassified
Corrosion/Erosion/Abrasion Caused By: Small amounts of suspended grit and sand	NPSH Available (m): Rated: 8.9 2nd: 10.8 3rd: _____	
Remarks: _____	Remarks: _____	Remarks: _____

PERFORMANCE REQUIREMENTS		
Max. Pump Speed (rpm): 300	Min. Solids Passage (mm): 40	Factory Testing:
Min. Pump Speed (rpm): TBD by mfr.	Min. NPSH Margin Ratio: 1.5	☒ Functional ☒ Performance
Speed at Rated Capacity (rpm): TBD by mfr.		Field Testing:
Max. Power at Rated Capacity (kW): 13.4		☒ Functional ☒ Performance
		Hydrostatic Test Pressure (kPag):
		150% of MAWP

Remarks: _____

PUMP DATA SHEET NO. 2 (cont'd)
TWAS PUMPS P-D405, P-D406

PUMP CONSTRUCTION DETAILS

Nozzles						Miscellaneous Connections		
	NPS (mm)	ANSI Class	Facing	Location			Size (mm)	Location
Suction	100	150	FF	Side		Drain		
Discharge	100	150	FF	Side		Vent		

Rotors:
Type: Three or four lobe
Size: TBD by mfr.

Suction Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Discharge Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Motor Coupling:
☐ In-line ☒ V-belt (overhead)

Packing:
Type: n/a
Manufacturer: n/a
Size/No. of Rings: n/a

Mechanical Seal:
Type: As specified
Manufacturer: Mfr.'s std.
Model: Mfr.'s std.
Lubrication: Oil

Bearings:
Radial (type/no.): Mfr.'s std.
Thrust (type/no.): Mfr.'s std.
Min. ABMA B-10 Life: 100,000 hrs
Lubrication: ☐ Grease ☒ Oil

Shaft Coupling:
Type: n/a
Manufacturer: n/a
Model: n/a

Remarks: _____

MATERIALS OF CONSTRUCTION

Pump Casing: Cast iron, ASTM A48	Wear Plates: Hardened steel	Shaft: AISI 4140
Cover Plates: Cast iron, ASTM A48	Baseplate: Fabricated steel	Shaft Sleeve: Stainless steel
Ports: Type 316 stainless steel	O-rings and Seals: Buna-N	
Rotors: Cast iron, ASTM A48		
Rotor Coating: Buna-N		

Remarks: _____

ADDITIONAL REQUIREMENTS

_____

MOTOR DATA SHEET NO. 2
TWAS PUMPS P-D405, P-D406

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Thickening

Service: Thickened Waste Activated Sludge

Pump Name: TWAS Pumps

Equipment Tag Number(s): P-D405, P-D406

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 14.9 ☐ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Per CAN/CSA-C390 Table 3
Voltage: 575	Guaranteed Minimum Power Factor at Full Load (%): Mfr.'s std.
Phase: 3	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1200	Mounting Type: ☒ Horizontal ☐ Vertical
☐ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☒ Multi-speed Speed (rpm): Min. 120 Max. 1200	☒ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: 10 to 100 % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☒ Constant Torque ☐ Constant Power	☒ Thermal Protection: Thermistors, one per phase ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low Voltage AC Induction Motors.

PUMP DATA SHEET NO. 3
FSL RDT FEED PUMPS P-D411, P-D412, P-D413, P-D414

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Thickening

Service: Fermented Sludge (blend of primary sludge, fermented primary sludge, and high rate clarifier sludge)

Pump Name: FSL RDT Feed Pumps

Equipment Tag Number(s): P-D411, P-D412, P-D413, P-D414

Manufacturer and Model: (1) Vogelsang; VX136-280QD
(2) Borger; FL 518
(3) _____

Number of Pumps Required: 4	Pump Type: Rotary lobe

Drive Type: ☐ Constant Speed ☐ Two Speed ☒ Variable Speed

LIQUID PROPERTIES	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: Fermented sludge	Capacity (m^3/hr): Rated: 80 2nd: 32 3rd: _____	Ambient Temperature (°C): Min: 5 Max: 40
Fluid Temperature (°C): Min: 10 Normal: 15-20 Max: 25	Differential Pressure (kPa): Rated: 275 2nd: 45 3rd: _____	Relative Humidity (%): Min: 0 Max: 100
Specific Gravity: 1.0-1.05 @ 20 °C		
Vapour Pressure (kPa): 2.5 @ 20 °C	Suction Pressure (kPa): Rated: 20 2nd: 60 3rd: _____	Altitude (m): 227.0
Viscosity (cp): 5-100 @ 20 °C		☒ Indoor ☒ Heated
pH: 6.5-7.5	Discharge Pressure (kPa): Rated: 295 2nd: 105 3rd: _____	☐ Outdoor ☐ Unheated
Total Suspended Solids (% by wt.): 1-4		Electrical Area Classification: Unclassified
Corrosion/Erosion/Abrasion Caused By: Small amounts of suspended grit and sand	NPSH Available (m): Rated: 12.2 2nd: 15.5 3rd: _____	
Remarks: _____	Remarks: _____	Remarks: _____

PERFORMANCE REQUIREMENTS		
Max. Pump Speed (rpm): 300	Min. Solids Passage (mm): 40	Factory Testing:
Min. Pump Speed (rpm): TBD by mfr.	Min. NPSH Margin Ratio: 1.5	☒ Functional ☒ Performance
Speed at Rated Capacity (rpm): TBD by mfr.		Field Testing:
Max. Power at Rated Capacity (kW): 10.0		☒ Functional ☒ Performance
		Hydrostatic Test Pressure (kPag):
		150% of MAWP

Remarks: _____

PUMP DATA SHEET NO. 3 (cont'd)
FSL RDT FEED PUMPS P-D411, P-D412, P-D413, P-D414

PUMP CONSTRUCTION DETAILS

Nozzles						Miscellaneous Connections		
	NPS (mm)	ANSI Class	Facing	Location			Size (mm)	Location
Suction	150	150	FF	Side		Drain		
Discharge	150	150	FF	Side		Vent		

Rotors:
Type: Three or four lobe
Size: TBD by mfr.

Suction Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Discharge Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Motor Coupling:
☐ In-line ☒ V-belt (overhead)

Packing:
Type: n/a
Manufacturer: n/a
Size/No. of Rings: n/a

Mechanical Seal:
Type: As specified
Manufacturer: Mfr.'s std.
Model: Mfr.'s std.
Lubrication: Oil

Bearings:
Radial (type/no.): Mfr.'s std.
Thrust (type/no.): Mfr.'s std.
Min. ABMA B-10 Life: 100,000 hrs
Lubrication: ☐ Grease ☒ Oil

Shaft Coupling:
Type: n/a
Manufacturer: n/a
Model: n/a

Remarks: _____

MATERIALS OF CONSTRUCTION

Pump Casing: Cast iron, ASTM A48	Wear Plates: Hardened steel	Shaft: AISI 4140
Cover Plates: Cast iron, ASTM A48	Baseplate: Fabricated steel	Shaft Sleeve: Stainless steel
Ports: Type 316 stainless steel	O-rings and Seals: Buna-N	
Rotors: Cast iron, ASTM A48		
Rotor Coating: Buna-N		

Remarks: _____

ADDITIONAL REQUIREMENTS

_____

MOTOR DATA SHEET NO. 3
FSL RDT FEED PUMPS P-D411, P-D412, P-D413, P-D414

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Thickening

Service: Fermented Sludge

Pump Name: FSL RDT Feed Pumps

Equipment Tag Number(s): P-D411, P-D412, P-D413, P-D414

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 11.2 ☐ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Per CAN/CSA-C390 Table 3
Voltage: 575	Guaranteed Minimum Power Factor at Full Load (%): Mfr.'s std.
Phase: 3	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1200	Mounting Type: ☒ Horizontal ☐ Vertical
☐ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☒ Multi-speed Speed (rpm): Min. 120 Max. 1200	☒ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: 10 to 100 % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☒ Constant Torque ☐ Constant Power	☒ Thermal Protection: Thermistors, one per phase ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low Voltage AC Induction Motors.

PUMP DATA SHEET NO. 4
TFS PUMPS P-D418, P-D419, P-D420

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Thickening

Service: Thickened Fermented Sludge

Pump Name: TFS Pumps

Equipment Tag Number(s): P-D418, P-D419, P-D420

Manufacturer and Model: (1) Vogelsang; VX136-105QD

(2) Borger; PL 200

(3) _____

Number of Pumps Required: 3	Pump Type: Rotary lobe

Drive Type: ☐ Constant Speed ☐ Two Speed ☒ Variable Speed

LIQUID PROPERTIES	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: Thickened fermented sludge	Capacity (m^3/hr): Rated: 33 2nd: 3.3 3rd: _____	Ambient Temperature (°C): Min: 5 Max: 40
Fluid Temperature (°C): Min: 5 Normal: 10-20 Max: 25	Differential Pressure (kPa): Rated: 862 2nd: 10 3rd: _____	Relative Humidity (%): Min: 0 Max: 100
Specific Gravity: 1.0-1.05 @ 20 °C		
Vapour Pressure (kPa): 2.5 @ 20 °C	Suction Pressure (kPa): Rated: -15 2nd: 10 3rd: _____	Altitude (m): 234.0
Viscosity (cp): 100-2500 @ 20 °C		☒ Indoor ☒ Heated
pH: 6.5-7.5	Discharge Pressure (kPa): Rated: 847 2nd: 20 3rd: _____	☐ Outdoor ☐ Unheated
Total Suspended Solids (% by wt.): 3-7		Electrical Area Classification: Unclassified
Corrosion/Erosion/Abrasion Caused By: Small amounts of suspended grit and sand	NPSH Available (m): Rated: 8.5 2nd: 10.8 3rd: _____	
Remarks: _____	Remarks: _____	Remarks: _____

PERFORMANCE REQUIREMENTS		
Max. Pump Speed (rpm): 425	Min. Solids Passage (mm): 40	Factory Testing:
Min. Pump Speed (rpm): TBD by mfr.	Min. NPSH Margin Ratio: 1.5	☒ Functional ☒ Performance
Speed at Rated Capacity (rpm): TBD by mfr.		Field Testing:
Max. Power at Rated Capacity (kW): 13.4		☒ Functional ☒ Performance
		Hydrostatic Test Pressure (kPag):
		150% of MAWP

Remarks: _____

PUMP DATA SHEET NO. 4 (cont'd)
TFS PUMPS P-D418, P-D419, P-D420

PUMP CONSTRUCTION DETAILS

Nozzles						Miscellaneous Connections		
	NPS (mm)	ANSI Class	Facing	Location			Size (mm)	Location
Suction	100	150	FF	Side		Drain		
Discharge	100	150	FF	Side		Vent		

Rotors:
Type: Three or four lobe
Size: TBD by mfr.

Suction Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Discharge Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Motor Coupling:
☐ In-line ☒ V-belt (overhead)

Packing:
Type: n/a
Manufacturer: n/a
Size/No. of Rings: n/a

Mechanical Seal:
Type: As specified
Manufacturer: Mfr.'s std.
Model: Mfr.'s std.
Lubrication: Oil

Bearings:
Radial (type/no.): Mfr.'s std.
Thrust (type/no.): Mfr.'s std.
Min. ABMA B-10 Life: 100,000 hrs
Lubrication: ☐ Grease ☒ Oil

Shaft Coupling:
Type: n/a
Manufacturer: n/a
Model: n/a

Remarks: _____

MATERIALS OF CONSTRUCTION

Pump Casing: Cast iron, ASTM A48	Wear Plates: Hardened steel	Shaft: AISI 4140
Cover Plates: Cast iron, ASTM A48	Baseplate: Fabricated steel	Shaft Sleeve: Stainless steel
Ports: Type 316 stainless steel	O-rings and Seals: Buna-N	
Rotors: Cast iron, ASTM A48		
Rotor Coating: Buna-N		

Remarks: _____

ADDITIONAL REQUIREMENTS

_____

MOTOR DATA SHEET NO. 4
TFS PUMPS P-D418, P-D419, P-D420

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Thickening

Service: Thickened Fermented Sludge

Pump Name: TFS Pumps

Equipment Tag Number(s): P-D418, P-D419, P-D420

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 14.9 ☐ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Per CAN/CSA-C390 Table 3
Voltage: 575	Guaranteed Minimum Power Factor at Full Load (%): Mfr.'s std.
Phase: 3	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1200	Mounting Type: ☒ Horizontal ☐ Vertical
☐ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☒ Multi-speed Speed (rpm): Min. 120 Max. 1200	☒ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: 10 to 100 % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☒ Constant Torque ☐ Constant Power	☒ Thermal Protection: Thermistors, one per phase ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low Voltage AC Induction Motors.

PUMP DATA SHEET NO. 5
SLUDGE TRANSFER PUMPS P-S401, P-S402

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Holding Tanks and Transfer

Service: Thickened Sludge Transfer

Pump Name: Sludge Transfer Pumps

Equipment Tag Number(s): P-S401, P-S402

Manufacturer and Model: (1) Vogelsang; VX186-368QD
(2) Netzsch;
(3) Boerger;

Number of Pumps Required: 2

Pump Type: Rotary lobe

Drive Type: ☐ Constant Speed ☐ Two Speed ☒ Variable Speed

LIQUID PROPERTIES	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: Thickened sludge	Capacity (L/sec): Rated: 76 2nd: 40 3rd: _____	Ambient Temperature (°C): Min: 5 Max: 40
Fluid Temperature (°C): Min: 5 Normal: 10-20 Max: 25	Differential Pressure (kPa): Rated: 510 2nd: 410 3rd: _____	Relative Humidity (%): Min: 0 Max: 100
Specific Gravity: 1.0-1.1 @ 20 °C		
Vapour Pressure (kPa): 2.5 @ 20 °C	Suction Pressure (kPa): Rated: 20 2nd: 60 3rd: _____	Altitude (m): 234.0
Viscosity (cp): 50-300 @ 20 °C		☒ Indoor ☒ Heated
pH: 6.5-7.5	Discharge Pressure (kPa): Rated: 530 2nd: 470 3rd: _____	☐ Outdoor ☐ Unheated
Total Suspended Solids (% by wt.): 3-7		Electrical Area Classification: Unclassified
Corrosion/Erosion/Abrasion Caused By: Small amounts of suspended grit and sand	NPSH Available (m): Rated: 12.7 2nd: 16 3rd: _____	
Remarks:	Remarks:	Remarks:

PERFORMANCE REQUIREMENTS		
Max. Pump Speed (rpm): 400	Min. Solids Passage (mm): _____	Factory Testing:
Min. Pump Speed (rpm): TBD by mfr.	Min. NPSH Margin Ratio: 1.5	☒ Functional ☒ Performance
Speed at Rated Capacity (rpm): TBD by mfr.		Field Testing:
Max. Power at Rated Capacity (kW):55		☒ Functional ☒ Performance
		Hydrostatic Test Pressure (kPag):
		150% of MAWP

Remarks:

PUMP DATA SHEET NO. 5 (cont'd)
SLUDGE TRANSFER PUMPS P-S401, P-S402

PUMP CONSTRUCTION DETAILS

Nozzles						Miscellaneous Connections		
	NPS (mm)	ANSI Class	Facing	Location			Size (mm)	Location
Suction	250	150	FF	Side		Drain		
Discharge	250	150	FF	Side		Vent		

Rotors:
Type: Three or four lobe
Size: TBD by mfr.

Suction Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Discharge Port Configuration:
☒ Straight ☐ Gooseneck
☐ 90-degree elbow

Motor Coupling:
☐ In-line ☒ V-belt (overhead)

Packing:
Type: n/a
Manufacturer: n/a
Size/No. of Rings: n/a

Mechanical Seal:
Type: As specified
Manufacturer: Mfr.'s std.
Model: Mfr.'s std.
Lubrication: Oil

Bearings:
Radial (type/no.): Mfr.'s std.
Thrust (type/no.): Mfr.'s std.
Min. ABMA B-10 Life: 100,000 hrs
Lubrication: ☐ Grease ☒ Oil

Shaft Coupling:
Type: n/a
Manufacturer: n/a
Model: n/a

Remarks: _____

MATERIALS OF CONSTRUCTION

Pump Casing: Cast iron, ASTM A48	Wear Plates: Hardened steel	Shaft: AISI 4140
Cover Plates: Cast iron, ASTM A48	Baseplate: Fabricated steel	Shaft Sleeve: Stainless steel
Ports: Type 316 stainless steel	O-rings and Seals: Buna-N	
Rotors: Cast iron, ASTM A48		
Rotor Coating: Buna-N		

Remarks: _____

ADDITIONAL REQUIREMENTS

Provide the following NPT taps on pump suction: 38 mm at bottom, 12 mm at top

Provide the following NPT tap on pump discharge: 38 mm at bottom

MOTOR DATA SHEET NO. 5
SLUDGE TRANSFER PUMPS P-S401, P-S402

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Holding Tanks and Transfer

Service: Thickened Sludge Transfer

Pump Name: Sludge Transfer Pumps

Equipment Tag Number(s): P-S401, P-S402

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 74.5 ☐ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Per CAN/CSA-C390 Table 3
Voltage: 575	Guaranteed Minimum Power Factor at Full Load (%): Mfr.'s std.
Phase: 3	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1200	Mounting Type: ☒ Horizontal ☐ Vertical
☐ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☒ Multi-speed Speed (rpm): Min. 120 Max. 1200	☒ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: 10 to 100 % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☒ Constant Torque ☐ Constant Power	☒ Thermal Protection: Thermistors, one per phase ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low Voltage AC Induction Motors.

SECTION 44 43 33

MOTORIZED AUTOMATIC STRAINERS

EQUIPMENT AND COMPONENT NUMBERS

ID No.	Equipment Description
STR-D433	Automatic Strainer
STR-D434	Automatic Strainer
STR-G535	Automatic Strainer
STR-G536	Automatic Strainer
STR-S673	Automatic Strainer
STR-S674	Automatic Strainer
STR-T140	Automatic Strainer

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Society of Mechanical Engineers (ASME):
      a. Boiler and Pressure Vessel Code (BPVC), Section VIII, Division 1.
      b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
   2. American Society for Testing and Materials (ASTM):
      a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Flanges.
   3. National Electrical Manufacturer’s Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   4. 2010 National Building Code of Canada, with 2011 Manitoba Amendments (NBC).

1.2 SUBMITTALS

A. Shop Drawings:
   1. Make, model, weight, and horsepower of each equipment assembly.
   2. General arrangement drawings including dimensions, size and location of connections to other work, and anchorage requirements.
   3. Manufacturer’s catalog information, descriptive literature, specifications, and identification of materials of construction.
   4. Performance data curves showing pressure loss vs. flow rate for the specific strainer element supplied.
   5. Backwash water requirements.
   6. External utility requirements such as air, water, power, drain, etc., for each component.
   7. Functional description of internal and external instrumentation and controls to be supplied including list of parameters monitored, controlled, or alarmed.
   8. Control panel drawings showing construction, dimensions, placement of operator interface devices, internal layout, and external interfaces.

9. Power and control wiring diagrams, including terminal numbers.
10. Description of sequence of operation including interlocks and alarms.
11. Shop and field painting systems proposed: Include manufacturer's descriptive technical catalog literature and specifications.

B. Quality Control Submittals:
1. Special shipping, storage and protection, and handling instructions.
2. Manufacturer's printed installation instructions.
3. Routine maintenance requirements prior to system startup.
4. Written certification that the factory-applied coating system(s) is identical to the requirements specified.
5. Manufacturer's Certificate of Proper Installation in accordance with Section 01 43 33, Contractor Field Services.
6. Functional and Performance Test Reports.
7. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
8. Submit written certification from Professional Engineer licensed in Province of Manitoba stating that support systems, anchorage, and equipment have been designed according to requirements of NBC for post-disaster structures, at time of Shop Drawing submittals.

1.3 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools for each different size strainer:

Item	Quantity
Bearings	One complete set
Gaskets and O-rings	One complete set
Packing	One complete set
Strainer element	One
Special tools required to maintain or dismantle	One complete set

B. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

PART 2 PRODUCTS

2.1 GENERAL

A. Design equipment, anchorage, and support systems for vertical and lateral loading in accordance with NBC.

2.2 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:
1. Eaton Filtration; Model 2596.
2. S.P. Kinney Engineers, Inc.; Model A.
3. Fluid Engineering; Model 751/753.
4. Hayward Gordon
5. Hellan

2.3 CONDITIONS OF SERVICE

A. Equipment shall be suitable for the following conditions of service:

	STR-D433, STR-D434	**STR-G535, STR-G536**	**STR-S673, STR-S674**	**STR-T140**
Fluid Handled	Flushing water	Flushing water	Flushing water	Flushing water
Temperature (degrees C)	5 - 25	5 - 25	5 - 25	5 - 25
Specific Gravity	1.0	1.0	1.0	1.0
pH	6 - 8	6 - 8	6 - 8	6 - 8
Suspended Solids (mg/L)	2 - 30	2 - 30	2 - 30	2 - 30
Inlet Pressure (kPa)	500 - 700	500 - 700	500 - 700	500 - 700

2.4 PERFORMANCE REQUIREMENTS

A. Equipment shall meet the following performance requirements:

	STR-D433, STR-D434	**STR-G535, STR-G536**	**STR-S673, STR-S674**	**STR-T140**
Rated Flow Capacity (L/s)	11	28	20	5
Maximum Clean Water Pressure Drop at Rated Flow (kPa)	14	14	13	14
Strainer Element Opening Size (microns)	150	150	150	200

A. Strainer shall utilize fluid being strained for backwashing strainer element while maintaining uninterrupted flow during backwashing. Flow required for backwashing shall not exceed 5 percent of strainer influent flow.

B. Strainer shall be capable of operating with maximum pressure drop of 1035 kPa without adverse effects.

C. Strainer shall be capable of removing substantially all material larger than specified strainer element opening size.

2.5 EQUIPMENT DESCRIPTION

A. Automatic, continuous, self-cleaning type strainer generally consisting of strainer body, strainer element, motor driven backwash device, backwash valve, control panel, and other appurtenances required for a complete operating system.

B. Designed such that entire operating unit including cover, motor, gear reducer, bearing housing, backwash device assembly, and strainer element can be removed from strainer body as complete assembly for inspection and maintenance.

C. Designed in accordance with ASME BPVC Section VIII, Division 1.

D. Strainer Body and Cover: Heavy-duty cast iron, ASTM A126 Gr. B. Equip strainer body with integral feet designed to support full operating weight of strainer and suitable for anchoring to concrete equipment pad as shown on Drawings. Provide strainer body with threaded and plugged drain connection.

E. Strainer Element: One-piece cartridge design, Type 316 stainless steel, type as recommended by manufacturer to suit application.

F. Motor: In accordance with Section 26 20 00, Low Voltage AC Induction Motors. See supplements following end of section for additional requirements.

G. Process Connections: Cast iron ASME B16.1 Class 125 flat-face flanges. Provide threaded outlet for backwash connection.

H. Seals and Gaskets: Buna-N or EPDM.

I. Provide automatic backwash valve for each actuator, stainless steel ball valve with electric motor actuator, Rotork ROM or approved equal in accordance with B8.

2.6 INSTRUMENTATION AND CONTROLS

A. General:
1. All components shall be CSA or cUL approved.
2. All controls and control panels shall be in accordance with requirements of Section 40 99 90, Package Control Systems.
3. Provide complete and functional system, including interfaces with plant PCS.
4. Provide full-voltage starters in package control panels for package system components. Motor starters shall be equipped with electronic overloads. Overloads shall be resettable without opening panel.
5. Segregate analog wiring in dedicated raceways.
6. Control components shall operate on 120V ac power.
7. Provide instruments in accordance with Section 40 99 90, Package Control Systems, unless specified otherwise. Provide industrial grade instruments suitable for intended service and environment.

8. Instrumentation and controls specified herein are minimum requirements. Equipment manufacturer shall provide additional components and features necessary to achieve intended function and provide safe and reliable operation of equipment supplied.
9. Provide all necessary devices including timers, relays, contacts, switches, indicating lights, transformers, fuses, and terminal blocks as required to implement the control functions specified.

B. Control Panels:

Panel No.	Name	NEMA 250 Rating	Enclosure Material	Mounting
LCP-D433	Automatic Strainer STR-D433 Local Control Panel	4X	Type 316 stainless steel	Skid
LCP-D434	Automatic Strainer STR-D434 Local Control Panel	4X	Type 316 stainless steel	Skid
LCP-G535	Automatic Strainer STR-G535 Local Control Panel	4X	Type 316 stainless steel	Skid
LCP-G536	Automatic Strainer STR-G536 Local Control Panel	4X	Type 316 stainless steel	Skid
LCP-S673	Automatic Strainer STR-S673 Local Control Panel	4X	Type 316 stainless steel	Skid
LCP-S674	Automatic Strainer STR-S674 Local Control Panel	4X	Type 316 stainless steel	Skid
LCP-T140	Automatic Strainer STR-T140 Local Control Panel	4X	Type 316 stainless steel	Skid

1. Hinged and lockable front cover and removable backplate.
2. Magnetic motor starter, overload relay, control power transformer, and disconnect switch interlocked with panel door.
3. Push-to-test type indicating lights.
4. Lamacoid nameplates for identification of panel, operator controls, and indicators.
5. All operator controls and indicators externally mounted on panel door.
6. Adequately sized to house all components with sufficient access for maintenance.
7. Power Supply to Panels: Single 120V, single-phase, 60 Hz supply to each panel. Power supply to all motors and instruments shall be obtained from associated panel.
8. Operator Controls and Indicators:
   a. Strainer HAND/OFF/AUTO selector switch.
   b. Alarm RESET pushbutton.

c. Power ON indicating light.
d. Backwash Cycle ON indicating light.
e. Strainer FAULT indicating light.
f. Differential Pressure HIGH indicating light.

9. External Interfaces:
   a. Dry contact with less than 2 mA minimum switching current at 24 VDC for Plant Control System 24 VDC discrete input signals:
      1) Strainer Running.
      2) Strainer Fault.
      3) Auto Mode.
10. Functional Requirements:
   a. When HAND/OFF/AUTO selector switch is in HAND position, strainer motor shall run and backwash valve shall open. In OFF position, strainer motor shall not run and backwash valve shall close. In AUTO position, strainer operation shall be automatically controlled as follows:
      1) Strainer motor shall start/stop and backwash valve shall open/close automatically as determined by adjustable repeat cycle timer, backwash valve open time, and differential pressure switch.
      2) When repeat cycle time (adjustable from 15 minutes to 10 hours) has elapsed, strainer motor shall start and backwash valve shall open until backwash valve open time (adjustable from 1 to 10 minutes) has elapsed.
      3) Should high differential pressure occur before repeat cycle time has elapsed, differential pressure switch shall override repeat cycle timer and start backwash cycle until differential pressure is satisfied.
      4) After differential pressure has been satisfied, strainer will continue to backwash for additional 60 seconds (adjustable from 1 to 150 seconds).
      5) In event of strainer FAULT (any abnormal condition that stops operation of strainer), operation of strainer shall be disabled until cause of fault is corrected.
      6) In event of power supply failure while strainer is operating, strainer shall automatically resume operation upon restoration of power supply. In event of power supply failure during strainer FAULT, strainer shall remain in fault condition upon restoration of power supply.

C. Instrumentation:
   1. Provide the following instruments for each strainer for monitoring and control of strainer operation:
      a. High differential pressure switch, adjustable set point and dead band, NEMA 4X enclosure, Ashcroft or approved equal in accordance with B8.

2.7 APPURTENANCES

A. Lifting Lugs: Provide suitably attached for all equipment assemblies and components weighing over 45 kg.

B. Equipment Identification Plates: In accordance with Section 40 05 53, Identification Labels for Equipment, Fabricated Tanks, Valves and Piping Systems.

2.8 FACTORY FINISHING

A. Prepare, prime, and finish coat in accordance with Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

3.2 FIELD QUALITY CONTROL

A. Functional Test:
   1. Conduct on each unit.
   2. Test for continuous 3-hour period.
   3. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
   4. Operating Temperatures: Monitor bearing areas on motor for abnormally high temperatures.

3.3 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by the City, for minimum person-days listed below, travel time excluded:
   1. Two person-days for installation assistance and inspection.
   2. Two person-days for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
   3. Two person-days for pre-startup classroom or Site training.
   4. One person-day for facility startup.
   5. One person-day for post-startup training of the City's personnel. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by the City and Contract Administrator.

B. See Section 01 43 33, Contractor Field Services and Section 01 91 14, Equipment Testing and Facility Startup.

3.4 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:
   1. Motor Data Sheets.

END OF SECTION

MOTOR DATA SHEET
AUTOMATIC STRAINERS STR-D433, STR-D434

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Sludge Thickening

Service: Flushing Water

Equipment Name: Automatic Strainers

Equipment Tag Number(s): STR-D433, STR-D434

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 0.19 ☒ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Mfr's standard
Voltage: 115	Guaranteed Minimum Power Factor at Full Load (%): Mfr's standard
Phase: 1	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1800 max.	Mounting Type: ☒ Horizontal ☐ Vertical
☒ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☐ Multi-speed Speed (rpm): Min. _____ Max. _____	☐ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: _____ to _____ % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☐ Constant Torque ☐ Constant Power	☐ Thermal Protection: _____ ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low-Voltage AC Induction Motors.

MOTOR DATA SHEET
AUTOMATIC STRAINERS STR-G535, STR-G536

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Grit and Screenings Building

Service: Flushing Water

Equipment Name: Automatic Strainers

Equipment Tag Number(s): STR-G535, STR-G536

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 0.19 ☒ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Mfr's standard
Voltage: 115	Guaranteed Minimum Power Factor at Full Load (%): Mfr's standard
Phase: 1	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1800 max.	Mounting Type: ☒ Horizontal ☐ Vertical
☒ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☐ Multi-speed Speed (rpm): Min. _____ Max. _____	☐ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: _____ to _____ % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☐ Constant Torque ☐ Constant Power	☐ Thermal Protection: _____ ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low-Voltage AC Induction Motors.

MOTOR DATA SHEET
AUTOMATIC STRAINERS STR-S673, STR-S674

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Secondary Clarifier

Service: Flushing Water

Equipment Name: Automatic Strainers

Equipment Tag Number(s): STR-S673, STR-S674

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 0.19 ☒ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Mfr's standard
Voltage: 115	Guaranteed Minimum Power Factor at Full Load (%): Mfr's standard
Phase: 1	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1800 max.	Mounting Type: ☒ Horizontal ☐ Vertical
☒ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☐ Multi-speed Speed (rpm): Min. _____ Max. _____	☐ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: _____ to _____ % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☐ Constant Torque ☐ Constant Power	☐ Thermal Protection: _____ ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☒ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low-Voltage AC Induction Motors.

MOTOR DATA SHEET
AUTOMATIC STRAINER STR-T140

Project: City of Winnipeg SEWPCC Upgrading/Expansion Project

Process/Facility: Biofilter

Service: Flushing Water

Equipment Name: Automatic Strainers

Equipment Tag Number(s): STR-T140

Type: Squirrel-cage induction meeting requirements of NEMA MG 1.

Manufacturer: For multiple units of same type of equipment, furnish motors and accessories from single manufacturer.

Hazardous Location: ☐ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Size (kW): 0.19 ☒ Min. ☐ Max.	Guaranteed Minimum Efficiency at Full Load (%): Mfr's standard
Voltage: 1115	Guaranteed Minimum Power Factor at Full Load (%): Mfr's standard
Phase: 1	Service Factor (at rated max. ambient temperature): ☐ 1.0 ☒ 1.15
Frequency (Hz): 60	Enclosure Type: TEFC
Synchronous Speed (rpm): 1800 max.	Mounting Type: ☒ Horizontal ☐ Vertical
☒ Constant Speed	Vertical Shaft: ☐ Solid ☐ Hollow
☐ Two-speed Speed (rpm): Slow _____ Fast _____	Vertical Thrust Capacity (N): Up _____ Down _____
☐ Multi-speed Speed (rpm): Min. _____ Max. _____	☐ Adjustable Speed Application (inverter duty rated) In accordance with Section 26 29 23, Variable Frequency Drives. Operating Speed Range: _____ to _____ % of rated speed
Variable Speed Load Classification: ☐ Variable Torque ☐ Constant Torque ☐ Constant Power	☐ Thermal Protection: _____ ☐ Space Heater: _____ volts, single phase ☒ Oversize main terminal (conduit) box for motors ☒ Terminal for connection of equipment grounding wire in each terminal box
Winding: ☐ One ☐ Two	

ADDITIONAL REQUIREMENTS

☒ In accordance with Section 26 20 00, Low-Voltage AC Induction Motors.