SECTION 11931

SUBMERSIBLE WASTEWATER PUMPS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

The work covered by this section and the related sections consists of providing all labor, material, equipment and performing all construction required to purchase and install non-clog wastewater pumps complete all accessories as specified herein and shown on the drawings. This section includes pump(s) to be supplied with motor, volute, mounting brackets, power cable and accessories.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including the General and Supplementary Conditions and Division 1 Specification sections, apply to this section.

B. Section 01300 – Submittals

C. Section 11930 – Pumps – General

D. Section 15100 – Mechanical Components

E. Section 16050 - Electrical General Requirements

1.03 PUMP PERFORMANCE DATA & CERTIFIED TEST RESULTS

A. Factory testing in accordance with the standards of the Hydraulic Institute shall be required for each pump.

B. Certified pump performance curves shall be submitted for approval by the Engineer on the wastewater pumps prior to shipment. The certified pump performance curves shall be submitted, including head, capacity, brake horsepower, and pump efficiency for each pump supplied.

C. The pump shall be tested through the specified range of flow, and head/capacity/efficiency curves plotted at maximum output speed. During each test, the pump shall be run at each head condition for sufficient time to accurately determine discharge, head, power input, and efficiency.

D. If any pump tested fails to meet any specification requirement it will be modified until it meets all specification requirements. If any pump tested fails

to meet the efficiency requirements at any of the listed flow or head conditions as specified and all reasonable attempts to correct the inefficiency are unsuccessful, the pump(s) shall not be accepted and shall be replaced with unit(s) which meets the specified requirements. Performance data must be the results of project pump. Also report amperage and voltage of each power leg, efficiency, and horsepower.

E. Motor data such as amperage and voltage of each power leg, efficiency, horsepower is also required.

1.04 QUALITY ASSURANCE

A. Provide shop drawings in maintenance material in accordance with Section 01300. Shop drawings shall be provided to show compliance with these specifications, plans or other specifications that will influence the proper operation of the pump(s). Shop drawings for approval must consist of:

1. Pump Performance Curves.
2. Pump Outline Drawing.
3. Station Drawing for Accessories.
4. Electrical Motor Data.
5. Control Drawing and Data.
6. Access Frame Drawing.
7. Typical Installation Guides.
8. Technical Manuals.
9. Parts List.
10. Printed Warranty.
11. Manufacturer’s Equipment Storage Recommendations.
12. Manufacturer’s Standard Recommended Start-Up Report Form.

Lack of the above requested submittal data is cause for rejection.

B. Provide operation and maintenance material and record drawings in accordance with Section 01730.

C. Provide manufacturer's certification of correct installation after manufacturer's inspection.

PART 2 PRODUCTS

2.01 SUBMERSIBLE WASTEWATER PUMPS

A. Requirements

1. The pump(s) shall be heavy duty, electric submersible rated, centrifugal, self-cleaning, semi-open impeller design, non-clog units designed for

handling raw, unscreened sewage and wastewater and shall be fully guaranteed for this use.

2. The pumps provided shall be capable of continuous operating in ambient outdoor conditions. The use of shower systems, secondary pumps or cooling fans to cool the motor shall not be acceptable.
3. The pump and motor unit shall be suitable for continuous operation at full nameplate load.
4. The pump, mechanical seals and motor units provided under this specification shall be from the same manufacturer in order to achieve standardization of operation, maintenance, spare parts, manufacturer's service and warranty.

Pump performance shall be non-overloading across the entire performance curve. Pump and motor shall be Flygt model NT3127.185 Type HT, impeller diameter 7 11/16 inches, utilizing the self-cleaning semi-open N-Series pump for wastewater handling, or approved equal.

Each pump shall be equipped with a 7.5 HP submersible electric motor, connected for operation on 230 volts, 3 phase, 60 hertz, 4 wire service with 50 feet of cable suitable for outdoor pump applications. The power cable shall be sized according to NEC and ICEA standards and also meet with P-MSHA Approval.

B. Pump Design

The pump(s) shall be designed for installation as shown on the drawings. Each pump is tested and approved in accordance with national and international standards (IEC 34-1, HI, CSA).

C. Pump Construction

Major pump components shall be of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts shall be AISI type 316 stainless steel construction. Sealing design shall incorporate metal-to-metal contact between machined surfaces. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Critical mating surfaces where watertight sealing is required shall be machined and fitted with Nitrile or Viton rubber O-rings. Fittings will be the result of controlled compression of rubber O-rings in two planes and O-ring contact of four sides without the requirement of a specific torque limit. Gaskets requiring specific torque limits to achieve compression shall not be

considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices shall be used.

D. Cooling System

Each pump motor shall be sufficiently cooled by the surrounding environment.

E. Cable Entry Seal

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

F. Motor

The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of withstanding at least 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-

type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80° C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

G. Bearings

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two row angular contact ball bearing. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

H. Mechanical Seal

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber, shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide seal ring. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

I. Pump Shaft

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T. Shaft sleeves will not be acceptable.

J. Impeller

The impeller shall be of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The Impeller shall be locked to the shaft and held by an impeller bolt. Mass moment of inertia calculations shall be provided by the pump manufacturer upon request. Impeller(s) shall be, retained with an Allen head bolt and shall be capable of passing a minimum 3-inch diameter solid. All impellers shall be coated with acrylic dispersion zinc phosphate primer.

K. Volute

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have integral spiral-shaped, sharp-edged groove(s) that is cast into the suction cover. The spiral groove(s) shall provide the sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

L. Protection

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

The thermal switches and float switch shall be connected to a Mini CAS control and status monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.

PART 3 EXECUTION

3.01 SUBMERSIBLE WASTEWATER PUMPS

A. Install all equipment in strict conformance with the manufacturer's specifications and industry standards.

B. Manufacturer's representative for pump shall inspect installation for correctness and compliance with manufacturer’s specifications and submit written certification that equipment is ready to be placed in service.

C. No piping connecting any of the equipment will be jacked, pried or forced in to position in any way. All piping must mate perfectly with the equipment it is attaching prior to installation of flange bolts or other connecting devices.

D. Spare Parts

1. None

E. Store spare pumps, parts, drivers, etc. in strict accordance with manufacturer's recommendations. Notify the owner in writing of any special storage maintenance required, and provide such maintenance until final acceptance of contract.

3.02 TESTING

A. Testing performed upon each pump shall include the following inspections:

1. Impeller, motor rating and electrical connections shall be checked for compliance with this specification.
2. Prior to submergence, each pump shall be run dry to establish correct rotation.
3. Motor and cable insulation shall be tested for moisture content or insulation defects.

B. A written quality assurance record confirming the above testing/inspections shall be supplied with each pump at the time of shipment.

C. Each pump (when specified) shall be tested in accordance with the latest test code of the Hydraulic Institute (H.I.) at the manufacturer to determine head vs. capacity and kilowatt draw required. Witness tests shall be available at the factory upon request.

D. The pump(s) shall be rejected if the above requirements are not satisfied.

3.03 START-UP SERVICE

A. The equipment manufacturer shall furnish the services of a qualified factory trained field service engineer for 8-hour working day(s) at the site to inspect the installation, perform start-up and instruct the owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the contractor shall have the manufacturer do the following:

1. Megger stator and power cables.
2. Check seal lubrication.
3. Confirm for proper rotation.
4. Confirm power supply voltage.
5. Confirm pump flow as measured by existing flow meter.
6. Confirm pump discharge pressures as measured by calibrated gauges, converted to feet of liquid pumped.
7. Based on field test data, confirm pump performance corresponds to the pump performance curve.
8. Measure motor operating load and no load current.
9. Check pressure control operation and sequence.

3.04 FACTORY SERVICE

Factory-Approved service facilities with qualified factory-trained mechanics shall be available for prompt emergency and routine service.

3.05 GUARANTEE

In addition to the general guarantee required elsewhere in these specifications, the pump manufacturer shall furnish the Owner with a written warranty to cover the pump(s) and motor(s) against defects in workmanship and material for a period of five (5) years or 10,000 hours of operation under normal use and service. The pump manufacturer will pay a pro-rated cost of all replacement parts and repair labor from the date of shipment of the pump unit. Pumps repaired under warranty will be returned to the owner freight prepaid. The warranty shall be in printed form and previously published as the manufacturer's standard warranty for all similar units manufactured.

END OF SECTION

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