PACO®
PUMPS

Suggested Specifications
Submersible Non-Clog Pumps
With Rail System Disconnect

{ ENGINEER'S NOTE: These specifications are intended to allow you maximum flexibility throughout. Items in bold parentheses ( ) represent choices. Inappropriate choices should be struck. Options should be selected as required.}

Scope: The contractor shall furnish and install, as shown on the plans and described in these specifications, one **(simplex, duplex, triplex)** center-line submersible non-clog wastewater system with slide rail lift-out feature mounted inside a _____ foot _____ inch diameter by _____ foot _____ inch deep **(concrete, steel, fiberglass)** wet well. **(Optional: _____ inch by _____ inch by _____ deep external valve vault)**. The pump(s) shall be PACO model QDSC or pre-approved equal. The contractor shall furnish all valving, piping, access hatches, level sensors and motor controls necessary to provide the owner with a fully operational system.

General: Equipment furnished and installed by the contractor under this section shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer. Definition of terms and other hydraulic considerations shall be as set forth in the Hydraulic Institute Standards.

Submittals: The data and specifications for each unit shall include, but shall not be limited to, the following:

PUMP
- Name of Manufacturer
- Type and Model
- Rotative speed
- Size of discharge nozzle
- Net weight of pump and motor assembly
- Complete performance curves showing capacity versus head, pump efficiency, and BHP
- Dimensional Drawing

MOTOR
- Rated size of motor, HP
- Temperature rating
- Full load rotative speed
- Efficiency at full, ¾ and ½ load
- Full current load
- Locked rotor current

Testing (Optional): A **(non-witnessed, witnessed)** Hydraulic Institute performance test shall be performed. The pump shall be tested at the design point as well as at least 4 other points to develop a set of curves. Data shall be collected to plot the head-capacity curve in addition to the efficiency and brake horsepower.

Performance and Design Requirements: The pumping unit shall be designed for the following operating conditions at maximum speed, unless otherwise noted:

Unit designation	**Pump No. (_____)**
Number of units	**(_____)**
Primary Design Point	
Rated total head, feet	**(_____)**
Capacity at rated head, GPM	**(_____)**
Secondary Design Point	
Rated total head, feet	**(_____)**
Capacity at rated head, GPM	**(_____)**

Operating Characteristics:

Operating head range, feet	**(_____)**
Max (nominal) pump operating speed at rated head, RPM	**(_____)**
Max BHP required at input shaft of pump for any point in the operating head range	**(_____)**
Min pump efficiency at rated head, feet	**(_____)**
Min pump nozzle size, inches	
Suction	**(_____)**
Discharge	**(_____)**
Min sphere diameter, inches	**(_____)**

Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range. The design performance shall be based on a wear ring axial clearance of not less than one mil per inch of wear ring diameter, or 12 mils total, whichever is greater.

Materials:

Casing	Cast iron ASTM A48 Class 30
Case Wear Ring	Cast iron ASTM A48 Class 30 **(Optional 416SS)**
Impeller	Cast iron ASTM A48 Class 30
Impeller Wear Ring	**(Optional 416SS)**
Shaft	AISI 416SS
Bearings	Deep grooved ball
Discharge Elbow	Cast iron ASTM A48 Class 30
Discharge Guide	Cast iron ASTM A48 Class 30

Pump Construction

Casing Assembly: The pump volute casting shall be of high strength ASTM A48, class 30B, close grain cast iron, single piece non-concentric design, with smooth contoured surfaces and fluid passages capable of passing any solid that passes through the impeller.

The volute casting shall be capable of withstanding the normal operating pressure surges and hydrostatic test pressures of a minimum 1.5 times the full diameter impeller shut-off head.

The volute shall be designed to support the entire operating weight of the motor rotating assembly once lowered into place and connected to the discharge elbow assembly.

Impeller: The impeller shall be of one-piece ASTM A48, Class 30B, close grain cast iron **(fully enclosed, Chenault)** design. The impeller shall be of non-clog design, with large smooth contours, without acute turns, free of blowholes and imperfections. The large free passages shall be capable of handling solids, fibrous materials, sludge and other matter normally found in conventional wastewater applications.

The impeller shall be of _____ vane design with high efficiency throughout a broad-band operating range, capable of passing a minimum _____ inch sphere.

Single and multi-vane impellers shall be capable of field trimming and balancing to meet actual site specific conditions. The impeller hub shall be accurately slip fitted and key driven to the motor shaft. The impeller shall be securely attached to the shaft by means of a locking washer and impeller screw of AISI-304 stainless steel.

Wear Rings: The pump volute shall be fitted with a **(Cast iron, 416SS)** case wear ring to provide efficient sealing between the impeller

and volute. The case wear ring shall be fully adjustable and shall be fitted to the case at a suitably machined recess and securely fastened with 300 series stainless steel recessed set screws accessible from the sides. The case wear ring shall be of full circle, deep section design to prevent distortion.
(Optional): The impeller shall be provided with a **(410SS)** impeller wear ring of dissimilar grade material to prevent galling. The continuous full circle wear ring design shall be fastened to a suitably machined surface with 300 series stainless steel recessed set screws.

Motor: The motor shall be dry air filled, squirrel cage induction shell type, Nema Design B. The stator windings shall be triple dipped and baked in Class F varnish and insulated with moisture resistant Class F insulation. The stator shall be heat-shrink fitted into the motor housing to provide accurate alignment and maximum heat transfer with the motor housing. UL approved as explosion-proof for operation in a Class I, Division I, Group D hazardous location.

The motor shall be rated for continuous duty service (submerged), and capable of sustaining ten (10) starts per hour, with a minimum of 1.15 service factor.

At design point, the motor winding temperature shall not exceed 105°C. The motor shall be non-overloading across the entire anticipated operating range of the system curve without use of the service factor.

Motor Enclosure: The motor enclosure shall be of ASTM A48, Class 30B, close-grain cast iron construction, with smooth surfaces devoid of irregularities and blow holes. All adjoining sections of the motor enclosure shall be joined and sealed with accurately machined rabbit joints with long overlaps and fitted with BUNA-N "O"-rings. The combined metal to metal overlap contact and "O"- ring seal compression shall insure watertight integrity to 65 feet of submergences.

Each motor shall be UL (Underwriter Laboratory) approved as Explosion Proof for operating in a Class I, Division I, Group D hazardous location.

Electrical Cables: The motor and sensor cables shall be 25 feet long **(Optional: _____ feet long)** of continuous unspliced cable. The cables shall be of heavy duty, submersible, hard service type, and shall have multi-conductor, stranded copper leads and type SOW neoprene jacketed portable cable rated at 600V 60°C.

Cable Entry: The power cable and cap assembly shall be designed to prevent moisture from wicking through the cable assembly even when the cable jacket has been punctured.

Power and control cable entry into the lead connection chamber shall include Buna-N grommets, epoxy sealed leads, and butt spliced connectors for positive moisture sealing. Compression type fittings or connectors alone shall not be considered equal.

Junction Chamber: The cable entry junction chamber shall provide for wire nut connection of the power cable to the motor stator leads. The auxiliary signal cable shall also be connected by wire nut to the motor winding thermal and motor seal moisture sensor leads.

Moisture Protection System: Dual (2) moisture sensing probes shall be provided that extend from the motor chamber into the oil chamber between the inner and outer seal. The system shall be designed to detect the presence of moisture in the oil chamber should the outer seal fail, and also in the motor chamber prior to reaching the bearing or stator assemblies.

Motor Sensors: The motor stator temperature shall be continuously monitored by two (2) low resistant bimetallic (N.C.) normally closed thermal switches embedded in the stator windings. These thermal sensor switches shall be used as additional supplemental motor protection and shall be wired in series with external, third leg overload protection provided by the motor starter in the control panel.

The motor shall also be provided with a tandem probe sensing system. The two moisture-sensing probes shall be mounted in the oil filled seal chamber and will detect the presence of conductive liquid, which passes the primary lower seal.

Upon detection the sensors shall actuate a panel mounted relay, which will provide the operator with a visual indication of impending seal failure.

Shaft: The pump and motor shaft shall be of one piece, extra heavy, high strength design, AISI-416 high chrome stainless steel shafting with high tensile strength. The shaft shall be of such design to provide for minimum overhang to reduce shaft deflection and prolong bearing life.

Bearings: The pump and motor shaft shall rotate on two permanently lubricated ball bearings. The upper bearing shall be of single row, deep grooved ball bearing type. The lower bearing shall be of single row, deep grooved ball bearing type locked in place to withstand thrust loading. The bearings shall be rated at a minimum B-10 bearing life of 17,500 hours at design loads. Upper and lower ball bearings shall be permanently lubricated with high temperature grease.

Mechanical Seals: Each pump shall be provided with a tandem mechanical shaft sealing system, operating independently.

The upper mechanical seal (secondary) shall have a ceramic stationary seal seat running against a positively driven rotating carbon ring which functions as an independent secondary barrier between the pumped fluid and the motor stator housing. Seal tension is pre-set by means of a snap ring. The upper mechanical seal shall run completely in an oil bath seal reservoir.

The lower mechanical seal (primary) shall have a **(ceramic, tungsten carbide)** stationary seal seat running against a positively driven rotating carbon ring which functions as an independent primary barrier between the pump fluid and the motor stator housing. Seal tension is pre-set by means of a snap ring.

Exposed Surfaces: All exposed surfaces shall first be cleaned by high pressure water or steam. Grease and oil shall be removed by a suitable solvent cleaner. Immediately following surface preparation, the clean metal surface shall be given a standard surface finished coat or air-dried alkyd resin type enamel containing zinc chromate rust inhibitive pigment. The completed coating shall have good adhesion and a high degree of resistance to moisture, alkalis and oils.

Rail Systems: The design of the rail disconnect system shall permit the easy removal and reinstallation of each pumping unit from the wet well for inspection or service without disconnecting or disturbing the

discharge piping. There shall be no need for personnel to enter the wet well.

Each pump shall be fitted with a guide rail bracket securely fastened to the pump discharge. The guide bracket shall insure proper guide rail alignment and stability during installation or removal of the pump unit.

For each pump, a Class 30B, cast iron discharge base elbow with a lower guide rail supports, shall be securely mounted to the wet well floor.

Installation of the pump and engagement with the discharge elbow shall be accomplished by the downward linear motion of the pump. The pump discharge shall automatically connect with the discharge elbow when lowered into place. The pump discharge shall be provided as standard with a metal-to-metal seat. No portion of the pump shall bear directly on the floor of the wet well.

Lifting Device: Each pumping unit shall be provided with a lifting **(chain, cable)** of **(galvanized, stainless steel)** construction, and of adequate strength to support 150% of the entire pump and motor assembly weight.

Installation: The installation of the pumping equipment shall be in accordance with the drawings and manufacturer's instructions. All equipment shall be supported and securely anchored, making sure all connections are plumb and tight. All construction debris shall be removed from the system and wet well prior to operation of the pumping equipment.

Start-Up and Field Testing: Start-up and operational field tests shall be conducted by the pump manufacturer's factory trained start-up representative. The start-up and operational test shall be conducted in the presence of the engineer, owner operator personnel and the contractor. Final site specific level control adjustments shall be made to ensure proper functioning of the system.