4" SUBMERSIBLE SEWAGE PUMPS RECESSED IMPELLER

GENERAL

Contractor shall furnish all labor, materials, equipment and incidentals required to provide _____ solids handling submersible centrifugal sewage pumps as specified herein.

OPERATING CONDITIONS

Each pump shall be rated _____ HP, _____ volts, _____ phase, _____ hertz, and_____ R.P.M. The unit shall produce _____ U.S. GPM at _____ feet TDH, with a minimum pump efficiency of _____% and maximum input kW of _____ kW. The pump shall be capable of handling a _____" 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 1.20. 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.

CONSTRUCTION

Each pump shall be of the sealed submersible type, model _____ as manufactured by Hydromatic Pump. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTMA-48, class 30. The pump shall be fitted with a 4" standard ASA 125 lb. flange, faced and drilled. All external mating parts shall be machined and Nitrile O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

ELECTRICAL POWER CORD

Electrical power cord shall be SOOW or W, water resistant 600V, 90ºC, UL and CSA approved and applied dependent on amp draw for size.

The pump shall be triple protected with a compression fitting and two epoxy potted areas at the power cord entry to the pump. 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.

The power cable entry into the cord cap assembly shall first be made with a compression fitting. 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 fitted with an epoxy compound that will prevent water contamination to gain entry even in the event of wicking or capillary attraction.

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 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 be sealed with a Nitrile O-ring on a beveled edge to assure proper sealing.

MOTOR

The stator, rotor and bearings shall be mounted in a sealed submersible type housing. The stator windings shall have Class F or Class H insulation and a dielectric oil-filled motor, NEMA B design. Further protection shall be provided by using on-winding thermal sensors. Because air-filled motors do not dissipate heat as efficiently as oil-filled motors, air-filled designs shall not be acceptable.

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. Dependence upon, or use of, water jackets for supplemental cooling shall not be acceptable.

Stators shall be securely held in place with a removable end ring and threaded fasteners so they may be easily removed. No special tools shall be required for pump and motor disassembly.

Pump shall be equipped with heat sensors. The heat sensor shall be a low resistance, bi-metal disc that is temperature sensitive. It shall be mounted directly on the stator windings and sized to open at 120ºC and automatically reset at 30–35ºC differential. The sensors shall be connected in series with motor starter coil, and the starter shall be equipped with three leg overload heaters, making all normal overloads protected by the starter.

BEARINGS AND SHAFT

An upper radial bearing and a lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings that are permanently lubricated by the dielectric oil that fills the motor housing. Double row, sealed grease packed bearings shall not be acceptable. Bearings that require lubrication according to a prescribed schedule shall not be acceptable. The upper radial bearing and lower thrust bearing shall have a minimum B-10 life of 50,000 hours.

The shaft shall be machined from a solid 416 stainless steel forging and be a design that is of large diameter with minimum overhang to reduce shaft deflection and prolong life.

SEALS

The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. Type 21 seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be replaced without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminates out of the seal area. Units that require the use of tungsten-carbide seals or foreign manufactured seals shall not be acceptable.

The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.

The electric probe or seal failure sensor shall be installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants that enter the seal chamber shall be detected by the sensor, which sends a signal to the specified warning device. Units equipped with opposed mechanical seals shall not be acceptable.

IMPELLER

Impeller shall be of the multi-vane, recessed solids handling design and have pump-out vanes on the backside of the impeller to prevent grit and other materials from collecting in the seal area. Single vane design impellers, which cannot be easily trimmed and which do not maintain balance with wear, causing shaft deflections and reducing seal and bearing life, are not acceptable. Impeller shall not require coating. Because most impeller coatings do not remain beyond the very early life of the impeller, efficiency and other performance data submitted shall be based on performance with an uncoated impeller. Attempts to improve efficiency by coating impeller shall not be acceptable.

Impellers shall be dynamically balanced. The tolerance values shall be listed below according to the International Standard Organization grade 6.3 for rotors in rigid frames.

RPM	TOLERANCE
3500	.01 in. – oz. /lb. of impeller weight
1750	.02 in. – oz./lb. of impeller weight
1150	.026 in. – oz./lb. of impeller weight
870	.03 in. – oz./lb. of impeller weight

A 400 series stainless steel washer and impeller bolt shall be used to fasten the impeller to the shaft. Straight end shafts for attachment of the impeller shall not be acceptable.

CASING

The casing shall be of the recessed impeller, 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 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.

SERVICEABILITY

The complete rotating assembly shall be capable of being removed from the volute without disturbing the suction piping, discharge piping, and volute. The motor housing, seal housing with seal plate and impeller still attached to the shaft shall be capable of being lifted out of the volute case from the top as one assembly.

SUPPORT

Though the pump may not require feet to support the unit while installed, the pump volute must have feet to support the unit when removed for service. Units that do not have feet upon which the unit can be supported when removed for service shall not be acceptable.

TESTING

Commercial testing shall be required and include the following:

- The pump shall be visually inspected to confirm that it is built in accordance with the specification as to the HP, voltage, phase and hertz.

- The motor seal and housing chambers shall be meggered for infinity to test for content or insulation defects.

- Pump shall be allowed to run dry to check for proper rotation.

- Discharge piping shall be attached, the pump submerged in water, and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an imbalance exists. If so, the stator shall be replaced.

- The pump shall be removed from the water, meggered again, dried and the motor housing filled with dielectric oil.

Optional testing available: Megger Test, Hydrostatic Test, Non-Witnessed Hydraulic Institute Performance Test.

PAINT

The pump shall be painted with waterborne hybrid acrylic/alkyd paint. This custom engineered, quick dry paint shall provide superior levels of corrosion and chemical protection.