PACO®
PUMPS

Suggested Specifications
Submersible Non-Clog Pumps
Type NSC

{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.}

1.10 Scope: The contractor shall furnish and install, as shown on the plans and described in these specifications, one **(simplex, duplex)** submersible non-clog wastewater system with free standing pumps and motors mounted inside a _____ inch diameter by _____ inch deep, **(concrete, steel, cast iron, fiberglass)** basin. The vapor tight cover plate shall have removable steel access and inspection covers. The contractor shall also furnish all valving, piping, level and motor controls necessary to provide the owner with a fully operational system.

1.20 Manufacturer: These specifications describe pumping equipment manufactured by PACO Pumps, Brookshire, TX. This is done to indicate the type, function and minimum standards of design, efficiency and quality required. This shall not be construed as elimination of other manufacturers capable of showing through the submittal and total cost evaluation process, equipment of comparable and equal quality, performance and value.

1.30 Submittals: The equipment selected was deemed to be the best selection based on design, efficiency, quality and performance. Other manufacturers of equally acceptable equipment shall submit to the engineer 15 days prior to the published bid opening date a minimum of three (3) sets of preliminary submittal data, consisting of the following:

1. Manufacturer's standard brochure of the equipment submitted.
2. Manufacturer's standard technical data sheet.
3. Manufacturer's standard dimensional drawings.
4. Manufacturer's standard installation instructions.
5. Manufacturer's standard operation and maintenance manual.
6. Manufacturer's standard published performance curve.
7. Performance data and physical characteristics showing actual minimum/design/maximum pump performance, hydraulic efficiency, break horsepower, motor efficiency and power factors at 100%, 75% and 50% operational load.
8. Exceptions taken sheet, listing in detail, each exception taken to the engineer's specifications and the value added by that exception.

1.60 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.

1.70 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.

1.90 Warranty: The pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and materials for a period of up to 5 years or 12,000 hours of operation under the standard municipal warranty policy or normal service, use and operation. The warranty shall be in printed certificate form and apply to all similar units.

2.00 Pumping Systems

2.10 Operating Conditions: Each wastewater pump shall be capable of delivering a design flow capacity of _____ GPM of raw unscreened wastewater against a total dynamic head of _____ feet, including a suction head of _____ feet, and static discharge head of _____ feet. Each pump shall also be capable of passing a _____ inch spherical solid. The pump shall be of broadband efficiency design allowing the motor to operate throughout the entire calculated system curve range without utilizing the motor _____ service factor. Utility power at the site shall be _____ phase, _____ Hertz, _____ volt and _____ wire service.

2.30 Motor Electrical Data

	Model	Model
Motor		
HP		
RPM		
Volt		
Service Factor		
Enclosure		
Amperage		
Start		
Run		

3.00 Pump Construction

3.10 Impeller: The impeller shall be of one-piece ASTM A48, Class 30B, close grain cast iron **(double shrouded, fully enclosed, Chenault, vortex)** 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 of _____ 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.

Coating of the impeller to show improved or better efficiency on published or test curves shall not be acceptable, because most impeller coating cannot remain intact beyond a relatively short term pumping life. All pump performance data submitted shall be based on uncoated impellers. Any attempts to alter the pump performance by coating the impeller shall not be acceptable.

3.20 Wear Plates (Optional): The pump volute shall be fitted with a **(brass, stainless steel)** case wear plate to provide efficient sealing between the impeller and volute. The case wear plate shall be fitted to the case at a suitably machined recess and securely fastened with 300 series stainless steel recessed head screws. The case wear plates shall be of full circle deep section design to prevent distortion.

(Optional): The impeller shall be provided with **(brass, stainless steel)** impeller wear plate of dissimilar grade material to prevent galling. The continuous full circle, deep section wear plate design shall be fastened to a suitable machined surface with 300 series stainless steel recessed head screws.

Although it is generally recognized that a rubber wear ring is more resistant to heavy abrasives found on a construction site, where efficiency of operation is not a factor, the inability of the rubber wear ring to accurately maintain tolerances and the rapid losses of efficiencies in short periods of time make the use of rubber wear rings unsuitable and therefore not considered equal or approved in normal fixed installation wastewater applications.

3.30 Volute: 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 which passes through the impeller.

The foot mounted volute shall be designed to support the entire operating weight of the motor rotating assembly once lowered into place.

All non-clog volutes 6" and larger shall be provided with double volute passages to minimize radial shaft loadings.

4.10 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 sectins 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 locations.

4.15 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.

4.20 Cable Entry: The cable entry water sealing design shall insure a watertight and submersible seal, comprised of a BUNA-N grommet, and epoxy sealed, butt connector spliced leads keep water from entering the top of the motor. The complete cable entry cap assembly shall be securely fastened to the motor junction chamber housing.

4.25 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.

4.30 Motor: The motors 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. U.L. 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 1.10 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.

4.40 Motor Sensors: The motor stator temperature shall be continuously monitored by three (3) 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 started 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.

4.50 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 and mechanical properties. The shaft shall be of such design to provide for minimum overhand to reduce shaft deflection and prolong bearing life.

4.60 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 high radial loading. The bearing 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.

4.70 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 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.

Mechanical seals of conventional double opposed spring action between the upper and lower seals, which require pressure differentials to offset external pressures, shall not be considered acceptable.

4.90 Exposed Surfaced: All exterior surfaces coming in contact with wastewater other than brass or stainless steel shall be protected by a suitable coating.

All exposed external metal 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 finish 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.

5.00 Pump Accessories

5.10 Sump Cover: The basin sump cover shall be of fabricated steel, _____ inches OD by _____ inches thick and shall be vapor tight construction, with sub-plates and openings as indicated on the plans.

5.20 Sump Basin: The contractor shall provide a _____ foot, _____ inch diameter, by _____ foot, _____ inch deep **(steel, cast iron, fiberglass, concrete)** sump basin with inlet and vent connections as indicated on the plans.

6.00 Controller

6.10 Control Panel: The electrical controls shall be mounted inside a NEMA **(1, 3R, 4, 7)** enclosure fabricated of steel. The enclosure shall be provided with a through the door disconnect and bear a UL label of an enclosure manufacturer.

All components will bear a UL label. All wiring, workmanship and schematics will comply with standards set forth by the National Electrical Code (NEC) and Underwriters Laboratory (UL).

6.20 Wiring/ Conduit: All pilot duty volt control circuit wiring inside the control panel, shall be a minimum of MTH, 600 volt rated, 18 gauge with 90°C temperature rating, in accordance with UL standards. All conduit connections are to be UL listed and installed in accordance with NEC standards.

All current carrying wire and conduit shall be properly sized in accordance with NEC standards.

6.25 Power Isolation: Power wiring and sensor/control wiring shall be isolated in separate conduits between the motor and controller to avoid electrical field interference causing nuisance and false sensing.

6.30 Motor Protection: Each pump motor shall be protected by a properly sized motor starter.

The magnetic motor starter is to be of open across-the-line type bearing a UL label for motor control devices and properly sized by motor horsepower.

All motor starters shall be equipped with under-voltage release and ambient compensated overload protection.

An overload reset button shall be mounted through the door to permit resetting of the starter overload without opening the panel door.

6.41 Mechanical Float Switches (Simplex): The automatic pumping cycle shall be controlled with a NEMA **(1, 4, 7, 9)** mechanical ball and rod float switch, mounted onto the cover plate with vapor tight stand. The float switch shall be provided with DPST, lever operated, snap action contacts. The mechanical float switch shall be field adjustable. The electrical contact shall maintain pump operation between the on and off level.

6.42 Mechanical Float Alternator (Duplex): The automatic pumping cycle, alternation and override function shall be controlled with a NEMA **(1, 4, 7, 9)** mechanical ball and rod float alternator switch, mounted onto the cover plate with vapor tight stand. The mechanical alternator shall be provided with 2 sets of DPST, lever operated, snap action contacts. The mechanical alternator shall be field adjustable, and provide automatic alternation of two pumps. Automatic override starting the second pump when needed shall also be provided.

6.43 Mercury Level Sensors (Optional): The automatic pumping cycle shall be controlled with sealed mercury level sensory, to sense the wet well level and control the pumping cycles. Each mercury level sensor shall be field adjustable to site specific conditions.

6.55 Moisture Sensing: A moisture sensing relay shall be provided for each submersible pump motor. The relay shall be electrically field connected to the tandem moisture probes mounted in the pump's oil filled seal chamber. When the motor probe senses the presence of moisture in the oil filled chamber, a relay coil will activate an indicating light on the panel door and annunciate an alarm signal.

6.70 Compression Alarm (Standard): An additional compression type sensor shall be provided to sense the static pressure of air trapped in the compression pipe as the liquid level rises. The compression alarm switch shall be provided with SPDT snap action contacts.

6.72 Mercury Sensor Alarm (Optional): An additional level sensor shall be provided to indicate high wet well level conditions. The sensor shall activate a panel mounted red alarm light.

(Option A) In addition, the high water alarm sensor shall activate a remote mounted NEMA 3R red alarm light.

(Option B) In addition, the high water alarm sensor shall activate a

6.75 Dry Telemetry Contacts: Dry telemetry contacts shall be provided inside the control panel to interface with the local volt alarm.

7.00 Equipment Manufacturer

7.10: These specifications and accompanying plans indicate specific equipment and materials which are deemed most suitable for the service anticipated. The pumping equipment shall be the product of a manufacturer with a minimum of eighty (80) years experience in the design and manufacturing of pumps. This is not done, however, to eliminate others of equal quality and experience. The contractor shall prepare his bid on the basis of the particular equipment and material specified for the purpose of determining the low bid.

After the execution of the contract, should the contractor desire to substitute "approved" equipment of makes other than those named in the contract, such substitutions will be considered for one reason only:

the equipment proposed for such substitution is equal or superior in construction and performance to that named in the contract, and higher quality has been demonstrated by at least ten (10) years of service in similar installations.

In the event the contractor obtains the engineer's approval on equipment other than that which was originally laid out, the contractor shall, at his own expense, make any changes in the structure, building, valving, or piping necessary to accommodate the substitute equipment.

It will be assumed that the cost to the contractor of the equipment proposed for substitution is less than that of the equipment named in the specifications, and if the substitution is approved, the contact price shall be reduced by an amount equal to the savings.