
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

PACO QDSC QUICK DISCONNECT SUBMERSIBLE PUMPS

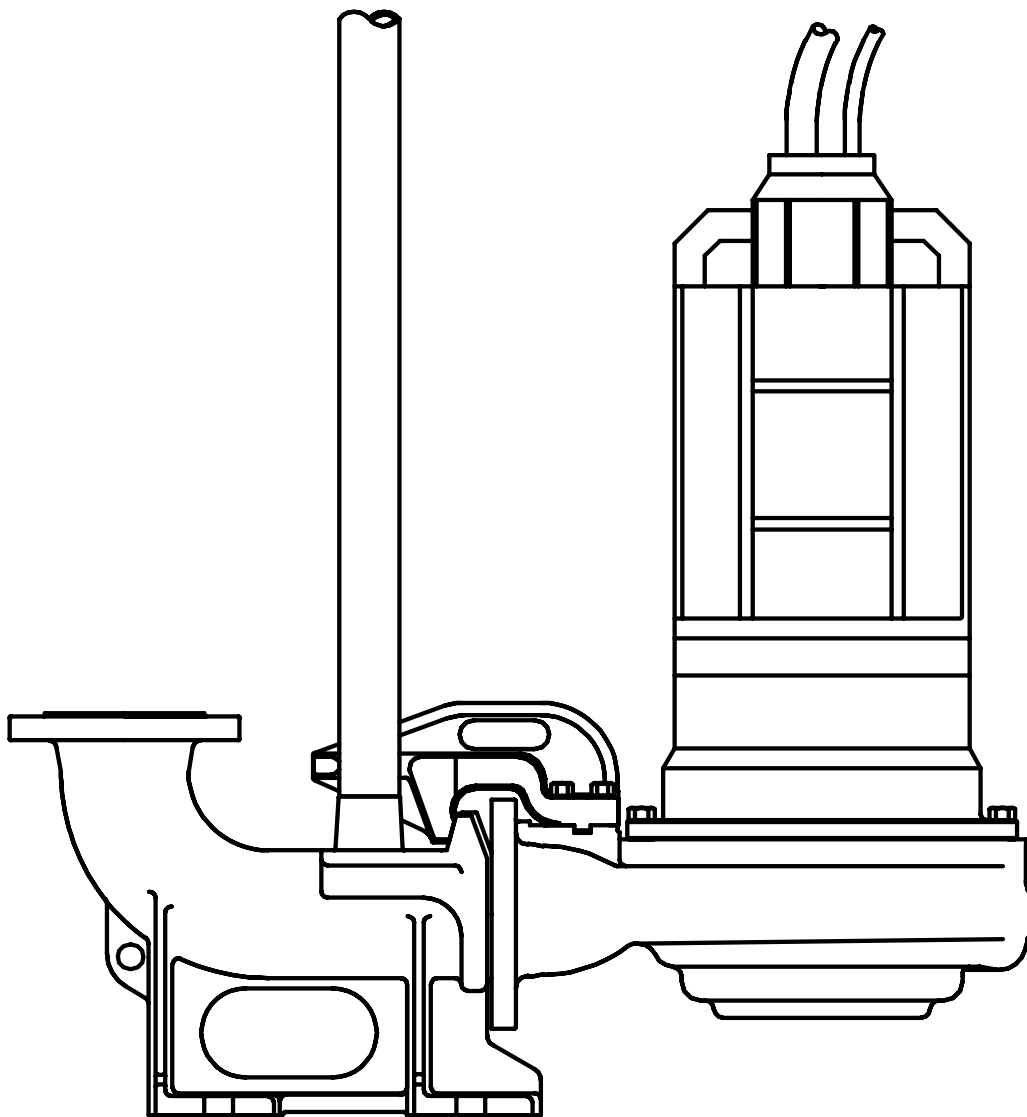


TABLE OF CONTENTS

I. INSTALLATION-MECHANICAL

A. Introduction 3
B. Pump and System Identification 3
C. Receiving and Acceptance 3
D. Temporary Storage 3
E. Installation Discharge Elbow, Upper Guide Rail Bracket & Accessories 4
F. Pump Installation Procedure 5

II. INSTALLATION-ELECTRICAL

A. General 6
B. Installation Wiring 6
C. Thermal Protection 6
D. Moisture Sensing Probes 6

III. OPERATING INSTRUCTIONS

A. Initial Start-Up Procedure 8
B. Routine Operating Procedure 8
C. Seal Failure Indicator System 8

IV. MAINTENANCE

A. Periodic Maintenance 9
B. Mechanical and Electrical Repairs 9
C. General Notes-Replacement Parts 9
D. Pump Disassembly 10
E. Motor Repairs 10-13

V. TROUBLESHOOTING 14

VI. WARRANTY 15

VII. SALES & SERVICE CENTERS 16

CAUTIONS and WARNINGS are inserted at key points of this manual to provide check points for personnel and machinery safety. CAUTIONS: Apply to personnel. WARNINGS: Apply to personnel and machinery.

I. INSTALLATION-MECHANICAL

A. INTRODUCTION

PACO Type QDSC submersible pumps are designed to operate in installations handling raw sewage, industrial waste water, or other liquids containing suspended solids. It is important that the installation, operation and maintenance of the equipment be accomplished in accordance with the instructions outlined in this manual.

CAUTION: *At no time shall the pump be stored within an incomplete pump station wet pit. The pump should not be placed into the pit until time for full installation and operation.*

QDSC are stationary pumps designed to operate completely or partially submerged in liquid. They connect automatically to a discharge connection fixed to the sump floor. The pumps can easily be lifted along guide rails for inspection and service.

CAUTION: *PACO type QDSC pumps are constructed mainly of cast iron and steel. They should not be used to pump corrosive liquids.*

B. PUMP AND SYSTEM IDENTIFICATION

All PACO pumps are identified by catalog and serial numbers. These numbers are stamped on the name plate (located on the pump volute) and should be referred to in all correspondence with the company.

NOTE: For customer convenience, a separate system nameplate is shipped with each pump. This nameplate must be mounted outside the wet well (by the customer) for quick, easy reference.

C. RECEIVING AND ACCEPTANCE

Thoroughly inspect this equipment before accepting shipment from the transportation company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept them until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight or express agent at once and request him to make an inspection.

D. TEMPORARY STORAGE

PACO type QDSC pumps are shipped from the factory ready for installation and use. They may be held in storage if the pump station is not completed. If storage is necessary, the pump should be left in its shipping container, as received. It should be stored in a warehouse or storage shed, in a clean, dry, temperature-stable area where the pump and its container may be further covered to protect it from water, dirt, dust, etc. Check that the ends of the electrical wires are protected against moisture.

E. INSTALLATION OF DISCHARGE ELBOW, UPPER GUIDE RAIL BRACKET AND ACCESSORIES.

1. Locate the discharge connection elbow on the floor of the sump. (Refer to Engineering plans for proper location and elevations.) Lift the access frame into position in its hole in the sump roof and pour concrete around the frame or provide a precast concrete cap with access door. Use caution to locate the access hatch in proper relation with the discharge elbow.

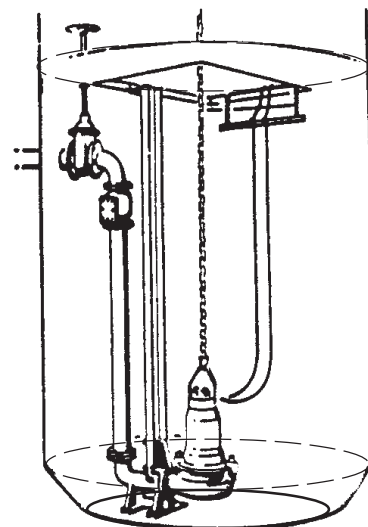
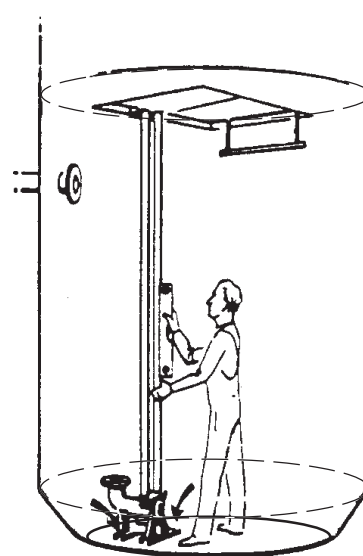
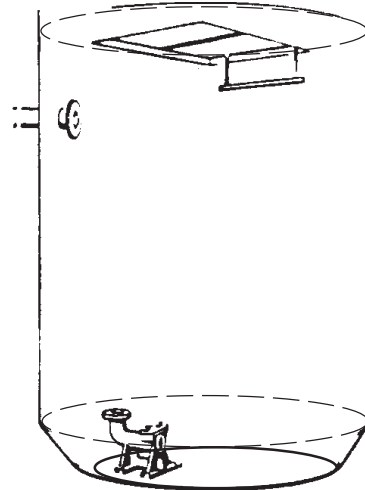
Attention should be paid to the dimensions of the sump and the size of the pump units. The pumps should stay free from the slope at the bottom of the sump, but the distance from the pumps to the wall must be close enough to prevent heavy sedimentation of sludge around the walls.

2. Cut the guide rails to the correct length and remove all burrs at the ends. Assemble the upper guide rail bracket with the pipes and mount them on the studs of the discharge connection elbow. Fasten the upper guide rail bracket to the frame with its two screws. Adjust the guide rail to a vertical position in both directions by using a spirit level. This will ensure a proper connection between the volute adapter and discharge connection elbow.

3. Mark the position of the discharge elbow mounting slots on the basin floor for the anchor bolts. Loosen the upper guide rail bracket and remove the discharge connection elbow with guide rails. Drill the holes with a suitable drill. Determine the drill dimension by measuring the plate collar at the lower end of the anchor bolt. Too large a hole will result in poor fastening of the bolts.

4. Hammer down the anchor bolts in the holes. Mount the discharge connection elbow and tighten it firmly with the bolts. Mount the guide rails and fix the guide rail bracket to the frame. Connect the discharge piping to the discharge connection elbow. A lifting device should be installed in order to simplify inspection and service of the pump units.

5. The level control equipment consists of mercury float sensors. Locate and suspend the float sensors in such a way that they cannot get entangled with cables or piping and that the functioning does not get disturbed by turbulence from the inflowing water. They must also be suspended at a sufficiently high level to prevent them from being sucked into the pump. Connect the float sensors to the automatic control panel according to the wiring diagram.



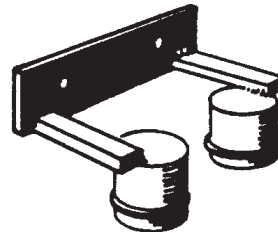
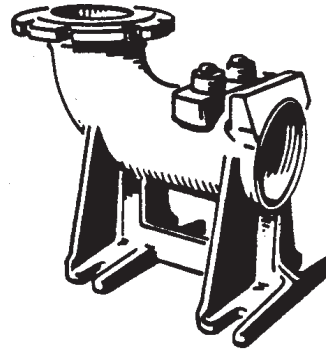
F. PUMP INSTALLATION PROCEDURE

The equipment needed in the sump for pump operation includes the discharge connection elbow an upper guide rail bracket, and guide rails.

Discharge Connection Elbow; for connection to the vertical rising main. The discharge connection elbow is designed with an oblique shoulder which matches the adapter of the volute and automatically connects the pump unit to the elbow when it is lowered into the sump along two guide rails. The guide rails are fixed to two tapered studs on top of the elbow.

Upper Guide Rail Bracket: equipped with studs for mounting of the two rails, which are **NOT** supplied with the pump. 2" pipe should be used for 4" & 6" models. 2-1/2" pipes should be used for 8" models.

An O-ring is fitted on each stud of the guide rail bracket. Remove all burrs carefully on the guide rails in order not to damage the O-rings during assembly. The O-rings serve as vibration and noise suppressors.



INSTALLATION OF PUMP UNITS

1. Lower Pump Units into place along guide bars. Check visually metal-to-metal contact between volute flange and discharge connection. If necessary, recheck and re-align discharge connection(s) and guide bars with pumps in place.

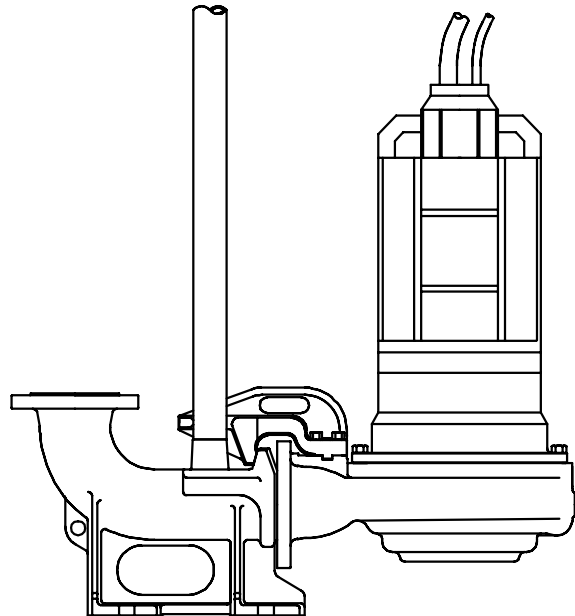
GROUTING

2. After proper alignment of all components, including metal-to-metal connection of pump flange is established, grout access cover, discharge connection(s) and pipe thrulets. Build up and shape slopes at bottom of the station as shown in station drawings. This will help in preventing build-up of solids at the bottom where side walls meet the floor.

SURFACE PROTECTION

3. An epoxy-coal tar system is suggested for all internal surfaces of the wet well, concrete or metallic. If possible, follow the recommendations in WPCF Manual of Practice No. 17 "Paints and Protective Coatings for Wastewater Treatment Facilities" or the instructions of a reputable manufacturer of protective coating systems, such as Carboline, Koppers, Inertol, Perry-Austen, etc.

WARNING: Do not use the motor electrical cables to support, lower, or pull the pump. To avoid tangling motor leads, guide them while pumps are being removed or installed.



II. ELECTRICAL INSTALLATION

A. GENERAL

The motor control circuit must have the following components in order to comply with the National Electrical Code. Installing personnel must also ensure that installation is in compliance with other applicable codes, ordinances or regulations.

1. Motor Disconnecting Device

A motor disconnecting device that is capable of disconnecting both the controller (motor starter) and the motor from their source of power.

The disconnecting device must be located so that the controller (motor starter) is directly visible from the disconnecting means. In all cases, the distance from the disconnecting device to the controller must be less than 50 feet. In most installations the disconnecting device will be a circuit breaker or fusible disconnect switch.

2. Motor short circuit and ground fault protection

Short circuit and ground fault protection are usually provided by means of a circuit breaker or fusible disconnect switch.

The size of the circuit breaker or fuse must be in accordance with Section 430-52 and Table 430-IS2 of the National Electrical Code.

3. Motor controller with running over current protection (magnetic starter).

CAUTION: Motor starters for submersible pumps must include ambient compensated, quick trip overload relays. Three-leg protection must be provided for three phase motors.

CAUTION: All electrical components must be installed in accordance with applicable local and state electrical codes in addition to the National Electrical Code.

B. INSTALLATION WIRING

1. Check incoming power source to insure it is the same as the voltage and phase of the motors.
2. Verify that the starters are suitable to operate pump motors on voltage and phase that is available.

3. Mount the control panel or motor starter(s) in close proximity to the pump to provide convenient control and ease of installation.

4. Wire panel or starter(s) to motor(s) and pilot devices(s): Wires to each motor must be sized for at least 125% of the motor nameplate full load amps. AWG #14 Type THW stranded wire is recommended for wiring of pilot devices (float switches).

C. THERMAL PROTECTION

Motors 1 HP and larger are provided with thermostats in motor windings. These thermostats are normally closed, and open when motor winding temperatures exceed safe operating levels. The thermostats are not suitable for direct control of motors, and they must be used in conjunction with the pilot control circuit of a magnetic starter. Thermostats do not provide motor thermal protection, and they should not be used in lieu of thermal overloads in the magnetic starter.

Thermostat leads marked P1 and P2 must be connected in series with the starter holding coil of the motor controller, so that the thermostat will open the circuit before dangerous temperatures are reached.

WARNING: Failure to connect the thermostat leads as described above could result in motor failure and/or dangerously high motor skin temperature. The warranty is voided if the thermostat leads are not properly connected.

D. MOISTURE SENSING PROBES

PACO submersible pump motors are equipped with two moisture sensing probes (electrodes). The system functions by detecting any electrically conductive liquid that has trespassed the outer seal and entered the motor completing (closing) the circuit between the probes indicating a possible seal failure.

The probes are installed in the motor and connected to two conductors (W1 and W2) of the control cable. A control and signal device (available from PACO or others. See ordering instructions for further information) must be installed at the job site to complete the moisture detection system.

NOTE: The motor warranty is void unless the moisture sensing probes and control device are properly connected and are fully operable.

INSTALLATION (PACO SUPPLIED MOISTURE DETECTION CONTROLLER)

NOTE: If supplied by others, consult installation manual and wiring diagrams.

Mount the controller on a vertical surface with the transformer on the left hand side and accomplish all indicated wiring. Terminals on the control are numbered and are in the same relative position as the terminals shown on the data label.

Contacts must be wired into the electrical load circuit(s) of the warning devices as required. Each contact used for load duty must be wired in series with the load and that series branch circuit connected across a power source compatible with the load.

Wiring must be provided from the moisture detector sensor probe leads of the Reliance Electric motor designated W1 and W2 to terminals 9 and 10 of the controller.

NOTE: Control leads should not be installed in the same conduit as power leads. Induced voltage can cause false moisture signals.

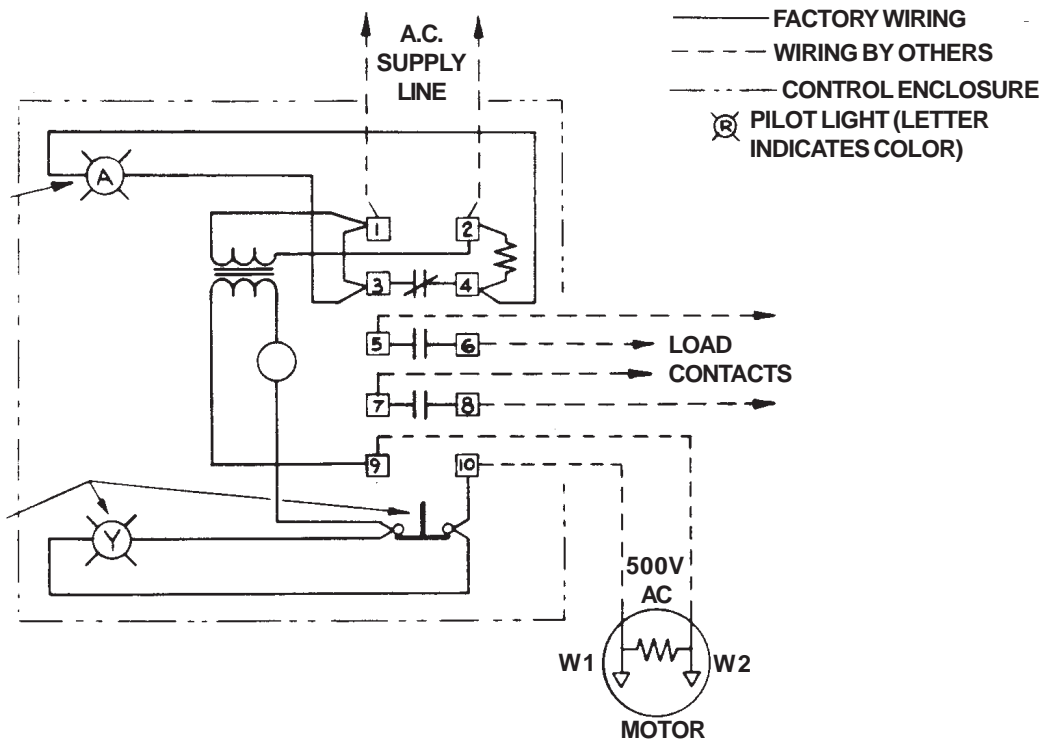
CONTACT OPERATION

Normally open load contacts close when the sensor probes detect the influx of moisture within the motor. These contacts are provided for operation of remote signal devices.

TEST PROCEDURE

A normally closed push-button and neon indicating lamp are provided as means of checking the moisture sensing-components.

When the push-button is depressed, the indicating lamp will be illuminated to indicate (A) power is supplied to the control, (B) the control is operative and (C) wiring to the moisture sensing probes in the motor is intact. This procedure should be performed periodically to confirm integrity of circuit.



III. OPERATING INSTRUCTIONS

A. INITIAL START-UP PROCEDURE

1. Thoroughly clean sump of all debris that might clog the pump, such as rags, paper, gloves, wood, etc.
2. Check to see that pump discharge is properly piped to receiving sewer, that discharge is free of obstructions, and that all discharge valves are open.
3. Verify that electrical connections have been made in accordance with Section II-G "Electrical Installation".
4. Check available electrical service for conformity with nameplate data. Pump motor will operate successfully with frequency not more than 5% and voltage not more than 10% above or below nameplate data (performance within this range will not necessarily be the same as the established performance at exact rated voltage and frequency).
5. Check direction of impeller rotation by either of the following methods:
 - Stand the pump on a hard surface or suspend it freely on the lifting cable. Turn the pump on and then off immediately. The correct rotation of the impeller is clockwise, and the pump should "kick-back" or rotate counter clockwise when viewed from the top of the motor. If pump kicks back in wrong direction, reverse rotation and test again.
 - Alternate method: Fill sump. Operate pump and note pumping rate. Reverse pump rotation and test again. The rotation which pumps water at the faster rate is the correct rotation.

DIRECTION OF ROTATION CAN BE REVERSED AS FOLLOWS:

- Disconnect the main power to control panel.
- For three phase motors, interchange any two motor leads at the starter. Do not switch incoming power line leads, as this will affect all pumps in a multiple installation.
- For single phase motors proper connections must be made in the motor connection chamber. Refer to wiring diagrams supplied in connection chamber and control box.

- Check operation and setting of control float switches for conformity with installation drawings.
- Fill sump and operate each pump. Record voltage and amperage per phase. Check for conformity with name plate data. Place all controls in "automatic" mode.

B. ROUTINE OPERATING PROCEDURE

When the electrical service has been properly connected, all control switches checked, and pump mechanically mounted in position, the operation of the pump is completely automatic. No operational procedures are required except to apply rated power to the pump. There are no specific shut-down procedures beyond disconnecting the electrical power supply.

C. SEAL FAILURE (MOISTURE SENSING) INDICATOR SYSTEM

PACO submersible pump motors are equipped with two (2) moisture sensing probes (electrodes) in the oil-filled chamber between the mechanical shaft seals. In the event that the outer shaft seal should leak, allowing water into the seal chamber, an electrical circuit will be completed between the two probes and a warning light will be activated.

The moisture detection system is by necessity a highly sensitive electronic circuit. As such, it is prone to occasional "False Signal" operation due to numerous uncontrollable factors including weather, humidity, type and condition of wiring, distance between pump and moisture detecting unit, and the overall integrity of the electrical installation. Short duration operation of the moisture indicator lamp is common (especially on cold start-up), and is of no consequence providing that the condition can be cleared after about 5 to 10 minutes of pump operation. Continuous or lengthy operation of the moisture indicating lamp, however, indicates possible seal failure and should be given prompt attention.

Since the moisture detector responds to a moisture condition existing anywhere between the pump and the detector, the possibility of operation due to external moisture or faulty wiring should be eliminated before concluding that the motor seal is at fault. If the motor control cables are in good condition and are connected directly to the moisture sensing control device, it is unlikely that the indication is due to external moisture.

When it is concluded that the moisture indicating lamp is being actuated by moisture within the motor, the most likely cause is failure of the outer seal. After disconnecting the power, the motor must be removed from the installation, and the oil and outer seal replaced. It is recommended that the inner seal be thoroughly inspected and replaced, if required.

NOTE: Upon indication of outer seal failure, the motor must be removed from service and the oil and outer seal must be replaced as soon as possible. If this procedure is not performed and additional damage to the motor occurs due to failure of the inner seal, the motor warranty will be voided.

IV. MAINTENANCE

A. PERIODIC MAINTENANCE

PACO type QDSC pumps are designed to operate satisfactorily with a minimum of preventative maintenance. However, at approximately six month intervals (the actual time interval will depend on the operating environment) certain preventive maintenance actions should be performed.

1. Pump wash-down - The accumulated build-up of fats, grease and sludge around the pump and motor housing reduces the dissipation of normal operational motor heat. This increasing internal heat (heat rise) shortens stator winding life and may cause the motor contactors to trip out for no apparent reason. It is therefore recommended that, at periodic intervals, the pump be washed down with a high pressure hose, after pumping down the pit influent to a level at the base of the pump.
2. Float switch cleaning - The build-up of the same fats, grease and sludge on the float switches may cause them to function improperly. The float switches should be checked for sludge build-up monthly. They may be removed from the pit and cleaned, or cleaned in place if they are anchored to structural parts of the station.

With proper application and installation of monitoring devices, periodic inspection of motor seals is not required. Should a malfunction occur the motor has been equipped with a moisture detection system and thermal protection which will provide advance warning of impending failure allowing the user to plan a maintenance program before failure occurs. Refer to Section III-C (Operating Instructions - Seal Failure Indicator System) for further information. No lubrication attention is required under normal use and service conditions.

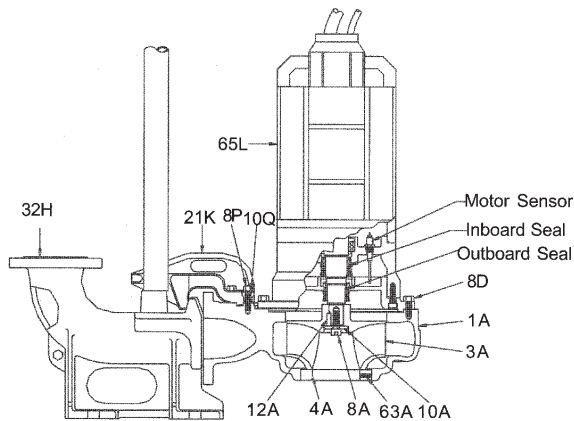
B. MECHANICAL AND ELECTRICAL REPAIRS

NOTE: No repairs shall be made to pumps during warranty period without prior factory approval; to do so may void the warranty.

CAUTION: *PACO submersible pumps are fitted with Reliance Duty Master Submersible Pump Motors. These motors are UL listed for Class 1, Groups C & D, Division 1, explosion proof. Motors may be repaired only by an approved Reliance/UL certified service center. If servicing is done by any agency other than a Reliance approved UL certified repair shop, the UL listing of the motor is voided.*

C. GENERAL NOTES - REPLACEMENT PARTS

To insure the quality and integrity of the Paco QDSC pump, it is recommended that all replacement and repair parts be obtained from PACO Pumps. When ordering, specify part required and serial number from pump nameplate.



ITEM	PART DESCRIPTION
1A	Volute
3A	Impeller
4A	Wear Ring
8A	Impeller Screw
8D	Hex Bolt
8P	Hex Bolt
10A	Impeller Washer
10Q	Lock Washer
12A	Key
21K	Sliding Bracket
32H	Elbow
63A	Set Screw
65L	Motor

D. PUMP DISASSEMBLY

(Key numbers in parentheses refer to the above drawing)

WARNING: Motor control may include automatic or manual overload resets. Disconnect all power leads to motor when performing any work on motor or pump.

- Open motor disconnect and tag with service notice.
- Remove pump from sump. If necessary to disconnect wiring, mark leads carefully so they will be reconnected in same manner.
- Remove cap screws (8D around base of motor and separate motor/impeller assembly from volute (1A).
- Remove impeller cap screw (8A) and impeller washer (10A).
- Use wheel or gear pullers to remove impeller (3A) or warm impeller slightly, to expand it and with two large screwdrivers or small pry bars, one on each side between impeller and backplate, pry carefully and evenly to force impeller off of shaft. BE VERY CAREFUL TO PRY EVENLY SO AS NOT TO BEND SHAFT.
- Reassemble in reverse order, warming impeller slightly before pressing it on, (if required). Tighten impeller screw firmly but do not put a strain on it.
- Under no circumstances should impeller be driven on by pounding as this would damage the seal. An alternate way is to use a cap screw to gradually pull impeller on shaft.

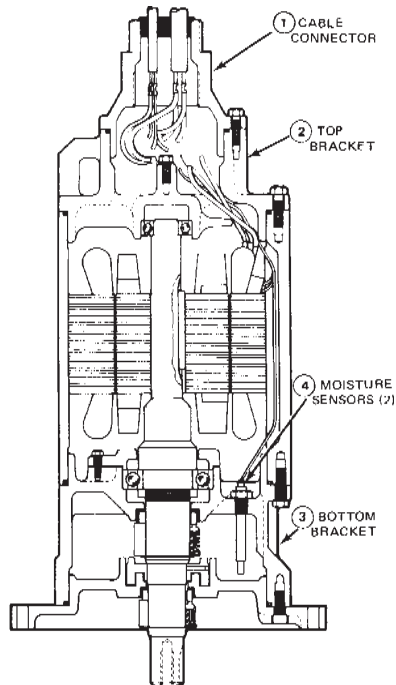
E. MOTOR REPAIRS

- PACO submersible pumps are fitted with Reliance DUTYMASTER Submersible Pump Motors. For compliance with current government regulations, and for operator safety, these motors are explosion proof, UL-listed for Class I, Group D, Division I hazardous locations.
- To protect the integrity of this motor, and to maintain the operator safety features that are inherent in the motor design, it is imperative that all motor repairs be accomplished in strict accordance with the instructions of Reliance Electric and Underwriters Laboratories.
- Reliance Electric Company Instruction Manual B-3633 is provided by PACO for general information and motor data. However, PACO strongly recommends that all motor repairs be accomplished by an approved Reliance/UL-certified motor service center.

WARNING: Motor may contain gas under pressure due to high operating temperatures from operation without being submerged. Disassembly may cause bodily injury. For assistance, contact a Reliance Electric Company office.

GENERAL NOTES: ALL PARTS

- Reliance T-Frame, Submersible Motors utilize an explosion-proof Class 1, Group D, tandem seal design, with an oil chamber separate from the winding area. In servicing these motors, all parts should be handled with utmost care to insure integrity of sealing surfaces and explosion-proof fits.



- Wound Stators—Reliance T-Frame Submersible Motors utilize a wound stator that has been pressed into the frame. The stator insulation system has been designed for the temperature and electrical rating involved. If the motor failure is analyzed to encompass a winding failure, it is recommended that a replacement wound stator be ordered from Reliance Electric Company or the nearest authorized Reliance Parts Distributor.
- Encapsulated Lead Connector Assembly—The lead connector assembly has been especially encapsulated to insure integrity of the motor. The connector can be removed from the motor in order to perform normal repairs. Should the lead connector assembly be damaged or the integrity of the encapsulation be in question, it is required that a replacement lead connector assembly be ordered from Reliance Electric Company or the nearest authorized Reliance Parts Distributor.
- Hardware—All hardware is stainless steel and should be replaced with the same type, if necessary.

ELECTRICAL REPAIRS

Electrical repairs such as stator repair or replacement, servicing of the single phase switch, or thermal protector may be accomplished without disturbing the rotating assembly, bottom bracket and oil chamber assembly.

PROCEDURE

1. Remove four bolts securing lead cable connector (1).

2. Disconnect Leads.
3. Remove four bolts securing bottom bracket (3) to frame. Lifting lugs may be utilized to remove frame from bottom bracket and rotating assembly.
4. Disconnect moisture sensing probe lead wire at probe (4).
5. Remove top bracket (2).

REASSEMBLY

Refer to reassembly instructions, (page 11).

WARNING: Motor may contain gas under pressure due to high temperatures from operation without being submerged. Disassembly may cause bodily injury. For assistance, contact a Reliance Electric Company office.

MECHANICAL REPAIRS

Mechanical repairs, including seal end or bearing replacement, may be accomplished per the following instructions.

CAUTION: UL listed motors must be returned to an authorized Reliance service facility for repairs other than to replace the outer seal or to reconnect leads in the cable housing.

PROCEDURE

CAUTION: Bottom bracket is oil-filled. Place motor in output shaft up position to prevent loss of oil.

1. Remove outer snap ring (5).
2. Remove rotating outer seal (6).
3. Remove four bolts from mounting adapter flange (7) and remove flange.

IF FAILURE IS ANALYZED TO BE AN OUTER SEAL FAILURE, PROCEED AS FOLLOWS:

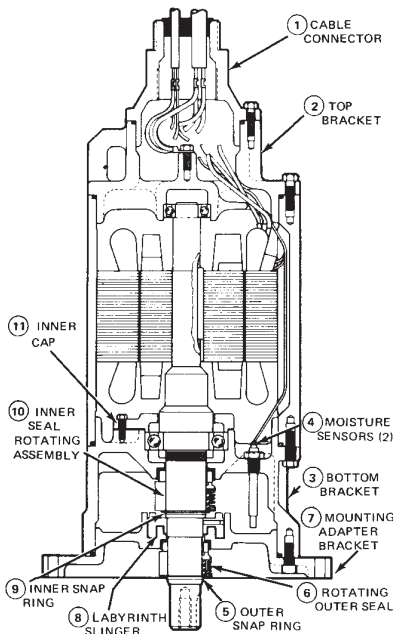
4. Empty oil from chamber.
5. Thoroughly clean the chamber and visually inspect inner seal (10). If mating faces do not show excessive wear, replacement is not required.

IF INNER SEAL REPLACEMENT IS REQUIRED, PROCEED AS FOLLOWS:

6. Remove labyrinth slinger (8) by loosening set screws and using bearing pullers.
7. Remove inner seal snap ring (9).
8. Remove inner seal rotating assembly (10).

IF FAILURE IS ANALYZED TO REQUIRE BOTTOM BEARING REPLACEMENT, PROCEED AS FOLLOWS:

9. Remove four bolts securing lead cable connector (1).
10. Disconnect leads.
11. Rotate motor to output shaft down position.
12. Remove four bolts securing bottom bracket (3) to frame. Lifting lugs may be utilized to remove frame from bottom bracket and rotating assembly.
13. Disconnect moisture sensing probe lead wire at probe (4).
14. Remove top bracket (2).
15. Remove three bolts securing inner cap (11) and remove inner cap.



REASSEMBLY INSTRUCTIONS

1. Rotating Assembly—Assemble rotor, bottom inner cap and bearings to shaft.
2. Place “O” rings on all bracket fits, then coat all fits with grease (not excessive).

3. Motor Assembly
 - Bottom bracket—rotating assembly.
 - Coat electro-plug pipe threads with Permatex and screw in place, making sure they are tight. Clean excessive Permatex from bracket.
 - Prepack bottom inner cap and bottom bracket 3/4 full with Chevron SRI grease.
 - Assemble bottom bracket to shaft assembly, locking bottom bearing with inner cap.
 - Attach lead wires (W1 and W2) and resistors specified to electro-plugs. Lower frame over rotating assembly, pulling W1 and W2 lead wires through cored slot in frame. Bolt frame to bottom bracket, making sure “O” ring is not damaged.
4. Top Bracket- Frame Assembly
 - Prepack top bracket bearing housing 3/4 full with Chevron SRI grease. Sleeve all lead wires with 4824-13-Z sleeving. Sleeving should be from coil head to end of frame.
 - Assemble top bracket to frame by pulling all lead wires through cored hole in top bracket. Make sure “O” ring is seated properly before tightening screws.
5. Mounting Flange Assembly
 - Place motor assembly in output shaft up position. Thoroughly clean bracket cavity, then lubricate ceramic seal cavity in bracket and rubber on seal with 4824-18-AF oil. Press ceramic seal into cavity using pressing tool. Extreme care should be taken to not damage the seal face. Lubricate the ceramic face with 4824-18-AF oil, then wipe face with clean, soft tissue and relubricate with four drops of 4824-18-AF oil. Lubricate shaft with 4824-18-AF oil and press rotating seal parts into position, using pressing tool, and lock with snap ring specified. Turn shaft by hand to make sure seal is seated correctly.
 - Assemble labyrinth slinger to shaft. Slinger can be heated to 250 - 275°F for 1/2 hour before assembly is required, making sure slinger is shouldered before tightening set screw. Add oil to back end bracket cavity per frame size specified below. The amount of oil must be measured accurately.

FRAME SIZE	OIL SPEC	QUANTITY
140 TY	4824-18-AF	1-7/8 PINTS
180 TY	4824-18-AF	1-1/2 QUARTS
210 TY	4824-18-AF	2-1/2 QUARTS
250 TY	4824-18-AF	3-1/2 QUARTS
320 TY	4824-18-AF	4 QUARTS
360 TY	4824-18-AF	4 QUARTS

ITEM	MANUFACTURER	IDENTIFICATION OF MATERIAL
1	Sun Oil Company	Sun Fleet Regular SAE 10W
2	Standard Oil Company	Sohio 62 SAE 10W
3	Shell Oil Company	Rotella 10 SAE 10 W

- After filling with oil, assemble bottom mounting plate to bracket, making sure “O” ring is seated properly. Then lubricate ceramic seal cavity in mounting plate and rubber on seal with 4824-18AF oil. Press ceramic seal into cavity, using pressing tool. After seating the ceramic face, lubricate, clean and relubricate shaft with 482418-AF oil and press rotating seal parts into position using pressing tool, and lock with snap ring specified. Turn shaft by hand to make sure seal is seated correctly.
6. Cable Connector Assembly
- Place “O” ring over fit and coat fit with Chevron SRI grease (not excessive).
 - Connect power leads per final voltage connection.
 - Insulate connectors with 4824-13-AU heat shrinkable plastic. If the 4824-13-AU shrinkable plastic is not available, tape may be used, but it should be an oil resistant type. Enough wraps should be used to insure the buildup will be sufficient to prevent the connector from breaking through the insulation. The following procedure should be employed: Five layers of plastic electrical tape followed by two layers electrical grade woven glass adhesive tape, such as Mystik 7020 or 3M #27, for oil and abrasion resistance.
 - Connect control leads W1 to W1, W2 to W2 and P1 to P1, P2 to P2.
 - Connect ground wire to ground terminal in front end bracket.

NOTE 1: Approved lubricating and insulating oil.

Approved lubricating and insulating oil shall meet Reliance approved source sheet 4824-18-AF. Manufacturers’ materials currently meeting this specification are as follows:

PAINTING AND SHIPPING

Before painting motor, cover exposed seal. Remove any paper, tape, etc., from seal area before crating motor. These motors can be shipped in shaft up or shaft down position. Care must be taken that exposed seal is not damaged during shipment. Carton must protect exposed seal from dirt, dust and damage.

MOTOR INSPECTION

After assembly, run motor in shaft down position for 30 seconds minimum to one minute maximum to allow seals to seat; then check for oil leakage. In some cases, a slight oil mist will appear around the seal. Wipe clean after test.

IV. TROUBLE SHOOTING

The following table lists some symptoms of an inoperable pump and suggests remedial measures for restoration of the unit to normal operation.

CAUTION: Possible electrical faults or problems should be serviced ONLY by a qualified, licensed electrician.

SYMPTOM	POSSIBLE CAUSE	REMEDY
1. Pump will not start	<ul style="list-style-type: none"> a. Power supply failure b. Burned-out fuse or tripped circuit breaker c. Damaged power or control cable d. Float switch failure e. Jammed impeller f. Water/oil inside motor 	<ul style="list-style-type: none"> a. Check power supply b. Check circuit protectors replace fuse(s), reset circuit breakers(s). (Check cause of fuse burn-out or tripping breakers) c. Check all cables for damage repair* d. Check float switches for proper operation e. Inspect and remove jamming object f. Refer to Symptom 4
2. Low Flow	<ul style="list-style-type: none"> a. Reverse pump rotation b. Liquid level in pit too low-pump cavitating c. Obstruction in pump or piping d. Partially closed valve e. Worn impeller or volute f. Operating head greater than design calculation 	<ul style="list-style-type: none"> a. Check rotation per paragraph III-A(5) b. Check liquid level and location of float switches c. Remove obstruction d. Check and adjust valve(s) e. Check pump parts and overhaul f. Advise PACO
3. Water in oil chamber	<ul style="list-style-type: none"> a. Age b. Damaged or improperly assembled lower mechanical seal c. Leaking oil chamber "O" rings 	<ul style="list-style-type: none"> a. Periodically drain & replace oil in chamber. b. Replace seal* c. Replace "O" rings*
4. Oil/water inside motor casing	<ul style="list-style-type: none"> a. Damaged upper mechanical seal b. Damaged "O" ring between oil chamber and motor casing c. Damaged cable connector assembly d. Damaged "O" rings at top of motor casing 	<ul style="list-style-type: none"> a. Replace seal* b. Replace "O" ring* c. Replace cable connector assembly* d. Replace "O" rings*
5. Repeated tripping of electrical safety devices	<ul style="list-style-type: none"> a. Supply voltage too high or too low b. Circuit protection underrated c. Phase current unbalanced d. Pump connected to incorrect voltage e. Wet or damaged wiring f. Obstruction in pump g. Damaged stator or rotar assembly 	<ul style="list-style-type: none"> a. Check input power (must be within 10% of rated voltage) b. Check rating and replace with proper size c. Check and correct d. Verify connections e. Inspect and repair or replace cable connector assembly* f. Remove obstruction g. Inspect and repair or replace*

***Inspection and repair of motor components must be accomplished in accordance with Reliance Electric instructions.**

Terms And Conditions Of Sale

SECTION 1: THE CONTRACT

The Contract shall be comprised of the following terms, together with such terms and conditions as are set forth in Seller's written proposal or quotation (the "Quotation"), including any documents, drawings or specifications incorporated therein by reference, and any additional or different terms proposed in Buyer's purchase order (the "Purchase Order") that are accepted by Seller in writing, which together shall constitute the entire agreement between the parties, provided, however, that preprinted terms on Buyer's purchase order or invoice shall not apply and Seller gives notice of objection to such terms. An offer by Seller in its Quotation that does not stipulate an acceptance date is not binding. This Contract shall be deemed to have been entered into upon written acknowledgment of the Purchase Order by an officer or authorized representative of Seller, which may not be modified, supplemented, or waived except in a writing executed by an authorized representative of the party to be bound.

SECTION 2: PRICE

The price quoted in the Quotation shall be the Purchase Price unless otherwise agreed in the Purchase Order. The Purchase Price for equipment shall include packing for shipment. Field Services shall be provided at Seller's standard rates. All other costs, including packing for storage, freight, insurance, taxes, customs duties and import/export fees, or any other item not specified in the Contract, shall be paid by Buyer unless separately stated in the Quotation and included in the price quoted. Any sales, use, or other taxes and duties imposed on the transaction or the equipment supplied shall be paid or reimbursed by Buyer.

SECTION 3: PAYMENT TERMS

Payment shall be due within 30 days of the date of Seller's invoice in U.S. funds unless otherwise agreed. If Buyer does not observe the agreed dates of payment, Buyer shall pay interest to Seller on overdue amounts at a rate that is the higher of: 9% per annum or a rate 5% in excess of the rate borne from time to time by new issues of six-month United States Treasury bills. Seller shall be entitled to issue its invoice for the Purchase Price for equipment upon the earlier of shipment, or notice to Buyer that Seller is ready to ship, and for services, upon completion. If the Purchase Price exceeds \$250,000 USD, Buyer shall pay the Purchase Price in Progress payments as follows: Fifteen percent (15%) upon submittal of general arrangement drawings, thirty five percent (35%) after receipt of first Bowl Casting, twenty percent (20%) after first case/bowl hydro test or bowl machining and thirty percent (30%) after notification of ready to ship.

SECTION 4: ACCEPTANCE AND INSPECTION

All equipment shall be finally inspected and accepted by Buyer within 14 days after delivery or such other period of time as is agreed in the Purchase Order. Buyer shall make all claims (including claims for shortages), excepting only those provided for under the warranty clause contained herein, in writing within such 14 day period or they are waived. Services shall be accepted upon completion. Buyer shall not revoke its acceptance. Buyer may reject the equipment only for defects that substantially impair its value, and Buyer's remedy for lesser defects shall be in accordance with Section 10, Warranty. If tests are made by Buyer to demonstrate the ability of the equipment to operate under the contract conditions and to fulfill the warranties in Section 10, Buyer is to make all preparations and incur all expenses incidental to such tests. Seller will have the right of representation at such tests at its expense, and the right to technically direct the operation of the equipment during such tests, including requiring a preliminary run for adjustments.

SECTION 5: TITLE AND RISK OF LOSS

Full risk of loss (including transportation delays and losses) shall pass to Buyer upon delivery, regardless of whether title has passed to Buyer, transport is arranged or supervised by Seller, or start-up is carried out under the direction or supervision of Seller. Delivery shall be ex works, INCOTERMS 2000. Loss or destruction of the equipment or injury or damage to the equipment that occurs while the risk of such loss or damage is borne by Buyer does not relieve Buyer of its obligation to pay Seller for the equipment.

SECTION 6: PATENT OR TRADEMARK INFORMATION

If the equipment sold hereunder is to be prepared or manufactured according to Buyer's specifications, Buyer shall indemnify Seller and hold it harmless from any claims or liability for patent or trademark infringement on account of the sale of such goods.

SECTION 7: CHANGES

Buyer may request, in writing, changes in the design, drawings, specifications, shipping instructions, and shipment schedules of the equipment. As promptly as practicable after receipt of such request, Seller will advise Buyer what amendments to the Contract, if any, may be necessitated by such requested changes, including but not limited to amendment of the Purchase Price, specifications, shipment schedule, or date of delivery. Any changes agreed upon by the parties shall be evidenced by a Change Order signed by both parties.

SECTION 8: CANCELLATION OR TERMINATION

Buyer shall have the right to cancel the Contract upon 15 days' prior written notice to Seller, and Seller shall stop its performance upon the receipt of such notice except as otherwise agreed with Buyer. If Buyer cancels the Contract, it shall pay: (a) the agreed unit price for equipment or components completed and delivered, (b) additional material and labor costs incurred, and for engineering services supplied by Seller with respect to the canceled items, which shall be charged to Buyer at Seller's rates in effect at the time of cancellation, but which shall not exceed the contract price for such items, and (c) such other costs and expenses, including cancellation charges under subcontracts, as Seller may incur in connection with such cancellation or termination.

SECTION 9: DELIVERY AND DELAYS

Seller shall use its best efforts to meet quoted delivery dates, which are estimated based on conditions known at the time

of quotation. Seller shall not be liable for any nonperformance, loss, damage, or delay due to war, riots, fire, flood, strikes or other labor difficulty, governmental actions, acts of God, acts of the Buyer or its customer, delays in transportation, inability to obtain necessary labor or materials from usual sources, or other causes beyond the reasonable control of Seller. In the event of delay in performance due to any such cause, the date of delivery or time for completion will be extended to reflect the length of time lost by reason of such delay. Seller shall not be liable for any loss or damage to Buyer resulting from any delay in delivery.

SECTION 10: WARRANTY

Seller warrants that the equipment or services supplied will be free from defects in material, and workmanship for a period of 12 months from the date of initial operation of the equipment, or 18 months from the date of shipment, whichever shall first occur. In the case of spare or replacement parts manufactured by Seller, the warranty period shall be for a period of six months from shipment. Repairs shall be warranted for 12 months or, if the repair is performed under this warranty, for the remainder of the original warranty period, whichever is less. Buyer shall report any claimed defect in writing to Seller immediately upon discovery and in any event, within the warranty period. Seller shall, at its sole option, repair the equipment or furnish replacement equipment or parts thereof, at the original delivery point. Seller shall not be liable for costs of removal, reinstallation, or gaining access. If Buyer or others repair, replace, or adjust equipment or parts without Seller's prior written approval, Seller is relieved of any further obligation to Buyer under this section with respect to such equipment or parts. The repair or replacement of the equipment or spare or replacement parts by Seller under this section shall constitute Seller's sole obligation and Buyer's sole and exclusive remedy for all claims of defects. SELLER MAKES NO OTHER WARRANTY OR REPRESENTATION OF ANY KIND WITH RESPECT TO THE EQUIPMENT OR SERVICES OTHER THAN AS SPECIFIED IN THIS SECTION 10. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED.

For purposes of this Section, the equipment warranted shall not include equipment, parts, and work not manufactured or performed by Seller. With respect to such equipment, parts, or work, Seller's only obligation shall be to assign to Buyer any warranty provided to Seller by the manufacturer or supplier providing such equipment, parts or work.

No equipment furnished by Seller shall be deemed to be defective by reason of normal wear and tear, failure to resist erosive or corrosive action of any fluid or gas, Buyer's failure to properly store, install, operate or maintain the equipment in accordance with good industry practices or specific recommendations of Seller, or Buyer's failure to provide complete and accurate information to Seller concerning the operational application of the equipment.

SECTION 11: TECHNICAL DOCUMENTS

Technical documents furnished by Seller to Buyer, such as drawings, descriptions, designs and the like, shall be deemed provided to Buyer on a confidential basis, shall remain Seller's exclusive property, shall not be provided in any way to third parties, and shall only be used by Buyer for purposes of installation, operation and maintenance. Technical documents submitted in connection with a Quotation that does not result in a Purchase Order shall be returned to Seller upon request.

SECTION 12: LIMITATION OF LIABILITY

Seller shall in no event be liable for any consequential, incidental, indirect, special or punitive damages arising out of the Contract, or out of any breach of any of its obligations hereunder, or out of any defect in, or failure of, or malfunction of the equipment, including but not limited to, claims based upon loss of use, lost profits or revenue, interest, lost goodwill, work stoppage, impairment of other equipment, environmental damage, nuclear incident, loss by reason of shutdown or nonoperation, increased expenses of operation, cost of purchase of replacement power or claims of Buyer or customers of Buyer for service interruption whether or not such loss or damage is based on contract, tort (including negligence and strict liability) or otherwise.

Seller's maximum liability under this Contract shall not exceed the Purchase Order amount of the equipment or portion thereof upon which such liability is based. All such liability shall terminate upon the expiration of the warranty period, if not sooner terminated.

SECTION 13: THIS COMPANY IS AN EQUAL OPPORTUNITY EMPLOYER

This agreement incorporates by reference applicable provisions and requirements of Executive Order 11246 and FAR Section 52.222-26 (covering race, color, religion, sex and national origin); the Vietnam Era Veterans Readjustment Assistance Act of 1974 and FAR Section 52.222-35 (covering special disabled and Vietnam era veterans); and the Rehabilitation Act of 1973 and FAR Section 52.222-36 (covering handicapped individuals). By acceptance of this agreement Buyer certifies that it does not and will not maintain any facilities in a segregated manner, or permit its employees to perform their services at any location under its control where segregated facilities are maintained, and further that appropriate physical facilities are maintained for both sexes. Buyer agrees that it will obtain a similar certificate prior to award of any nonexempt lower-tier subcontracts.

SECTION 14: LAW AND ARBITRATION

The Contract shall be governed by the law of the State of Texas. Any disputes arising out of this Contract shall be resolved by informal mediation in any manner that the parties may agree within 45 days of written request for mediation by one party to the other. Any dispute that cannot be resolved through mediation shall be resolved by binding arbitration conducted in English in Portland, Oregon under the Commercial Rules of the American Arbitration Association except as otherwise provided in this Section. The arbitration shall be conducted by three arbitrators chosen in accordance with said Rules. The arbitrators are not entitled to award damages in excess of compensatory damages. Judgment upon the award may be entered in any court having jurisdiction.

Check our worldwide offices at
www.paco-pumps.com