SECTION 11315

SUBMERSIBLE SEWAGE PUMPS

# GENERAL

## SCOPE OF WORK

### Furnish, install, and field test sewage pumps and submersible motors, with all required appurtenances shown in the plans and specified herein as necessary for a complete operating installation.

### The Contractor is responsible for ensuring all equipment required is provided, and that it is compatible and suitable for the application.

### The specifications and drawings adequately describe the system, but do not purport to cover all required details. Provide all appurtenances required, whether specifically noted herein or not, at no additional cost to the Owner.

### Provide O&M manuals for all equipment installed.

## RELATED WORK SPECIFIED ELSEWHERE

### Section 09800 - Painting and Coating

### Section 15000 - General Piping System and Appurtenances

## REFERENCE STANDARDS

Herein specified pump equipment shall meet the design standards of the following organizations as applicable.

### AFBMA – Anti-Friction Bearing Manufacturers Association

### IEEE – Institute of Electrical and Electronics Engineers, Inc.

### AISI – American Iron and Steel Institute

### ANSI – American National Standards Institute

### ASME – American Society of Mechanical Engineers

### ASTM – American Society of Testing and Materials

### AWS – American Welding Society

### HIS – Hydraulic Institute Standards

### NBS – National Bureau of Standards

### NEMA – National Electric Manufacturers Association

### NFPA – National Fire Protection Association

### SAE – Society of Automotive Engineers

### UL – Underwriters Laboratories, Inc.

### FM – Factory Mutual

## DESCRIPTION

### General

#### Submersible pumps to be installed in a wet well for purposes of pumping unscreened domestic raw sewage.

### Provisions

#### The size and location of pump discharge elbows will vary from manufacturer to manufacturer. It shall be the Contractors responsibility to make adjustments to the pump and/or discharge piping and fittings as necessary to match the discharge piping elevations that are set on the drawings. Any costs for modifications required to meet the elevations set on the drawings shall be borne by the Contractor.

#### The drawings and specifications indicate general arrangement and layout based upon pumping equipment supplied by hereinafter-specified manufacturers. If equipment accepted requires arrangement, dimensions, or design, which differs from that indicated or specified, or additional equipment not specified, any costs for modifications required are to be borne by the Contractor.

#### Drawings and specifications direct attention to certain features of equipment, but do not purport to cover all details entering into design and construction of the equipment, controls, or appurtenances.

#### Conduit, wire, and connections for electrical power are shown on the electrical drawings. In the event that the system proposed requires additional power, wiring or starters other than what is shown on electrical drawings, Contractor is fully responsible for any additional electrical costs.

### Conditions of Service

#### Pumps will be installed within a wet well specifically designed for such service.

#### Pumps will handle raw domestic sewage, with entrained grit, solids, and stringy materials.

#### Pertinent elevations and dimensions as indicated on drawings.

### Operating Requirements

#### Each pump system shall conform to the following operating parameters:

#### Rated Condition

##### Capacity, gpm [xx]

##### TDH, ft. [xx]

##### Static Head, ft. [xx]

##### Shutoff Head, ft. (maximum) [xx]

##### Rotating Speed, rpm [xx]

##### Motor Horsepower (maximum) [xx]

## QUALITY ASSURANCE

### All parts to be amply proportioned for long, continuous, and uninterrupted service. Provisions to be made for easy lubrication, adjustment, or replacement of all parts. Corresponding parts of multiple units shall be interchangeable.

### The motor and pump shall providing by one company with sole source responsibility for the warranty of the unit.

### All materials used in construction of equipment to be of best quality and entirely suitable in every respect for the service specified.

### All bolting and fasteners in the pump and wetted areas shall be Class 316 stainless steel unless otherwise specifically recommended by the manufacturer for strength or safety reasons and approved by the Engineer.

### All wetted, ferrous, interior surfaces of the pumps shall be coated with a minimum of 10 mils of 100% solids, thermosetting fusion bonded, holiday free, dry powder epoxy coating such as 3M Company, Inc. #134, or a factory applied coal tar epoxy coating with a minimum of 25 mils dry film thickness, or approved equivalent.

## FACTORY TESTING

### Each completed and assembled motor shall receive a routine factory test in accordance with NEMA, IEEE, and SWPA standards.

### The pumps and motors shall be performance tested as an integral unit at the factory prior to shipment. The performance shall be within the limits set by the Hydraulic Institute Standards. Certified pump curves shall be submitted to and approved by the engineer prior to shipment of the pumping equipment. As a minimum, each completed pump shall be performance tested for total dynamic head, capacity, efficiency, and power requirements at three (3) operating points plus shutoff head for the selected impeller diameter. The testing shall be certified by the pump manufacturer.

## FIELD TESTING

### Field tests shall be performed in the presence of the DISTRICT.

## SUBMITTALS AND MISCELLANEOUS REQUIREMENTS

### Submit data completely describing products including plan and section views and listings of all components and their materials of construction.

### Certified head/capacity speed rating curves for each required pump. Plot following as ordinates versus flow rate as the abscissae:

#### Total Dynamic Head

#### Efficiency (pump, wire-to-wire)

#### Brake horsepower

### Provide the following information:

#### Maximum allowable impeller dia.

#### Maximum allowable horsepower (torque)

### Complete information on the rail mounting system including dimensional drawings.

### Pump and motor certified factory test reports.

# PRODUCTS

## GENERAL

### Pump shall be equipped with stainless steel nameplate, stating the unit is accepted for use in NEC class 1, division 1, group C, D hazardous locations with third party, Factory Mutual, approval.

## PUMP CONSTRUCTION

### The submersible pumping units shall be self-contained, integral pump/motor units designed to operate at continuous full load in a partially or completely submerged condition.

### The pump volute, motor and seal housing, and stationary base elbow shall be manufactured of high quality close grained cast iron, ASTM A-48, Class 30. All fasteners exposed to the pumped liquids shall be 316 stainless steel.

### The pump shall be capable of handling a 3” minimum spherical solid. The pump shall be non-overloading throughout the entire range of operation without employing service factor. The pump shall reserve a minimum service factor of 1.15. The performance curve submitted for approval shall state in addition to head and capacity performance, the pump efficiency, solid handling capacity, and reflect motor service factor.

## manufacturer

### Submersible sewage pumps shall be manufacturer by Cornell or DISTRICT approved equal.

## ELECTRICAL POWER CORD

### Electrical power cord shall be STW-A, water resistant 600V, 60 degree C, UL and CSA approved and applied dependent on amp draw for size.

### The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. A separation between the junction box area of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.

### Each individual lead shall be stripped down to bare wire at staggered intervals, and each strand shall be individually separated. This area of the cord cap shall then be filled with an epoxy compound potting which will prevent water contamination to gain entry even in the event of wicking or capillary action.

### The power cord leads shall then be connected to the motor leads with extra heavy connectors having brass inserts with a screwed wire to wire connection, rather than a terminal board that allows for possible leaks.

### The connection box wiring shall be separated from the motor housing wiring by stripping each lead down to bare wire, at staggered intervals, and separating each strand. This area shall be filled with an epoxy compound potting. Fiberglass terminal boards which are subject to heat fatigue and cracking, and which may lead to possible leaks shall not be acceptable.

### The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall each be sealed with a Buna N Rubber O-ring on a beveled edge to assure proper sealing.

### Separate power and control cables shall be provided to prevent false sensor warnings.

## MOTOR

### The stator, rotor and bearings shall be mounted in a sealed submersible type housing constructed of close grained cast iron, ASTM A-48, Class 30. The motor windings shall have Class H insulation and shall be NEMA B design with torque and starting current in accordance with NEMA MG-12. Further temperature protection shall be provided by on winding thermal sensors.

### The submersible motor shall be of an air filled high efficiency design, and shall be rated for continuous full load operation. The motor construction shall be of explosion proof, TENV-TEXP design and capable of being certified for use in Class I, Groups C & D hazardous locations by either Factory Mutual or Underwriters Laboratories. Motors shall be capable of withstanding up to 15 starts per hour and shall have a minimum 1.15 Service Factor.

### Stator windings shall be solid copper. The entire wound stator shall receive a minimum of two coats of insulating varnish utilizing a dip and bake process. Stators must be capable of being repaired or rewound by local motor service station. Units which require service only by the factory shall not be acceptable. No special tools shall be required for pump and motor disassembly.

### The pump and motor shall be specifically designed so that they may be operated partially or completely submerged in the liquid being pumped. The pump shall not require cooling water jackets which utilize water exchanged from the sewage.

### Pump motors shall be designed to withstand 50 feet differential water pressure at all seal locations.

### The top end of the motor housing shall be fitted with lifting lugs capable of supporting the combined weight of pump and motor. All external hardware including nameplates shall be 316 stainless steel. Exterior coating and wetted parts coating shall be as specified within this Section.

### Pump shall be equipped with heat sensors. The heat sensors shall be a low resistance, bi-metal disc that is temperature sensitive. They shall be mounted directly on the stator windings and sized to open at 120 degree C and automatically reset at 30-35 degree C differential. The sensors shall be connected to safely shut down the motor upon temperature overload.

## BEARINGS AND SHAFT

### Bearings shall be specifically selected to carry all radial and axial loads imposed by the pump and motor under all operating conditions. Bearings shall be rated to provide a minimum L-10 Bearing Life of 25,000 hours at any design operating point. Bearing temperature rise shall be limited to a maximum of 60 degrees C under full load conditions.

### All bearings shall be permanently lubricated with premium moisture resistant grease. All bearings shall be locally available from third party sources other than the pump manufacturer.

### The single piece motor/pump shaft shall be constructed of 316 or 416 stainless steel.

## SEALS

### The pump shall have two independent, tandem mounted, mechanical seals in oil filled housing. The oil level in the housing shall be suitable for a minimum two years of service before requiring replacement.

### Mechanical seals shall be of a Type 21, with silicon carbide rotating seal faces and silicon carbide stationary seal faces. All other seal components of both inner and outer seals shall be 316 stainless steel.

### There shall be a moisture detection sensor system to provide an alarm when the system detects the presents of moisture in either the lower oil seal housing or the air-filled motor stator housing. The moisture sensing probe leads shall terminate at a conductance relay located in the control panel which shall provide an alarm in the event of moisture intrusion.

## IMPELLER

### Impeller shall be designed specifically for the project with 100% recessed impeller.

### Impellers shall be statically and dynamically balanced.

### Impellers shall be capable of handling a 3” minimum spherical solid.

## CASING

### The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be manufactured of close grained cast iron, ASTM A-48, Class 30. The casing shall be of the centerline discharge type equipped with an automatic pipe coupling arrangement for ease of installation and piping alignment.

### The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers.

### A volute case wearing ring shall be provided to minimize impeller wear. The wear ring shall be made of corrosion and abrasion resistant materials and held by 316 stainless steel fasteners. The wear ring shall be easily replaceable in the field.

## PAINTING AND COATING

### The pump shall be painted after assembly, but before testing, with a zinc chromate base enamel. The paint shall be applied in one coat with minimum mil thickness of 15 mils. The paint shall be air dried prior to testing.

### All wetted, ferrous, interior surfaces of the pumps shall be coated with a minimum of 10 mils of 100% solids, thermosetting fusion bonded, holiday free, dry powder epoxy coating such as 3M Company, Inc. #134, or a factory applied coal tar epoxy coating with a minimum of 25 mils dry film thickness, or approved equivalent.

## RAIL MOUNTING SYSTEM

### General

#### Contractor shall furnish all labor, materials, equipment and incidentals required to provide a complete pumping system as specified herein.

#### The system shall include submersible non-clog pump(s), discharge base elbow, guide rail, piping, float mounting bracket, 316 SS lifting chain or 316 SS cable with 4” stainless steel rings every 10-feet, and control equipment.

#### The design of the rail mounting system shall be such that the pumping units shall be automatically connected to the discharge piping when lowered into place on the discharge connection. The pump shall be easily removable for inspection or service without the need for removal of nuts, bolts, or other fasteners, and without the need for personnel to enter the wet well.

### Guide Rail

#### The guide rail used to direct the pump in proper alignment with the stationary discharge piping shall be of a dual-rail design. The rail(s) shall be manufactured from non-corrosive, non-sparking, FRP or shall be manufactured from 316 stainless steel.

#### The pump shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a single down-and-in motion of the pump.

### Discharge Base Elbow

#### A discharge base elbow shall be furnished for each pump. The discharge base elbow shall rest squarely on the floor of the pump well and be securely anchored to the floor. The discharge base elbow shall be designed to carry the full weight of the pump and discharge piping.

#### The base elbow shall be single cast piece*.* The elbow shall be at 90 degrees with a standard 125-lb flange faced and drilled on the outlet side and an inlet flange faced only. The base elbow shall be lined and coated with 10 mils fusion bonded epoxy.

### Float Mounting Bracket

#### A float mounting bracket shall be provided. Float mounting bracket shall provide strain relief to hold level control cords and allow adjustment of level controls to desired pumping and alarm levels. Continuous cords are to run from pump(s) and level controls to j-box outside of wetwell. No splices shall be made in wiring. Float mounting bracket shall be fabricated from 316 stainless steel.. Float mounting bracket shall attach to access hatch frame at the top of the wet well with 316 stainless steel fasteners. A dielectric spacer should be installed between the aluminum access frame and float mounting bracket.

### Lifting Cable

#### Each pumping unit shall be provided with a 316 stainless steel lifting cable or 316 stainless steel lift rated chain with 4” stainless steel rings every 10-feet, stainless steel rating tag and cable. The lifting cable shall be of sufficient length to extend from the pumping unit at one end to the top of the wet well at the other end. The access frame shall provide a hook to attach the lifting cable when not in use.

#### The lifting cable shall be capable of lifting the pump and motor assembly load.

## SPECIAL TOOLS AND SPARE PARTS

### Provide one complete set of all special tools required for maintenance of pumping units.

### Provide the following spare parts:

#### One (1) complete set of gaskets and O-Rings for each pump.

#### One (1) set of impeller and suction cover wear rings for each pump.

#### One (1) set of nameplates for the motor and pump.

#### One (1) impeller for each pump.

## NAMEPLATES

### The pump and motor manufacturer’s nameplates shall be embossed or stamped on stainless steel and fastened to the equipment with No. 4 or larger oval head stainless steel screws or drive pins. Pump nameplate information shall include impeller diameter and rating point. Motor nameplate shall indicate clearly all items of information enumerated in NEMA Standards MG1-10.37, MG1-10.38, or MG1‑20.60, as applicable.

# EXECUTION

## COORDINATION

### Coordinate with trades and other equipment to the fullest extent possible, particularly with respect to concrete structures and insets required.

### Provide an efficient, well coordinated arrangement without conflict or sacrifice of design.

## DELIVERY, STORAGE, AND HANDLING

### Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.

### Block and/or support during transportation of the pump, impeller, motor rotor, shaft, and bearings to prevent vibration stress loading of the equipment.

### Deliver spare parts at same time as pertaining equipment. Spare parts shall be delivered to the Owner as part of the pump training.

### Grease coat all exposed ferrous surface prior to shipping to prevent corrosion during on site storage.

### Strapping locks on the mechanical seals are not to be removed until start-up of the pumps.

### Pumps shall arrive with the correct oil level and properly sealed.

## INSTALLATION

### Install all items with care, and in accordance with printed recommendations of manufacturer.

### Handle all coated ferrous items with canvas or nylon slings or other suitable methods to avoid damaging the coating.

### Energize no equipment, except by manufacturer's serviceman, until authorized in writing.

### Installation conducted in accordance with applicable Hydraulic Institute Standards.

## EQUIPMENT START-UP

### Operate unit to demonstrate ability to operate continuously without vibration, jamming, overheating, and to perform as specified, after installation, and after manufacturer's representative check of installed equipment.

### Comply with manufacturer's operating and maintenance instructions during start-up and operation.

### Promptly correct improper installation of equipment, at no additional compensation.

### Cooperate with other suppliers of equipment at the time of start-up and in making of all final adjustments necessary to place equipment in satisfactory working order.

## WARRANTY

### The pump supplier shall warranty the pumps and motors for a period of one (1) year from the date of acceptance. The warranty shall include 100 percent coverage of the manufacturers labor and materials. The warranty shall include the pump and motor identification number.

**END OF SECTION**