Yeomans Pump
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Series 9100

SUBMERSIBLE WASTEWATER
GUIDE RAIL SYSTEM

SUGGESTED SPECIFICATIONS

PART I GENERAL

1.1 DESCRIPTION

Work Included: Under this section, the contractor shall provide all labor, equipment and material necessary to furnish, install, test and place in operation Submersible Pumping Units as shown in the plans and as specified herein.

Other Project Specific Work

1.2 Related Work Described Elsewhere: *Project Specific*

1.3 GENERAL

Furnish and install_____ Submersible Pumping Units complete with all accessories, controls and appurtenances as shown in the plans and specified herein or as required for a complete operating system. Each Pumping Unit shall be rated for handling unscreened sewage wastewater in accordance with the operating conditions defined in Table 1 of these specifications.

The design shall be such that the pumping units will 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. Each pump shall be fitted with a (galvanized steel chain, stainless steel cable, or stainless steel chain) of adequate strength and length to permit raising the pump for inspection and removal.

1.4 QUALITY ASSURANCE

Qualifications of Manufacturers: The pumps shown and specified are based on the products manufactured by Yeomans Pump Company, Aurora, Illinois. Catalog numbers and references are given only as an indication of the quality of materials and workmanship to be used. Equal products by other manufacturers, approved by the Engineer and Owner, will be acceptable in accordance with the Substitute Equipment requirements in the General Conditions Section of these Specifications.

1.5 QUALITY CONTROL

The Submersible Pumping Units shall conform to all applicable requirements of NEMA, IEEE. NEC, FM, SWPA and Hydraulic Institute. For purposes of this specification, the revision and/or version of the referenced standards in effect on the date of bid shall apply.

The Submersible Pumping Units specified shall be the products of reputable manufacturers who have been regularly engaged in the design, manufacture and furnishing of Wastewater Pumping Equipment for at least ten (10) years. The manufacturer of the pump shall assume full responsibility for the compatibility of the supplied components with the application. The motor and pump shall be manufactured by one company providing sole source responsibility *for* the warranty of the unit. Manufacturers who do not manufacture the submersible motor and who limit their warranty to that of the motor manufacturer shall not be acceptable.

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PART 2 PRODUCTS

2.1 PUMPS

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 without the need for any external cooling devices such as water jackets. Motors shall be cooled by an adequately sized motor frame which shall conform to the latest applicable requirements of NEMA, IEEE. ANSI and NEC standards and shall meet the latest design standards of a Totally Enclosed Non-Ventilated NEMA frame motor. Heat transfer shall be accomplished by convection through the stator wall to the surrounding media. Designs which incorporate cooling jackets and in particular, designs which rely on circulation of the pumped sewage for cooling, are not considered equal to the equipment described in this specification and shall not be acceptable.

The nameplate ratings of the motor shall be based on 40 degrees C ambient environment. The pump motors shall be designed to withstand 200 PSI differential water pressure at all seal locations. All motors shall be furnished and certified per IEEE 117 with Class F rated insulation materials or better. All motors not having IEEE 117 certified insulation systems shall be considered not acceptable. Insulation materials rated lower than Class F (Ie. Class B or A) are specifically prohibited.

Pumps shall be Series 9100, Model_____ as manufactured by Yeomans Pump Company, Aurora, Illinois or approved equal.

2.1.1 BEARINGS AND LUBRICATION

Bearings shall be specifically selected to carry all radial and axial loads imposed by the pump and motor. All bearings shall have a Class 3 internal fit conforming to AFBMA Standard 20.

Bearings shall be rated to provide a minimum L1O Bearing Life of 25,000 hours at any design operating point within plus or minus 40% of flow at the best efficiency point (BEP) of the pump performance curve. Bearing selection shall limit the bearing temperature rise to a maximum of 60 degrees C under full load operation.

All bearings shall be permanently lubricated with a premium moisture resistant grease containing rust inhibitors and shall be suitable for operation over a temperature range of -25 degrees C to +120 degrees C. The bearings shall not require any additional or periodic lubrication. All bearings shall be commercially available from third party sources other than the pump/motor manufacturer.

2.1.2 SHAFT SEALS

Two independent, tandem mounted, mechanical seals shall be provided in the oil filled housing to isolate and protect the air-filled motor from the pumped media. The oil level shall not require constant monitoring and shall be suitable for a minimum of two (2) years service under specified operating conditions before requiring replacement for normal maintenance. The reservoir shall act as a barrier to trap moisture and provide sufficient time for a planned shutdown in the event of an outer seal failure. The inner mechanical seal shall be constructed with a solid block carbon rotating seal face and a solid block ceramic stationary seal face. The outer mechanical seal shall be constructed with a solid block carbon rotating seal face and a solid block ceramic stationary face (Alternate: solid block tungsten carbide stationary and rotating faces). All other seal components of both inner and outer seals shall be 316 stainless steel. The outer mechanical seal shall be located in a recessed housing outside the main flow path of the pump to avoid damage. Mechanical seals which employ sprayed or laminated seal faces shall neither be considered equal, nor shall they be acceptable.

Mechanical seals shall be readily and commercially available from third party sources other than the pump and motor manufacturer, their agents, dealers and/or distributors. Mechanical Seals shall be John Crane Type 21 or approved equivalent.

2.1.3 MOISTURE DETECTION SYSTEM

A dual (2) moisture sensing probe system shall detect the entrance of moisture and provide an alarm. The moisture detection system shall be designed to detect the entrance of moisture in both the lower oil seal housing and the air-filled motor stator housing. The use of single probe or float switch type sensor systems shall not be acceptable. 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. The sensing relay shall either be provided or approved by the pump/motor manufacturer.

2.1.4 CABLE ENTRY SYSTEM

The power and control cable entry system shall be designed to provide a positive, leak-free seal to prevent liquid from entering the air filled motor housing. The design shall incorporate provisions which prevent moisture from wicking through the cable assembly even in the event that the cable jacket has been punctured. All cable shall be type SEDW-A and U.L.. Listed for the intended submersible service.

The power and control cable entry into the lead connection chamber shall be epoxy encapsulated for positive moisture sealing. A Buna-N cable grommet shall be provided in addition to the epoxy sealed leads. Compression type grommet fittings employed as the primary sealing system shall neither be considered equal nor shall they be acceptable. Separate power and control cables shall be provided to prevent false sensor warnings.

2.1.5 MATERIALS OF CONSTRUCTION - MOTOR

The submersible motor enclosure including frame, end brackets, flanges and cap assembly shall be constructed of close grained cast iron, ASTM A-48, Class 30 or better.

The top end bracket will be fitted with a lifting bail and shall be capable of supporting the combined weight of the pump and motor.

All mating fits on the motor frame shall have rabbet joints with large overlap as well as 0-ring seals to provide for a watertight seal. O-rings shall be Buna-N.

The one-piece motor/pump shaft shall be constructed of 416 stainless steel and shall be precision machined, ground and polished to ensure proper tolerances at all contact points. The entire rotating assembly shall be designed with sufficient rigidity and balanced to provide for a maximum shaft deflection at the lower seal of .002" under all operating points between plus or minus 40% of the flow at best efficiency point (BEP) on the pump's performance curve.

The motor rotor shall be constructed of die cast aluminum, fabricated copper or their respective alloys. The rotor shall have an interference fit to the shaft and the rotating assembly dynamically balanced to NEMA limits per MG1-12.05. Balance weights, if required, shall be secured to the rotor resistance ring or rotor fins. Machine screws or nuts and bolts used to attach balance weights are specifically prohibited.

All exposed metal parts of the pump/motor shall be cleaned, primed and finished with the manufacturer's standard paint system.

2.1.6 MATERIALS OF CONSTRUCTION – PUMP

The pump casing, impeller, motor housing and stationary base elbow shall all be manufactured of close grained cast iron, ASTM A48, Class 30. All casting surfaces coming into contact with the pumped liquid shall have a surface cleanliness equal to that of a SSPC-SP3 process prior to being factory protected by one (1) coat of corrosion resistant, high solids solution for submerged service.

The pump casing shall be of the semi-concentric volute design, of one piece construction, having centerline discharge to minimize clogging or flow interference, and to provide the proper weight distribution for use with the sliding guide bracket disconnect system. The casing shall have integral antivortexing vanes which can also facilitate maintenance.

The impeller shall be of a multi-vaned, fully shrouded enclosed design and shall have large passages to provide smooth flow transition and unimpeded passage of large spherical solids. All impellers shall be statically and dynamically balanced. Repelling vanes shall be provided on the rear shroud to expel solids and reduce axial thrust and pressure at the seal area Solids passing capability of the impeller offered shall be clearly indicated on the manufacturers performance curve.

Wearing Rings- Standard for Model 6123 and smaller: The volute suction shall be fitted with a replaceable hard polyurethane, radial/axial clearance, corrosion and abrasion resistant wearing ring system a minimum of 3/8 inch thick, securely fastened and replaceable.

Wearing Rings- Optional for all other models: A replaceable, hardened. 3/8 inch minimum thickness 420 stainless steel wear ring shall be provided on the impeller inlet to reduce the effects of abrasive wear and provide the ability to renew the running clearance. The impeller wear ring shall be hardened to 325-375 BHN. The volute suction shall contain a replaceable, hardened 420 stainless steel wear ring to match the impeller wear ring. The suction wear ring shall be hardened to 425-475 BHN. A minimum of 50 BHN hardness differential between the impeller and suction wear rings shall be provided. Each wear ring shall shall be positively secured by means of recessed stainless steel machine screws flush with the ring surface.

2.1.7 SLIDING GUIDE BRACKET & RAIL SYSTEM

The pump slide bracket shall be of heavy duty construction and shall be of a molded instant set polymer material. The slide bracket shall be sparkless design and shall be corrosion, abrasion and chemical resistant. Slide brackets made of cast iron with a non-sparking strike plate of a wear resistant instant set polymer sparkless construction are acceptable.

The base discharge elbow shall be uniquely designed to match the volute flange to eliminate head losses. The discharge elbow shall be designed to carry the full weight of the pump and discharge piping.

Guide rail mounting brackets shall be furnished to stabilize the guide rails for installation in deep wet wells. Brackets shall be spaced at proper intervals to provide rigidity and parallelism. The brackets shall be designed to fit exactly into the pipes for which they were designed. Adjustable and/or flexible brackets designed to fit a variety of guide rail pipe sizes shall not be acceptable. Mounting brackets shall be of stainless steel construction.

Optional for 3" and 4 units up to 30 HP: A sliding flange constructed of ductile iron ASTM A536-84 Grade 60-40-18 shall be an integral part of the pumping unit and shall be furnished with a sealing washer to connect with the cast iron base discharge elbow. The elbow shall be bolted to the floor of the wet-well and be so designed as to receive the pump connecting flange without the need for any bolts, nuts or clamps. The unit shall be field convertible to a portable pump by means of removal of the guide bracket from the pump volute, without modification. Sealing of the pumping unit to the discharge connection shall be self-cleaning and accomplished by a simple linear downward motion of the pump with the entire pump unit guided by a V-bar two-point contact design. No portion of the pump shall bear directly on the floor of the wet-well and no rotary motion of the pump shall be required for sealing.

2.1.8 ELECTRICAL

The submersible motors shall successfully operate under power supply variations per NEMA MG1 -14.30. Motors shall be NEMA Design B with torque and starting current in accordance with NEMA MG-12.

The submersible motors 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 (F.M.) or Underwriters Laboratories (U.L.). Motors shall be capable of withstanding up to 15 starts per hour and shall have a minimum 1.15 Service Factor.

Stators shall be solid copper wound and shall be press fitted into the stator housing for true positive alignment and efficient heat transfer. The motor insulation system shall be Class F minimum, utilizing materials and insulation systems evaluated and certified with IEEE 117 classification tests. The entire wound stator assembly shell receive a minimum of two (2) coats of insulating varnish utilizing a dip and bake process.

Three (3) normally closed, automatic reset, thermostats connected in series shall be embedded in adjoining phases of the stator windings. The thermostats shall be connected to safely shut down the motor upon opening.

2.1.9 TESTING

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

The pumps shall be performance tested at the manufacturer's plant prior to shipment. The performance shall be within the limits set forth by the Hydraulic Institute. Certified curves shall be submitted to the design engineer upon request.

As a minimum, each finished pump shall be performance tested for total dynamic head, capacity, efficiency and power requirements at five (5) operating points plus shut-off head for the selected impeller diameter, of which, the design capacity operating point shall be certified by a Professional Engineer who may be an employee of the pump manufacturer.

The engineer and owner reserve the right to witness any and all factory testing.

After installation, a Field Test shall be performed by the installing contractor on each completed Submersible Pump and lift out assembly. The test shall demonstrate to the satisfaction of the Owner that the equipment meets all specified performance criteria, is properly installed and anchored, end operates smoothly without exceeding the full load amperage rating of the motor or excessive motor heating.

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2.1.10 WARRANTY

The Pump Manufacturer shall Warrant to the Owner the Submersible Pump Units against defects in material and workmanship for a period of 1 year from date of acceptance or 18 months from date of shipment, whichever is sooner. This warranty shall cover the cost of labor and materials, excluding removal and reinstallation costs, required to correct any warrantable defect. FOB, Manufacturer's Authorized Warranty Service Center.

Additionally, the Pump Manufacturer shall provide and administer a 5 year, prorated materials warranty on the Submersible Pump against defects in materials and workmanship. The warranty shall provide for the replacement of any part of the pump found to be defective in accordance with the following schedule:

19 to 36 Months	Payment of 75% of the Current Replacement Parts Cost.
37 to 48 Months	Payment of 50% of the Current Replacement Parts Cost.
49 to 60 Months	Payment of 25% of the Current Replacement Parts Cost.

2.1.11 FIELD SERVICE

_____ Days of Field Service shall be provided by an authorized, factory trained representative of the Pump Manufacturer. Services shall include, but not necessarily be limited to, inspection of the completed installation to ensure that it has been performed in accordance with the manufacturer's warranty.

The Contractor shall be responsible for coordinating the required field services with the Pump Manufacturer.

END OF SECTION

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TABLE 1 - PERFORMANCE DATA

Pump Item Number	_____
Number of required units	_____
<u>Rated Condition</u>	
Capacity (Flow)	_____ GPM
Head	_____ Feet (TDH)
Minimum Efficiency	_____ %
<u>(Alternate) Condition "B"</u>	
Capacity (Flow)	_____ GPM
Head	_____ Feet (TDH)
Minimum Efficiency	_____ %
<u>(Alternate) Condition "C"</u>	
Capacity (Flow)	_____ GPM
Head	_____ Feet (TDH)
Minimum Efficiency	_____ %
Shutoff Head	_____ Feet
Minimum motor horsepower required	_____ HP
Electrical Characteristics Required	_____Volt ____Hz. ___Ph.
Maximum pump operating speed	_____ RPM
Minimum Discharge Size	_____ inches
Minimum Solid Size required to pass through Impeller	_____ inches diameter
Liquid to be Pumped	_____
Pumping Temperature	_____ °F
Specific Gravity @ Pumping Temperature	_____