

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 three (3) identical, submersible, non-clog pumping units, spare parts and accessories in accordance with the requirements of these specifications.

E3. DELIVERY

E3.1 Goods shall be delivered in 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 "Submersible 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 At the time of submission 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 "Submersible Pumping Units".

E6. OPERATING AND MAINTENANCE MANUALS

E6.1 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 "Submersible 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, he 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 "Submersible Pumping Units".

E8. SUBMERSIBLE PUMPING UNITS

E8.1 General Requirements

E8.1.1 Pumps

- (a) Rated capacity: each pump must meet or exceed the following operating point:
28.3 L/s (450 USgpm) @ 9.8m (32.2') head (includes static head)
- (b) Rotation (viewed from above): CW
- (c) Type of impeller: non-clog
- (d) Size of sphere pump impeller shall pass: 75mm dia.
- (e) Required size of Discharge: 150mm dia.
- (f) Net Positive Suction Head Available: 9.72m (31.9) maximum

E8.1.2 Motors

- (a) Maximum Horsepower: 20
- (b) Power Supply: 600 Volt AC, 3PH
- (c) Speed: 1760 rpm
- (d) Motor Service Factor: 1.15
- (e) Motor Efficiency @ : Full Load: 83% min.
- (f) Percent of Full Load Amps at Given Operating Point: 90% max.
- (g) Motor Speed Torque Characteristics: Nema Design B
- (h) Starts Per Hour Capability: 15 maximum
- (i) 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.

E8.2 Materials

E8.2.1 Pump casing: ASTM A48, Class 30 grey cast iron.

E8.2.2 Impeller: ASTM A48, Class 30 grey cast iron with 3% nickel content.

E8.2.3 Wear Rings:

- (a) Impeller wear ring: ASTM Standard A296 stainless steel minimum 250 Brinell Hardness.
- (b) Volute wear ring: ASTM A48, Class 30 cast iron.

E8.2.4 Pump Shaft: ASTM A276 Type 416 stainless steel.

E8.2.5 Nuts, Bolts and Fasteners: ASTM A276 Type 316 Stainless Steel.

E8.2.6 Guide Rails: Hot dipped galvanized steel or cast iron.

E8.2.7 Lifting Chain: Grade 80 high strength alloy, oblong link, chain, with hot dipped galvanized finish.

E8.3 Construction

E8.3.1 Pump Casing

- (a) Pump casing shall be a heavy-duty single volute design with an integral centreline discharge outlet.
- (b) The volute shall have smooth passages without blowholes, porosity or other irregularities.
- (c) The pump discharge shall be complete with a flanged connection meeting ANSI flange thickness, dimensions and bolt pattern requirements.
- (d) Sealing of casing components shall be by metal-to-metal contact between machined surfaces.
- (e) Where watertight sealing is required surfaces shall be machined and fitted with nitrile rubber O-rings. O-rings shall provide watertightness by being compressed in position and making contact on four sides without the requirement of a specific torque requirement.

E8.3.2 Impeller

- (a) The impeller shall be of the non-clog design capable of handling solids, fibrous material, sludge and other material typically found in raw sewage.
- (b) The impeller shall be dynamically and statically balanced.
- (c) The impeller shall be keyed to the pump shaft and retained with an Allen head bolt

E8.3.3 Wear Rings

- (a) Removable wear rings shall be provided on the suction inlet of the impeller between the impeller and the volute and on the volute.
- (b) The wear 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.

E8.3.4 Pump Shaft

- (a) Pump and motor shaft shall be an integral piece.
- (b) The shaft shall be sized to transmit the rated loads with a liberal safety factor.
- (c) Shafts shall be accurately ground and stepped to accommodate bearings and the mechanical seal.

E8.3.5 Bearings

- (a) The pump shaft shall rotate on two permanently grease lubricated bearings of sufficient size to transfer all radial and axial loads to the housing while minimizing shaft deflection and heat build-up.
- (b) The upper bearing shall be a single roller bearing and the lower bearing shall be a two row taper or angular contact bearing.
- (c) The bearings shall be designed for a B-10 life of not less than 100,000 hours in accordance with AFBMA.

E8.3.6 Mechanical Seals

- (a) Each pump shall be provided with a double mechanical seal that operate independently from one another in an oil filled reservoir.
- (b) The lower seal shall be located directly behind the impeller shall contain one stationary and one positively driven rotating ring. Ring material shall be either tungsten carbide or silicon carbide.

- (c) The upper seal shall be located directly below the motor shall contain one stationary tungsten carbide or ceramic seal ring and one positively driven rotating carbon seal ring.
- (d) Each seal shall be held in contact by its own spring system.
- (e) Seals shall require neither maintenance or adjustment nor depend on direction or rotation for sealing.

E8.3.7 Discharge Assembly

- (a) Provide a quick-disconnecting discharge assembly for each pump consisting of a slide bracket bolted to the pump discharge flange and a mating discharge elbow to allow the pump to be installed and removed from the wet well without personnel entering the wet well.
- (b) The assembly shall be designed so the pump discharge will seat automatically to the discharge elbow with a metal-to-metal contact with the pump in the fully lowered position.
- (c) No part of the pump itself shall bear directly on the wet well floor.

E8.3.8 Guide Bars or Rails

- (a) Provide a minimum of 2 guide bars or rails for each pumping unit extending from the top of the pumping station wet well to the discharge elbow.
- (b) The following elevations shall be used to determine the guide bars or rails length.
 - (i) Wet well floor elevation: 220.675.
 - (ii) Top of intermediate floor elevation: 226.817. Floor thickness: 225 millimetres.
 - (iii) Top of top floor elevation: 233.477. Floor thickness: 225 millimetres.
- (c) Provide intermediate support brackets as required for proper support of the fully loaded guide rails. Intermediate guide rail supports shall not interfere with pump removal and installation.

E8.3.9 Lifting Handle

- (a) Provide a lifting handle for each pump securely bolted to the top of the pumping unit.
- (b) The lifting chain shall be sized to handle a minimum of 2 times the weight of the pumping unit and any stresses placed on the handle by the lifting or lowering action.

E8.3.10 Lifting Chain

- (a) Provide a 12.8 metre long lifting chain for each pumping unit. The lifting chain shall be sized to handle a minimum of 2 times the weight of the pumping unit and any stresses placed on the chain by the lifting or lowering action.
- (b) The lifting chain shall be securely attached to the lifting handle on the pumping unit with a removable clevis or other device.

E8.3.11 Pump Motor

- (a) Motors shall conform to CSA Specification C22.2 No. 100 and all other CSA Specifications referenced therein.
- (b) The pump motor shall be designed and assembled by the same manufacturer
- (c) Motor horsepower shall be adequate so the pump is non-overloading throughout its entire operating range.
- (d) Each pump motor shall be an induction type, squirrel cage rotor design.
- (e) Rotor and stator shall operate in an air filled watertight housing.
- (f) Motors shall be suitable for full voltage or reduced voltage starting.

- (g) Each motor shall be able to operate, without damage, at full load with voltages from 10% below to 10% above 575 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.
- (h) Each motor will be subject to a maximum of 15 starts per hour and the stator winding insulation suitable for such operation.
- (i) In no case shall stator winding insulation be less than Class F
- (j) Thermal switches set to open at 125 degrees C shall be embedded in the stator lead coils to monitor the temperature of each phase winding. Thermal switches for phase winding shall be in addition to motor overload protection and shall be connected to the control panel.
- (k) The junction chamber containing the terminal board shall be hermetically sealed from the motor by an elastomeric O-ring seal. Connection between the cable conductors and stator leads shall be made with threaded, compression type binding posts permanently affixed top a terminal board.
- (l) A leakage sensor shall be included to detect water in the stator chamber. The sensor shall be connected to a switch that stops the motor and send an alarm to both the local panel and a remote monitoring location when water is detected in the chamber.

E8.3.12 Cooling System

- (a) Each pumping unit shall be provided with an adequately designed, non-clogging, liquid filled, cooling system encircling the stator housing to allow the pump to run continuously at temperatures up to 40 degrees C when not submerged.
- (b) The liquid in the cooling system shall not be sewage, filtered or otherwise.
- (c) Impeller back vanes may be used to provide circulation of the cooling fluid through the cooling system.
- (d) The cooling system shall be accessible from the exterior of the pumping unit.
- (e) Provisions shall also be made for external cooling and seal flushing.

E8.3.13 Surface Coating

- (a) The outside surfaces of each pumping unit shall have an electrostatically applied powder coat, baked on epoxy finish resistant to raw sewage or approved equal.
- (b) Equipment nameplates shall not be painted or coated over.

E8.3.14 Power Cable

- (a) Each pump shall be provided with a continuous length of power cable from the motor control centre to the cable entry on the pump.
- (b) Power cable shall be sized according to CEC and CSA requirements.
- (c) The outer jacket of the power cable shall be oil resistant chloroprene rubber or approved equal, suitable for use in raw sewage.

E8.3.15 Power Cable Entry

- (a) Each pump shall be provided with a watertight power cable entry consisting of a single elastomer grommet with washers located on each side all having a close tolerance fit against the power cable and the inside diameter of the entry providing a compression fit to seal fluid out.
- (b) The assembly shall allow easy replacement of cable by using the same entry grommet.
- (c) The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the interior from fluid.

E8.4 Measurement and Payment

E8.5 Supply of pumping Units will be measured for payment on a unit basis and paid for at the Contract Unit Price for "Submersible Pumping Units". Number of units to be paid for will be the total number of submersible pumping units supplied in accordance with this specification, accepted and measured by the Contract Administrator.

E8.6 Further to Clause 12 of the General Conditions, payment for the pumping units shall be as follows:

- (a) Seventy-five percent (75%) of the equipment price upon delivery of all items to the satisfaction of the Contract Administrator;
- (b) The balance of the equipment price upon successful operation of the pumping units or six (6) months after delivery, whichever comes first, if, in the opinion of the Contract Administrator, the delay has been through no fault of the Contractor and the submission of the certified pump curves and operating and maintenance manuals.

E9. CONTROL SYSTEM

E9.1 Provide a control system for a 2 pump arrangement in a metal panel specifically designed for sewage pumping stations that performs the following functions.

- (a) Indication and alarming of pump protection features.
- (b) Alternation to second duty pump on failure of first duty pump.
- (c) Monitoring of power supply quality such as, low/high voltage, phase imbalance and failure.
- (d) Storage of operating data including power consumption, duration and frequency of each pump operation.
- (e) Telemetry.

E9.1.2 Supply of the control system will be measured for payment on a unit basis and paid for at the Contract Unit Price for "Control System". Number of units to be paid for will be the total number of control systems supplied in accordance with this specification, accepted and measured by the Contract Administrator.

E10. SPARE PARTS

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

- (a) 2 impellers.
- (b) 3 mechanical seals.
- (c) 3 set of wear rings.

E10.1.1 Spare parts shall be identical to those supplied in the pumping units.

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

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.
- E11.1.1 The cost of any special tools or accessories shall be included in the bid price for "Submersible 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, 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.