

**PART E**  
**SPECIFICATIONS**

## **PART E - SPECIFICATIONS**

### **GENERAL**

#### **E1. GENERAL**

E1.1 These Specifications shall apply to the Work.

#### **E2. GOODS**

E2.1 The Contractor shall supply two (2) identical, wastewater, non-clog pumping units, spare parts and accessories in accordance with the requirements of these specifications.

#### **E3. DELIVERY**

E3.1 Goods shall be delivered within sixteen (16) weeks after approval of shop drawings, f.o.b. destination, freight prepaid to the McPhillips Pumping Station, 360 McPhillips Street, Winnipeg, Manitoba.

E3.2 Goods shall be delivered between 8:30 a.m. and 4:30 p.m. on Business Days. The successful bidder shall give forty-eight (48) hours notice to the Contract Administrator before delivery so that arrangements for receiving can be made.

E3.3 The Contractor shall off-load goods and place into storage at the delivery location as directed by the Contract Administrator or representative.

E3.4 The cost of delivery and off-loading of goods shall be included in the Total Bid Price.

#### **E4. SHIPPING, RECEIVING AND UNLOADING OF PUMPING EQUIPMENT**

E4.1 Carefully prepare equipment for shipment as follows

- (a) Clearly tag and identify each item.
- (b) Cover or plug openings in the equipment.
- (c) Securely crate or strap equipment to pallets and cover to prevent movement and damage during transport.
- (d) Ensure corners or casting do not extend beyond the crate or pallet.
- (e) Provide suitable lifting hooks for handling crates, boxes and heavy pieces.

E4.2 The Contract Administrator or a representative, will inspect and record the condition of all equipment upon delivery and will reject equipment found to be damaged to the extent that it cannot be put to the use for which it was intended.

E4.3 The Contract Administrator or a representative will check for sphere handling capability by passing a wooden test sphere through each pump. Pumps not passing the required sphere size will be rejected.

E4.4 The Contractor shall take possession of rejected equipment, make the necessary arrangements and pay the costs for the prompt repair and return or replacement of the equipment to not delay installation to the Contract Administrator's satisfaction.

E4.5 The Contractor shall promptly repair superficially damaged equipment at their own expense and to the Contract Administrator's satisfaction to not delay installation.

E4.6 The cost of shipping, receiving and unloading of pumping units shall be included in the bid price for "Wastewater Pumping Units".

## **E5. SHOP DRAWINGS**

E5.1 Submit shop drawings for all equipment to be supplied and receive a release for construction from the Contract Administrator before equipment is produced for this Contract.

E5.2 The Contractor shall inform the Contract Administrator in writing of any deviation in the shop drawings from the requirements of the contract documents.

E5.3 Submit 5 prints on a sheet size appropriate for item and information being depicted or an electronic file in a format acceptable to the Contract Administrator.

E5.4 Show following information in the lower right hand corner of each shop drawing

- (a) Name of pumping station.
- (b) City's project number.
- (c) City's Purchase Order Number.
- (d) Manufacturer's name and description or model number of the item.
- (e) Serial number(s) of equipment.
- (f) Date (to be revised per resubmission)

E5.5 The Contract Administrator will review the shop drawings and will release them for construction with reasonable promptness so as to cause no delays. The review is only for conformance with the design concept of the project and with the information given in the specifications. The Contract Administrator's review of a separate item shall not indicate approval of an assembly in which the item functions.

E5.6 Make any corrections required by the Contract Administrator and resubmit the specified number of corrected copies of each shop drawing. Direct specific attention in writing or on resubmitted shop drawings for revisions other than the corrections requested by the Contract Administrator on previous submissions.

E5.7 By approving and submitting shop drawings, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, or will do so, and that he has checked and coordinated each shop drawing and sample with the requirements of the work and of the specifications.

E5.8 The cost of shop drawing preparation and submission shall be included in the bid price for "Wastewater Pumping Units".

## **E6. OPERATING AND MAINTENANCE MANUALS**

E6.1 The Contractor shall provide the Contract Administrator with five (5) copies of the manufacturer's technical literature for each component supplied detailing correct installation procedure and recommended operating and maintenance schedule, grades of lubricants required and assembly/disassembly instructions. Provide one set of manuals for each different pumping unit provided.

E6.2 The cost of operating and maintenance manual preparation and submission shall be included in the bid price for "Wastewater Pumping Units".

E6.3 Final payment for the pumping equipment will be made only after the Contract Administrator has received and accepted the manuals.

## **E7. PUMP TESTS**

### **E7.1 Testing Methods**

E7.1.1 Pump tests shall be conducted in accordance with Hydraulic Institute Standards - Centrifugal Pumps Test Code. All definitions for the purpose of testing shall be as set forth by Hydraulic Institute Standards - Centrifugal Pumps Ratings.

E7.1.2 Motor tests shall be conducted in accordance with CSA 22.2 No. 100, EEMAC, MG-2

(a) In addition to the specified test standards, each motor shall be tested for:

- (i) Running current
- (ii) Locked rotor current
- (iii) Hi-pot test
- (iv) Winding resistance

### **E7.2 Shop Tests**

E7.2.1 Each pump shall be tested in the manufacturer's shops over the range of operation from shut-off to run-out. A certified test curve in duplicate showing the head, capacity, pump efficiency and power for each pump shall be furnished to the Contract Administrator for approval prior to the pumps being shipped. Test curves shall be signed by the pump manufacturer's official responsible for the test.

E7.2.2 Final payment for the pumping equipment will be made only after the Contract Administrator has received the certified test curve for each pump supplied.

### **E7.3 Field Tests**

E7.3.1 Field tests will be performed on each pumping unit as soon as possible after the Contractor has inspected the installation. Field tests will be to determine and check for the following.

- (a) Capacity.
- (b) Noise (bearing, mechanical seal, cavitation, other).
- (c) Vibration.
- (d) Electrical energy supplied to the motors from motor control centre.

E7.3.2 The liquid pumped during the field test will be raw sewage with a density taken to be 1.00 kilogram per litre.

E7.3.3 If the field pump tests indicates the equipment supplied does not meet the requirements specified in E8, the Contractor shall promptly correct the problem at his expense to the Contract Administrator's satisfaction.

E7.3.4 If the Contractor is not satisfied with the procedure of the tests or the City's interpretation of the results thereof, the Contractor may have the tests repeated, or their interpretation referred to a referee acceptable to both the City and himself. The cost of the services of such referee shall be borne by the City if the referee rules that the tests as reported by the City were to the detriment of the Contractor, but if otherwise, the Contractor shall pay the cost of the services of the referee and of repeating the tests. The decision of the referee shall be final and binding both on the City and the Contractor.

E7.3.5 The cost of pump testing shall be included in the bid price for "Wastewater Pumping Units".

## **E8. WASTEWATER PUMPING UNITS**

### **E8.1 General Requirements**

- (a) Two (2) identical pumping units are required for the Assiniboine Park Conservatory Wastewater Pumping Station.
- (b) The units will be used to pump raw sewage having a temperature range of 0° to 30°C and will operate under conditions of flooded suction.
- (c) Each pump shall be a single stage, non-clogging, centrifugal flow, vertical mounted, pump coupled to an electric motor on a level above the pump with a drive shaft assembly suitable for dry pit installation.

#### E8.1.1 Pumps

- (a) Rated capacity: each pump must meet or exceed the following operating point:  
18.93 L/s (300 USgpm) @ 8.8m (28.9') head (includes static head)
- (b) Rotation (viewed from above): Clock-wise (Centreline Discharge)
- (c) Type of impeller: non-clog
- (d) Size of sphere pump impeller shall pass: 75mm dia.
- (e) Required size of Discharge: 100mm dia.
- (f) Net Positive Suction Head Available: 9.45m (31.0) maximum

#### E8.1.2 Motors

- (a) Power Supply: 550 Volt AC, 3PH
- (b) Speed: 1200 rpm
- (c) Motor Service Factor: 1.15
- (d) Motor Efficiency: High Efficiency Motor
- (e) Percent of Full Load Amps at Given Operating Point: 90% max.
- (f) Motor Speed Torque Characteristics: Nema Design B
- (g) Starts Per Hour Capability: 6 maximum
- (h) CSA Specification Conformance: C 22.2 No. 100

E8.1.3 Durable metal nameplates shall be securely attached to each pumping unit supplied. Pump nameplates shall indicate the serial number, capacity, head, rpm, and other pertinent data. Motor nameplates shall indicate the serial number, voltage, phase, hertz, rpm, horsepower, service factor, Nema Design, insulation class and any other pertinent data.

#### E8.1.4 Drive Shaft Assembly

- (a) Pumps shall be provided with a vertical hollow steel drive shaft with flexible coupling(s) to transmit power from the motor to the pump. The assembly shall be of approved design "Hayes-Dana" or approved equal. The coupling arrangement shall permit easy removal of either the pump or motor without disturbing the other. Only one length of shaft shall be used between the pump and motor.
- (b) The distance from the centreline of pump suction to the motor room floor is 3.05 metres. The Bidder shall use this distance to approximate the drive shaft length for bidding purposes. After award of the contract, the Contractor shall be responsible to take exact measurements for final sizing of the drive shaft length.
- (c) The drive shaft and coupling(s) shall have ample capacity to transmit power continuously for all operating conditions with up to 3 degrees of misalignment which may occur during or develop after installation.

- (d) Provide flexible, removable, U-shaped, minimum 1.6mm thick galvanized steel mesh coupling guards around each drive shaft. Construct and install coupling guards to OSHA standards.
- (e) Removable metal shaft guards shall be provided with the drive shafts.
- (f) The cost of the drive shafts, flexible couplings and guards shall be included in the bid price for the "Wastewater Pumping Units."

## **E9. DESIGN, WORKMANSHIP AND CONSTRUCTION OF PUMPING UNITS**

### **E9.1 General**

- (a) All unspecified materials shall be selected specifically for their suitability considering their duty. Castings shall be free from flaws and imperfections and machined surfaces finished true.
- (b) The inside and outside corners and edges of all castings shall be rounded off. Nuts and bolts shall have approved means to prevent them from becoming loose (pins, spring or friction washers, or mastic compound). No patching, plugging, shimming or other means of overcoming defects, discrepancies or errors shall be used without the written permission of the Contract Administrator.
- (c) All rotating components shall be statically and dynamically balanced as an assembled unit.

### **E9.2 Casings**

- (a) Pump casings shall be cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal.
- (b) The pump casing shall be of the centrifugal volute type of ample thickness and rigidity to withstand stresses due to hydraulic forces, weight of piping, erection loads, operating and testing.
- (c) The casings shall be so proportioned that the change in energy of the sewage from the kinetic form as it leaves the impeller, to the pressure form as it leaves the casing will take place gradually without eddy formation or shock. It shall be so designed that radial forces of the impeller shaft and bearings shall be balanced. Inside water passages shall be smooth and free from any projections.
- (d) The front head shall permit equal distribution of sewage to all parts of the impeller without the use of stationary guides or vanes on the suction side of the impeller.
- (e) The casing shall be designed to permit the removal of the rotating assembly without disturbing the suction and discharge piping.
- (f) The volute shall be equipped with a handhole to permit access to the inside for cleaning and unclogging of the volute. A tapped 10mm NPT hole shall be provided on the top of the volute to allow trapped air within the volute to be bled off. The tapped hole shall be provided with a suitable length of brass pipe and a shut off ball valve.
- (g) The fully assembled casing shall be shop tested and certified to successfully withstand a hydrostatic test pressure of not less than 1.5 times the shut-off head of the largest impeller size as shown by the characteristic curve.
- (h) The casing shall be equipped with a lifting ring capable of lifting the entire pumping unit.

### **E9.3 Backhead and Stuffing Box**

- (a) The backhead shall be a separate piece from the volute casing and of cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal.

- (b) The backhead shall be designed to rigidly support the bearing frame and be a self-centering and self-indexing fit with the volute casing to ensure proper alignment.
- (c) A minimum of two large openings opposite each other adjacent to the stuffing box shall be provided to allow access for maintenance.
- (d) Provision shall be made on the backhead for external axial adjustment of the rotating element to maintain proper clearance between the impeller and front head wearing rings.
- (e) The stuffing box shall be integral with the backhead and suitable for the use of a double mechanical seal and provided with a bolt down two piece split gland plate.
- (f) Tapped 10mm NPT inlet and vent holes complete with suitable lengths of brass pipe and shut-off ball valves shall be provided on the stuffing box for seal water inlet and outlet.
- (g) The stuffing box shall be provided with a tapped drain hole.

#### E9.4 Bearing Frame

- (a) Bearing frame shall be cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal machined for accurate and permanent bearing alignment completely enclosing the shaft between the bearings.
- (b) The bearing frame shall be designed to rigidly support the motor adapter frame and be a self-centering and self-indexing fit with the backhead to ensure proper alignment.
- (c) Provide lip type grease seals in contact with the shaft complete with grease fittings for bearing lubrication.

#### E9.5 Suction and Discharge

- (a) Suction and discharge shall be flanged, faced and drilled to conform to ASME Specification B 16.1 (Class 125).
- (b) Pumps shall be equipped with a 90° suction elbow with a handhole to permit access to the suction side of the impeller for cleaning and inspection. Suction elbows may be of the increasing type in order to meet the required suction size.
- (c) Gauge connections, tapped for 10mm NPT threaded pipe, shall be provided on each suction and discharge nozzle located close to flanges. Tapped holes shall be provided with suitable removable plugs.
- (d) The suction and discharge shall be orientated horizontally opposite each other on the centreline of the pump.

#### E9.6 Impeller

- (a) The impeller shall be fabricated from cast iron conforming to ASTM Specification A 48, for Gray Iron Castings, Class 30 or approved equal. The cast iron shall contain not less than 3 percent nickel.
- (b) The impeller shall be of the non-clog enclosed channel type. The impeller shall be cast in one piece and shall be balanced both statically and dynamically. If the impeller supplied has been trimmed from a larger impeller, it shall be trimmed over its full height, no lip or protrusion shall be left around the bottom edge. Trimmed impellers shall be balanced after trimming. The impeller shall be machined and polished to a smooth finish.
- (c) The impeller shall be designed to ensure smooth operation without cavitation or vibration and shall be keyed securely to the tapered shaft and held in place by an impeller nut and stainless steel set screw. The impeller nut shall be dome shaped with a smooth face and blend into the hub so as not to allow any stringy material to accumulate around the nut. Hex shaped nuts shall not be used. The assembly of the

impeller and shaft shall be so constructed and the parts so interlocked that the impeller cannot become loosened by torque resulting from rotation.

#### E9.7 Wear Rings

- (a) Removable wear rings of the axial or radial type shall be provided for the front head and impeller. Wear rings shall be fabricated from stainless steel conforming to ASTM Standard A296, for Corrosion-Resistant Iron Chromium, Iron-Chromium-Nickel, and Nickel-Base Alloy Castings for General Application, Grade CA-15 or approved equal.
- (b) The rings shall be machined for a close fit to minimize the leakage of sewage from the discharge to the suction. The rings shall be attached in such a way as to allow for ready adjustment or replacement and to prevent loosening under normal operation or under reverse pump rotation. The impeller ring hardness shall be not less than 300 Brinell and shall exceed the front head ring hardness by not less than 50 Brinell.

#### E9.8 Shaft Assembly

- (a) The shaft assembly shall be fabricated from steel conforming to ASTM A108, Grade 1141 or approved equal.
- (b) The shaft shall be of sufficient diameter to assure rigid support of the impeller and to transmit loads without slip, vibration or undue deflection at all operating speeds and loads.
- (c) The shaft shall be accurately machined along its entire length and keyways shall be provided at both ends.
- (d) A replaceable shaft sleeve fabricated from stainless steel conforming to ASTM A296, Grade CA-15 or approved equal shall be provided where the shaft passes through the stuffing box. The hardness shall not be less than 350 Brinell.
- (e) Shaft sleeve shall be fitted and securely fastened in place after shaft grinding and sealed to prevent leakage between the sleeve and shaft.
- (f) The shaft sleeve shall extend no less than 2mm above the top of the gland cover.

#### E9.9 Bearings

- (a) Bearings shall be of the heavy duty anti-friction type suitable for oil or grease lubrication. Radial bearings shall be of the self-aligning plain roller or ball type and thrust bearings shall be of the tapered roller or angular contact type. All bearings shall be amply proportioned for all possible loads without undue heating and shall be rigidly supported so as to counteract any possible tendency towards vibration. Duplex bearings, if used, shall be ground and matched.
- (b) Lubrication shall be adapted to the operation of the units without full-time attendance.
- (c) The bearings shall be designed for a B-10 life of not less than 100,000 hours in accordance with AFBMA.

#### E9.10 Mechanical Seals

- (a) The pumps shall be equipped with double mechanical seals. The primary and secondary sealing faces shall be carbon to ceramic. Seals shall be as manufactured by John Crane, Durametallc or approved equal.
- (b) Seals shall be pressurized and lubricated by domestic water.

#### E9.11 Pump Support

- (a) Pumps shall be provided with a rigid four legged stand or the 90° suction elbow shall have an integrally cast base support to firmly support the entire weight of the pump.



The stand or base shall be suitable for mounting to the existing concrete floor or on a concrete base using anchor bolts.

#### E9.12 Motors

- (a) Each pump shall be driven by a vertical shaft, squirrel cage, totally enclosed fan cooled, high efficiency induction motor. Motors shall conform to CSA Specification C22.2 No. 100 and all other CSA Specifications referenced therein.
- (b) Motors shall be suitable for full voltage or reduced voltage starting.
- (c) Each motor shall be able to operate, without damage, at full load with voltages from 10% below to 10% above 550 volts. Motor horsepower shall not be less than 5% in excess of the maximum power requirement of the pump at any point on the pump characteristic curve. This rating shall be exclusive of the motor service factor.
- (d) Each motor will be subject to a maximum of six (6) start/stop cycles per hour and the stator winding insulation suitable for such operation.
- (e) In no case shall stator winding insulation be less than Class F.
- (f) Each motor shall be equipped with heavy duty grease-lubricated and anti-friction bearings with an AFBMA B10 rating of 100,000 hours.
- (g) Each motor shall have a maximum noise level of 85 dBa at 1.2m distance.
- (h) Acceptable motor manufacturers: Westinghouse, General Electric, Toshiba, Baldor, U.S. Electric, TECO or approved equal.

#### E9.13 Painting

- (a) All exterior metal surfaces, except finished and machined surfaces, shall be given two undercoats of a rust inhibitive primer and one coat of an approved enamel.
- (b) Nameplates shall not be painted over.

### **E10. SPARE PARTS**

E10.1 Provide the following spare parts for the pumping equipment.

- (a) 2 sets of wear rings.
- (b) 2 mechanical seals.
- (c) 2 impellers.
- (d) 2 volute gaskets

E10.1.2 Spare parts shall be properly packaged to resist damage and the package shall be clearly identified as to its contents.

E10.1.3 Spare parts shall be identical to those supplied in the pumping units.

E10.2 Supply of spare parts will be measured for payment on a unit basis for each type of spare part and paid for at the Contract Unit Price for "Spare Parts". Number of units to be paid for will be the total number of spare parts supplied in accordance with this specification, accepted and measured by the Contract Administrator.

### **E11. TOOLS AND ACCESSORIES**

E11.1 Provide special tools or accessories required for maintenance, adjustment, assembly or disassembly of the equipment supplied.

E11.2 The cost of any special tools or accessories shall be included in the bid price for "Wastewater Pumping Units".

## **E12. INITIAL START-UP INSPECTION**

- E12.1 Pumping equipment supplied under this Contract will be installed by the City under a separate contract.
- E12.1.1 The Contractor shall provide the services of a qualified technical representative to be present at the initial start-up of each pumping unit supplied under this contract.
- E12.1.2 The Contractor shall allow for one (1) full working day of supervision for each pumping unit.
- E12.1.3 The representative shall perform an inspection of the pumping units and associated piping to ensure they have been properly installed, in accordance with the manufacturer's instructions, conduct and document amp draw, rotation and speed tests, check for unusual vibration or noises and instruct City personnel in the operation and maintenance of the equipment. The Contractor will not be responsible for the installation Work.
- E12.1.4 The price provided for "Initial Start-up Inspection" shall cover all costs associated with this item of Work including travel expenses, accommodations, meals, and wages.
- E12.2 Performance of initial start-up inspection will be measured for payment on a unit basis for each day and paid for at the Contract Unit Price for "Initial Start-up Inspection". Number of days to be paid for will be the total number of days of start-up inspection performed in accordance with this specification, accepted and measured by the Contract Administrator.
- E12.3 If both pumps have their initial start-up inspection on the same day, only one day shall be paid for initial start-up.