

SECTION 43 11 33

ROTARY POSITIVE DISPLACEMENT BLOWER

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. Acoustical Society of America (ASA): 47, Specification for Sound Level Meters.
  2. American Bearing Manufacturers Association (ABMA).
  3. American Gear Manufacturers Association (AGMA).
  4. American National Standards Institute (ANSI).
  5. ASTM International (ASTM):
    - a. A48/A48M, Standard Specification for Gray Iron Castings.
    - b. A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
  6. American Society of Mechanical Engineers (ASME): PTC-10, Power Test Codes.
  7. American Welding Society (AWS):
    - a. B2.1, Standard for Welding Procedure and Performance Qualification.
    - b. D1.1, Structural Welding Code – Steel.
    - c. QC 1, Standard for AWS Certification of Welding Inspectors.
  8. Canadian Standards Association (CSA).
  9. Electrical and Electronics Manufacturers Association of Canada (EEMAC).
  10. National Building Code of Canada (NBCC).
  11. National Electrical Manufacturers Association (NEMA).

1.2 DEFINITIONS

- A. Absolute Discharge Pressure: Pressure in kilopascals absolute (kPa absolute) at the blower discharge flange in relation to Job Site barometric pressure.
- B. Brake kW: Standard curve kW required corrected for pressure, temperature, and relative humidity at inlet conditions.
- C. Discharge Pressure: Pressure in kilopascals gauge (kPag) at the blower discharge flange at rated capacity.
- D. Inlet Cubic Metres per Hour ( $\text{m}^3/\text{h}$ ): Volumetric rate of air at the inlet flange of the blower corrected to absolute pressure, temperature, and relative humidity. The pressure takes into account the inlet piping and filter pressure drops.
- E. Pressure Rise: Pressure developed within the blower between the inlet and outlet flanges. It is the discharge pressure less the inlet pressure measured at the discharge and inlet flanges, respectively.

- F. Standard Cubic Metres per Hour (sm<sup>3</sup>/h): Volumetric rate of air measured in standard cubic metres per hour at 20 degrees C, pressure of 101.3 kPa absolute, and relative humidity of 36 percent.

1.3 SYSTEM DESCRIPTION

- A. Blower system featuring one rotary positive displacement blower to supply air for the lamella settler air scour system.
- B. Provide blower system including, but not limited to, blower, motor, drive, guards, drive coupling, baseplate, vibration isolators, supports, inlet silencer, discharge silencer, bypass silencer, relief valve, flexible connectors, noise enclosure, spare parts, inlet air filter, and miscellaneous appurtenances as necessary for a complete operating system.

1.4 DESIGN REQUIREMENTS

- A. Design equipment with due regard to safety of operation, accessibility, and durability of parts, and complying with applicable OHSA, provincial, and local safety regulations.
- B. The blower will receive unfiltered room air and discharge into a separate discharge line.
- C. Intermittent and continuous operation in an indoor environment.
- D. Blower shall start no more than four times per hour when operating in intermittent service.
- E. Blowers shall meet rated performance and sound level when operating at a maximum gear speed of 1,143 m per minute. Operating speed shall not exceed 80 percent of rated speed.
- F. Maximum Sound Pressure Level: 85 dBA, factory calculated, with inlet and discharge silencers, measured with a sound enclosure.
- G. Performance Requirements:

<b>Design Conditions</b>	
Design Capacity, sm <sup>3</sup> /h	As required for proper lamella scouring
Design Capacity, im <sup>3</sup> /h	As required for proper lamella scouring
Altitude, m	240 m
Barometric pressure, kPa absolute	100.3 kPa
Inlet pressure at compressor flange, kPa absolute	Determined by Contractor

<b>Design Conditions</b>	
Inlet air temperature, degrees C (Guarantee Point)	20
Inlet air temperature range, degrees C	5 to 40
Relative humidity, % (Guarantee Point)	36
Discharge pressure at compressor discharge flange, kPa absolute	Determined by Contractor
Blower pressure rise required, kPa	Determined by Contractor
Pressure relief valve setting, kPa	Determined by Contractor
Shaft brake power, kW <sup>1,2</sup>	Determined by Contractor
<sup>1</sup> Includes main oil pump, if specified, and all gear and bearing frictional losses. <sup>2</sup> Not to exceed motor nameplate power at 1.0 service factor at the inlet air temperatures, pressure relief valve setting and altitude listed above.	

1.5 SUBMITTALS

- A. Shop Drawings:
1. Complete list of system components to be provided.
  2. Make, model, weight, and horsepower of each equipment assembly.
  3. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
  4. Standard and specialized equipment assembly cuts.
  5. System layout, installation, and placing drawings for equipment, drivers, and bases.
  6. Performance data for each type of equipment that will show compliance with specification requirements stated herein.
  7. Power demand over the operating range of the blower.
  8. Detailed structural, mechanical, and electrical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work.
  9. Motor: See requirements of Section 26 20 00, Low-Voltage AC Induction Motors.
  10. Instruments data.
  11. Sound Enclosure:
    - a. Complete description of sound enclosure and accessories.
    - b. Calculated noise attenuation.
  12. Written certification from professional engineer licensed in the Province of Manitoba stating that support systems, anchorage, and equipment have been designed for post-disaster structures in accordance with the requirements of the 2010 National Building Code of Canada and the 2011 Manitoba Amendments, at time of shop drawing submittals.

- B. Samples: Color samples for finish coating. If paint manufacturer of finish coat differs from manufacturer of prime coat, provide both manufacturers' written confirmation that materials are compatible.
- C. Other Submittals:
  - 1. Factory calculated sound levels (dBA) of blower unit with silencers and sound enclosure.
  - 2. Identification of outside utility requirements for each component such as air, water, power, etc. Include operating parameters for required utilities.
  - 3. Routine maintenance requirements prior to plant startup.
  - 4. Test Reports:
    - a. Factory test reports for blower and motor.
    - b. Field test procedures.

1.6 EXTRA MATERIALS

- A. Furnish, tag, and box for shipment and storage the following spare parts, special tools, and materials:

Item	Quantity
Oil, synthetic	One year supply
Inlet filters	Enough for five complete changes
Flexible coupling	One
Gaskets and seals	One complete set
Drive V-belts	One complete set
Special tools required to maintain or dismantle	One complete set for each unit

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

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. General:
  - 1. Manufacture parts to North American standard sizes and gauges.
- B. Materials, equipment, and accessories specified in this section shall be products of:
  - 1. Roots: Model Whispair Series.
  - 2. Sutorbilt: Model Legend Series.
  - 3. Hibon Ingersoll Rand
  - 4. Robuschi Robox

## 2.2 COMPONENTS

### A. Blower:

1. Rotary positive displacement type, direct or belt driven by horizontal electric motor.
2. Casing:
  - a. One-piece construction, ASTM A48/A48M Class 30B close-grain cast iron, strongly ribbed to prevent distortion at the specified operating conditions. Separate headplates of cast iron.
  - b. ASME B16.1 Class 125 flanged inlet and outlet connections.
3. Bearings:
  - a. Each shaft and impeller assembly shall be supported by single-row roller bearings or double-row spherical roller bearings, sized for a minimum L10 rating of 100,000 hours.
  - b. Drive end bearings shall be fixed to control axial location of impeller assembly.
  - c. Bearings and gears shall be lubricated by a splash type lubrication system on both ends of the rotors.
  - d. Provide each bearing with a positive lip type oil seal designed to prevent lubricant from entering air stream and a labyrinth seal on each shaft designed to reduce air leakage at point where shaft extends through headplate of blower casing.
  - e. Make further provision to vent area between the two sealing systems to atmosphere to relieve excessive pressure on seals.
4. Impellers:
  - a. Each impeller/shaft assembly integrally cast from high-strength ASTM A395/A395M Type 60-45-15 ductile iron with a minimum tensile strength of 413,700 kPa.
  - b. Straight, two-lobe involute type, rotating in opposite directions in a common casing without rubbing, liquid seals, or lubrication.
  - c. Positioned by timing gears to maintain proper clearances.
  - d. Impellers and timing gears shall be mounted on shafts supported by antifriction bearings, fixed to control the axial location of impeller/shaft in the casing.
  - e. Statically and dynamically balanced by removing metal from impeller body.
  - f. Positively timed by a pair of accurately machined carbon steel spur gears hardened to 58-62 Rockwell alloy timing gears manufactured to comply with AGMA. Gears mounted on shafts with tapered fit and secured by a locknuts.
5. Shafts:
  - a. Cast iron, integral with impellers.
  - b. Machine labyrinth seals into shaft to minimize air leakage.
6. Direct-Drive Coupling:
  - a. Service Factor: 1.5 on power.
  - b. Guard over coupling.
  - c. Manufacturers:
    - 1) Falk.

- 2) Dodge.
7. Belt Drive:
  - a. V-belt drive with automatic belt tension device.
  - b. Minimum service factor of 1.4.
  - c. Designed not to exceed allowable overhung load limits of blower and motor.
  - d. Provide belt guard.
- B. Motor:
  1. Squirrel-cage ac induction type, meeting requirements of Section 26 20 00, Low-Voltage AC Induction Motors, and as specified herein.
  2. Motor Size: Determined by Contractor.
  3. Nominal Speed: Maximum 1,750 rpm, constant.
  4. Rated Voltage: 575 volt, three-phase, 60-Hz.
  5. Enclosure Type: TEFC as specified in Section 26 20 00, Low-Voltage AC Induction Motors.
  6. Drive: Direct-drive coupling or V-belt drive.
  7. Motor Efficiency: Premium efficiency as specified in Section 26 20 00, Low-Voltage AC Induction Motors.
  8. Service Factor: 1.15.
- C. Blower Support:
  1. Baseplate: Cast iron or fabricated steel mounted on concrete equipment pad as shown on Drawings.
  2. Support Stand: Designed by manufacturer and shall be reinforced to withstand anticipated loadings of blower, motor, inlet and discharge silencers and associated piping.
  3. Factory mount blower and motor as a package.
  4. Provide vibration isolators to limit transmission of vibration to anchor points at floor.

### 2.3 ACCESSORIES

- A. Combination Inlet Filter/Silencer:
  1. Suitable for indoor installation and mounted directly to the inlet flange of the blower. Silencer shall be located upstream of the inlet filter.
  2. Filter media efficiency of 90 percent by weight per ASHRE 52-76 with synthetic dust equivalent to separation > 95% @ 5 microns. Filter element shall be washable by maintenance personnel as a preventative maintenance procedure.
  3. Rated capacity of filter shall be the maximum rated capacity of the blower. Filter and silencer performance losses shall be included in the blower performance calculation.
  4. Housing shall be designed to withstand a full vacuum or 103 kPag.
  5. Inlet filter clean pressure drop will be not more than 50 mm of water. End connections shall be ANSI: B16.5, Pipe Flanges of the size required. Intake filters shall be provided with 13 mm tapped connections on the inlet and discharge sides of the filter for differential pressure instrument connections.
  6. Provide differential pressure gauge to measure the pressure drop across the intake filter.

7. Provide pressure differential indicating switch as manufactured by Dwyer, Ashcroft or United Electric. Switch shall be equipped with DPDT contacts that change state on high differential pressure, based on manufacturer's recommendations.
  8. Manufacturers and Products:
    - a. Universal.
    - b. Stoddard.
- B. Discharge and by-pass Silencers:
1. Designed to reduce pulsation from rotary lobe blowers at blower operating timing gear speed.
  2. For timing gear speeds below transition speeds, use a multi-chambered reactive type silencer, and for timing gear speeds at or above transition speed, use a multi-chambered reactive and absorptive type silencer packed with hair-felt packing.
  3. Inlet/Outlet Air Velocity: 1,680 m/min, maximum.
  4. Pressure Loss: 150 mm WC maximum, through silencer at design flow rate.
  5. Inlet and outlet flanges shall match the piping size shown on Drawings and blower flanges. Flange drilling shall be 125-pound ANSI standard.
  6. Provide drain coupling and plug.
  7. Manufacturers and Products:
    - a. Universal.
    - b. Stoddard.
- C. Flexible Connectors:
1. Pressure spool, single arch, expansion joint type with ASME Class 150 flanges, sized to match blower flanges.
  2. Operating Temperature Rating: Determined by Contractor.
  3. Install at inlet and outlet flanges.
  4. Thrust restraint rods on discharge if not otherwise restrained.
  5. Manufacturers and Products:
    - a. Mercer; Style 500.
    - b. General Rubber; Style 1025.
    - c. Vibraflex; PCS Series.
- D. Check Valve:
1. Wafer type, installed in blower discharge piping downstream of silencer and relief valve.
  2. Cast iron body, stainless steel pin and spring, and two semicircular cast iron or aluminum plates.
  3. Seat: Viton or Silicone for high temperature operation. Elastomeric hinges will not be allowed.
  4. Manufacturer: Techno Corporation or equal.
- E. Safety Relief Valve:
1. Spring type or cast iron weighted non-vibrating type, with flanged connection.
  2. Sized to relieve entire discharge flow without overloading blower.
  3. Provide nozzle on discharge silencer to mount relief valve.

- F. Discharge Pressure Gauge:
  - 1. Provide pressure gauge to indicate the blower discharge pressure.
  - 2. Include pulsation snubber.
  
- G. Discharge Temperature Sensor:
  - 1. Allow for the installation of a HIGH discharge air temperature sensor located directly after blower discharge.
  - 2. Provide details of the required sensor for supply by others as per 40 90 00.
  
- H. Discharge Pressure Sensor:
  - 1. All for the installation of a HIGH discharge air pressure sensor located directly after blower discharge.
  - 2. Provide details of the required sensor for supply by others per 40 90 00.
  
- I. Noise Enclosure:
  - 1. Provide noise enclosure covering the entire blower package including the drive motor.
  - 2. Designed and fabricated for easy inspection and maintenance of all blower package components. Provide quick release panels weighing not more than 20 kg each. Panels weighing more than 20 kg shall be hinged with the appropriate frame reinforcements and supporting elements.
  - 3. Sound enclosure acoustic material as a minimum shall comply with UL 94 - HF1 for fire-retardant self-extinguishing, non-dripping materials. Materials with a lesser rating are not acceptable. If used, non-flammable packing materials such as compressed mineral fibers are only acceptable if lined with appropriate retaining mat and supported by galvanized perforated sheet.
  - 4. Mount enclosure and blower package on a skid / oil-drip pan designed for meeting environment protection standards and for easy transportation and installation.
  - 5. Provide grounding strap between blower base and package skid to bypass any vibration isolating mounts.
  - 6. Provide separate electric motor driven fan for heat removal from noise enclosure.
  - 7. Total Noise Enclosure: 85 dBA average noise level at 1 meter.

## 2.4 INSTRUMENTATION AND CONTROLS

- A. Supply loose instruments in accordance with Section 40 90 00, Process Instrumentation and Control System.
- B. Provide a comprehensive control narrative and functional requirements specification in accordance with Section 40 90 00, Process Instrumentation and Control System.
- C. Provide items not specifically called out which are required to implement functions required for proper system operation.

## 2.5 FACTORY FINISHING

- A. Furnish manufacturer's standard enamel finish, color as selected.

## 2.6 SOURCE QUALITY CONTROL

- A. Blower Performance Test:
  - 1. Perform on the blower actually furnished in accordance with manufacturer's established criteria.
  - 2. Test each blower for a minimum of 1 hour after stabilization at conditions near the performance ratings for mechanical integrity and flow performance.
    - a. Perform at or above specified performance pressure rise.
    - b. Tolerance on Flow: Plus or minus 4 percent, after correction to rated conditions.
  - 3. Measure power consumption using a calibrated wattmeter.
  - 4. Test Report: Confirm capacity and power, complete with data and calculations used in the test.
  
- B. Motor Test: See Section 26 20 00, Low-Voltage AC Induction Motors.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. By Installation Contractor in accordance with manufacturer's written instructions.
  
- B. Anchor Bolts: Furnish templates from manufacturer and as specified in Section 05 50 00, Metal Fabrications (Basic).

### 3.2 FIELD QUALITY CONTROL

- A. In accordance with Section 01 43 33, Contractors' Field Services.
  
- B. Functional Test: Prior to facility startup, conduct on each blower system, assisted by Installation Contractor, for correct rotation, proper alignment and connection, quiet operation, and satisfactory specified performance.

### 3.3 MANUFACTURER'S SERVICES

- A. See Section 01 43 33, Contractors' Field Services and Section 46 43 80 High Rate Clarification System.

END OF SECTION

SECTION 43 21 13.29

CENTRIFUGAL PUMPS

PART 1 GENERAL

1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
1. American Society for Testing and Materials (ASTM):
    - a. A48, Standard Specification for Gray Iron Castings.
    - b. A276, Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
    - c. A436, Standard Specification for Austenitic Gray Iron Castings.
    - d. A532, Standard Specification for Gray Iron Castings.
    - e. A743, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Nickel-Base Corrosion Resistant, for General Application.
    - f. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
    - g. B148, Standard Specification for Aluminum-Bronze Sand Castings.
  2. American Iron and Steel Institute (AISI):
    - a. Type 416 Stainless Steel.
    - b. Type 1018 Carbon Steel.
    - c. Type 1141 Steel.
  3. Hydraulic Institute Standards (ANSI/HIS): Centrifugal/Vertical General Pump Standards.
  4. American Society of Mechanical Engineers (ASME):
    - a. B16.1, Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
    - b. B16.5, Pipe Flanges and Flanged Fittings.
    - c. B16.47, Large diameter Flanges and Flanged Fittings
  5. Institute of Electrical and Electronics Engineers (IEEE): 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
  6. National Electrical Manufacturer's Association (NEMA): MG 1, Motors and Generators.
  7. National Building Code of Canada (NBCC).

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- A. Shop Drawings:
1. Make, model, weight, and horsepower of each equipment assembly.

2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
3. Performance data curves showing head, capacity, horsepower demand, and pump efficiency over the entire operating range of the pump, from shutoff to maximum capacity. Indicate separately the head, capacity, horsepower demand, overall efficiency, and minimum submergence required at the guarantee point.
4. Detailed drawings showing the equipment dimensions, size, and locations of connections and weights of associated equipment.
5. Power and control wiring diagrams, including terminal numbers.
6. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
7. Factory finish system.
8. Written certification from professional engineer licensed in the Province of Manitoba stating that support systems, anchorage, and equipment have been designed for post-disaster structures in accordance with the requirements of the 2010 National Building Code of Canada and the 2011 Manitoba Amendments, at time of shop drawing submittals.

- B. Other Submittals:
1. Factory Functional Test Reports.

1.4 EXTRA MATERIALS

- A. Furnish, tag, and box for shipment and storage the following spare parts, special tools, and materials:

Item	Quantity
Pump casing liner	One complete set
Impeller	One
Bearings	One complete set
Gaskets and seals	One complete set
Drive V-belts - if applicable	One complete set
Special tools required to maintain or dismantle pump	One complete set

PART 2 PRODUCTS

2.1 GENERAL

- A. Coordinate pump requirements with drive manufacturer and be responsible for pump and drive requirements.

## 2.2 PUMP DESIGN

- A. The pumps shall be specifically designed to pump slurries of grit, debris, inorganic and organic solids as applicable to the process.
- B. Pumps shall be equipped with flat-face flanges conforming to ASME B16.1 Class 125.
- C. Pump shaft shall be accurately machined and be of sufficient strength to transmit full driver output.
- D. Bearings shall be grease or oil bath lubricated. For oil bath lubrication provide built-in sight glass to check proper oil level. The bearings shall be rated for a minimum ABMA L10 life of 100,000 hours, without credit for any rear pump-out vanes to balance hydraulic thrust.
- E. Shaft Sealing: Mechanical seal which requires no external flushing.
- F. Mounting:
  - 1. Horizontal Mounting: The common pump and motor base shall be minimum 10 mm thick fabricated steel, suitably constructed to support the full weight of the pump and the motor.
  - 2. Pumps with a V-belt drive shall be provided with adjustable motor base so that the motor can be easily moved from V-belt tensioning and adjustment. Provide fiberglass belt guard to safely enclose the V-belt. Pump with direct-coupled motor shall be provided with flexible spacer coupling between the motor shaft and pump shaft. Provide coupling guard to safely enclosure the coupling.

## 2.3 SUPPLEMENTS

- A. Some specific requirements are attached to this section as supplements.

## 2.4 ACCESSORIES

- A. See Section 01 61 00, Common Product Requirements.

## 2.5 FACTORY FINISHING

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

## 2.6 SOURCE QUALITY CONTROL

- A. Functional Test:
  - 1. Conduct on each pump.
  - 2. Perform manufacturer's standard production tests.
- B. Performance Test:
  - 1. Conduct on each pump.
  - 2. Perform under simulated operating conditions.
  - 3. Test for a continuous 3-hour period without malfunction.

- C. Motor Test: In accordance with Section 26 20 00, Low Voltage AC Induction Motors.
- D. Hydrostatic Tests: Pump casing tested at 150 percent of shutoff head. Test pressure maintained for not less than 5 minutes.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. The pumps will be installed by Installation Contractor. Contractor shall inspect the installation to ensure it is in accordance with their printed instructions.

#### 3.2 FIELD FINISHING

- A. See Section 09 90 00, Painting and Coatings and Section 01 61 00, Common Product Requirements.

#### 3.3 FIELD QUALITY CONTROL

- A. Functional Tests:
  - 1. Conduct on each pump.
  - 2. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
- B. Performance Test: In accordance with Hydraulic Institute Standards.

#### 3.4 MANUFACTURER'S SERVICES

- A. See Section 01 43 33, Contractors' Field Services and 46 43 80, High Rate Clarification System.

#### 3.5 SUPPLEMENTS

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

END OF SECTION

<b>PUMP DATA SHEET</b> <b>Centrifugal Pumps</b>		
Project: <u>SEWPCC Upgrading/Expansion Project – Prepurchase of High Rate Clarification Equipment</u>		
City: <u>City of Winnipeg</u>		
Service: <u>Sludge/Slurry Recirculation</u>		
Pump Name: <u>Recirculation Pumps</u>		
Equip. Tag Number(s): <u>TBD</u>		
Manufacturer and Model: (1) _____ (2) _____ (3) _____		
No. Pumps Required: <u>TBD by Contractor</u> Drive Type: <input type="checkbox"/> Constant <input type="checkbox"/> Adjustable <input type="checkbox"/> Direct-Coupled <input type="checkbox"/> Belt		
LIQUID	OPERATING CONDITIONS	SERVICE CONDITIONS
Name: <u>Sludge/slurry</u>  Pumping Temperature (°C):  Normal _____ Max _____ Min _____  Specific Gravity @ _____ °C: _____  Vapor Pressure (kPa): _____  Viscosity (cp) @ _____ °C: _____  pH: _____  Corrosion/Erosion/Abrasion Caused by:  _____  Remarks: _____  _____  _____	Capacity (L/s): <u>TBD by Contractor</u>  Total Dynamic Head (m): <u>TBD by Contractor</u>  Suction Pressure (kPa):  Max _____ Rated _____  Min. Continuous Flow (L/s): _____:  NPSH Available (m): _____        Remarks: _____  _____  _____	Temp (°C): Max _____ Min _____  Rel. Hum (%): Max _____ Min _____  Altitude (m): _____  <input checked="" type="checkbox"/> Indoor <input checked="" type="checkbox"/> Heated  <input type="checkbox"/> Outdoor <input type="checkbox"/> Unheated  Area Classification: <u>Unclassified</u>  Other: _____     Remarks: _____  _____  _____
<b>PERFORMANCE REQUIREMENTS (manufacturer to supply missing data)</b>		
Proposal Curve No.: _____	Max. Head, Rated Imp. (m): _____	NPSH Required (m): _____
Speed Range (rpm): _____/ _____	Max. Power, Rated Imp (kW): _____	3% Head Drop _____
Efficiency (%): _____	Suction Specific Speed: _____	
Rated Power (kW): _____	Factory Testing: <input type="checkbox"/> Required <input type="checkbox"/> Not Required	
Remarks: _____  _____		

<b>PUMP DATA SHEET (cont'd)</b>						
<b>Centrifugal Pumps</b>						
<b>PUMP CONSTRUCTION DETAILS (manufacturer to supply missing data)</b>						
Nozzles				Miscellaneous Connections		
	Size	Rating	Facing	Location		Size
						Location
Suction	_____	_____	_____	_____	Drain	_____
Discharge	_____	_____	_____	_____	Vent	_____
<p>Casing Mount: <input type="checkbox"/> Foot <input type="checkbox"/> Centerline <input type="checkbox"/> Bracket <input type="checkbox"/> Near Centerline</p> <p>Hydro Test Pressure (psig): _____</p> <p>Field Testing: <input type="checkbox"/> Not required <input type="checkbox"/> Required, functional and performance</p>						
<p>Impeller Diameter (mm): Rated _____ Max _____ Min _____</p> <p>Impeller: <input type="checkbox"/> Radial <input type="checkbox"/> Cupped</p> <p>Packing: Manufacturer _____ Type _____ Size/No. Rings _____</p> <p>Mechanical Seal: API Class Code _____ Manufacturer _____ Model _____ Manufacturer Code _____</p>						
<p>Bearings (Type/No.): Radial _____ Thrust _____</p> <p>Lubrication Type: <input type="checkbox"/> Grease <input type="checkbox"/> Oil</p> <p>Direct Coupling: Manufacturer _____ Type _____ Model _____</p> <p>Driver Half-Coupling Mounted by: <input type="checkbox"/> Pump Mfr. <input type="checkbox"/> Driver Mfr. <input type="checkbox"/> Purchaser</p> <p>Gland Type/Material: _____</p> <p>Gland Plate Taps Required: <input type="checkbox"/> Quench <input type="checkbox"/> Flush <input type="checkbox"/> Drain <input type="checkbox"/> Vent</p>						
Remarks: _____						
<b>MATERIALS (manufacturer to supply missing data)</b>						
Case: _____ Impeller: _____ Shaft: _____						
Case Wear Rings: _____ Impeller Wear Rings: _____ Shaft Sleeve: _____						
Baseplate: _____						
<b>ADDITIONAL REQUIREMENTS</b>						
_____						
_____						
<input type="checkbox"/> Vent and drain connections tapped and plugged <input type="checkbox"/> Suction and discharge gauge connections tapped and plugged						

<b>MOTOR DATA SHEET (cont'd)</b> <b>Centrifugal Pumps</b>	
Project: <u>SEWPCC Upgrading/Expansion Project – Prepurchase of High Rate Clarification Equipment</u>	
City: <u>City of Winnipeg</u>	
Equipment Name: _____	
Equipment Tag Number(s): <u>TBD</u>	
Type: <u>Squirrel-cage induction meeting requirements of NEMA MG 1</u>	
Manufacturer: <u>For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer</u>	
Hazardous Location: <input checked="" type="checkbox"/> Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark	
Motor kW: <u>TBD by Contractor</u>	Guaranteed Minimum Efficiency at Full Load: _____ percent
Voltage: <u>575</u>	Guaranteed Minimum Power Factor at Full Load: _____ percent
Phase: <u>3</u>	Service Factor (@ rated max. amb. temp.): <input type="checkbox"/> 1.0 <input checked="" type="checkbox"/> 1.15
Frequency: <u>60</u>	Enclosure Type: <u>TEFC</u>
Synchronous Speed: <u>Max. 1800</u> rpm	Mounting Type: <input type="checkbox"/> Horizontal <input type="checkbox"/> Vertical
<input type="checkbox"/> Multispeed, Two-Speed: _____ / _____ rpm	<input type="checkbox"/> Vertical Shaft: <input type="checkbox"/> Solid <input type="checkbox"/> Hollow
<input type="checkbox"/> Constant kW rating	<input type="checkbox"/> Vertical Thrust Capacity (lb): Up _____ Down _____
<input type="checkbox"/> Variable Torque	<input type="checkbox"/> Adjustable Speed Drive: See Section 26 29 23, Low Voltage Adjustable Frequency Drive Systems.
<input type="checkbox"/> Constant Torque	Operating Speed Range: _____ to _____% of Rated Speed
Winding: <input type="checkbox"/> One <input type="checkbox"/> Two	<input type="checkbox"/> Thermal Protection: _____
	<input type="checkbox"/> Space Heater: _____ volts, single phase
	<input type="checkbox"/> Oversize main terminal (conduit) box for motors
	<input type="checkbox"/> Terminal for connection of equipment grounding wire in each terminal box
Additional Motor Requirements: <input checked="" type="checkbox"/> See Section 26 20 00, Low-Voltage AC Induction Motors	
Special Features: _____ _____	