PACO®
PUMPS

# Suggested Specifications
# Submersible Sump Pump
# Type SM

**{ 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 sump pump 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, Inc., 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 design pump performance.
8. Exceptions taken sheet, listing in detail, each exception taken to the engineer's specifications and the value added by that exception.

**1.50 Testing (Optional):** Each pump shall be given a commercial operational test to check for leakage, excessive vibration and to determine conformance with the performance specifications.

**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 unit or any part thereof shall be warranted against defects in material or workmanship within one year from date of installation or 18 months from date of manufacture, whichever comes first, and shall be replaced at no charge with a new or manufactured part, F.O.B. Factory or authorized warranty service station. The warranty shall not assume responsibility for removal, reinstallation or freight, nor shall it assume responsibility of incidental damages resulting from the failure of the pump to perform. The warranty shall not apply to damage resulting from accident, alteration of design, misuse or abuse.

## 2.00 Pumping System:

**2.10 Operating Conditions:** Each sump pump shall be capable of delivering a design flow capacity of _____ GPM against a total dynamic head of _____ feet, including a suction head of _____ feet, and static head of _____ feet. 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 | | |

## 3.0 Pump Construction

### 3.10 Impeller

The impeller shall be on one-piece ASTM A48, Class 30B, close grain cast iron design. The impeller shall be of semi-open design, with smooth contours, without acute turns, free of blowholes and imperfections, with high efficiency throughout a broad-band operating range.

The 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.

**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.

**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 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 submergence.

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

**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, butt connector spliced leads, keeping 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 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 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.

The pump and motor shall be of adequate design to provide proper heat transfer and cooling required by the motor at maximum rated power.

**4.40 Motor Sensors:** The motor stator temperature shall be continuously monitored by three (3) low resistant, bi-metallic (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.

**4.50 Shaft:** The pump and motor shaft shall be of one piece, extra heavy, high strength design, and of AISI-416 high chrome stainless steel shafting with high tensile and mechanical properties. The saft shall be of such design to provide for minimum overhang 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 radial 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.

**4.70 Mechanical Seals:** Each pump shall be provided with a tandem mechanical shaft sealing system, operating independently. The upper secondary mechanical seal 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 primary mechanical seal 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 preset by means of a snap ring.

Mechanical seals of conventional double opposed spring action between the upper and lower seals, requiring pressure differentials to off-set external pressures shall not be considered acceptable.

**4.90 Exposed Surfaces:** 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 finished coat of air-dried alkyd resin type enamel containing zinc chromate rust inhibitive pigment. The completed coating shall have a 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 of vapor-tight construction with sub-plates and openings as indicated on the plans.

**5.20 Sump Basin:** The contractor shall provide a _____ 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.

**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 Switch (Simplex):** The automatic pumping cycle shall be controlled with a NEMA **(1, 4, 7, 9)** mechanical ball and rod float switch, mounted onto the coverplate 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 coverplate 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 Sensory (Optional):** The automatic pumping cycle shall be controlled with sealed mercury level sensors, to sense the wet well level and control the pumping cycles. Each mercury level sensor shall be field adjustable to sit specific conditions. Electrical interlocks are to maintain pump operation between each level.

**6.55 Moisture Sensing:** 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 pumps oil filled seal chamber. When the motor probe senses the presence of water in the oil filled seal 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 an audible-visible combination remote mounted NEMA 3R red light and **(bell, horn)**. A "Push-To-Silence" button shall be provided which will activate a relay silencing the audible alarm, the visual light will continue to indicate an alarm condition until the condition has been corrected.

**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.