





ARTIFICIAL LIFT SUBMERSIBLE PUMPS


Owner's Manual


BEFORE GETTING STARTED

Read and follow safety instructions. Refer to product data plate(s) for additional operating instructions and specifications.

This is the safety alert symbol. When you see this  symbol on your pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury:

 DANGER warns about hazards that will cause serious personal injury, death or major property damage if ignored.

 WARNING warns about hazards that can cause serious personal injury, death or major property damage if ignored.

 CAUTION warns about hazards that will or can cause minor personal injury or major property damage if ignored.

 NOTICE indicates special instructions which are important but not related to hazards.

Carefully read and follow all safety instructions in this manual and on pump.

Keep safety labels in good condition.


Replace missing or damaged safety labels.




Hazardous voltage. Can shock, burn, or cause death.

Ground pump before connecting to power supply. Disconnect power before working on pump or motor.

 WARNING Wire motor for correct voltage. See motor nameplate.

 WARNING Ground motor before connecting to power supply.

 WARNING Meet all national and local electrical codes for all wiring.

 WARNING Follow wiring instructions in this manual when connecting motor to power lines.

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GETTING STARTED

BEFORE INSTALLING PUMP, BE SURE TO READ THIS OWNER'S MANUAL CAREFULLY.

⚠ CAUTION When installing an ESPCP pump, ensure the pump is lubricated at assembly before starting or the pump will be damaged. The motor on this pump is guaranteed by the manufacturer. In event of failure, it must be returned to an authorized service station for repairs. Motor warranty is void if repairs are not made by an authorized repair station.

Inspect the Shipment

Please examine your product carefully to ensure that no damage occurred during shipment. If damage is evident, please contact the place of purchase. Please check that the packages include a pump, motor and motor leads (if your pump purchase includes a motor).

INSTALLATION RECORDS

IMPORTANT INFORMATION FOR INSTALLERS OF THIS EQUIPMENT!

THIS EQUIPMENT IS INTENDED FOR INSTALLATION BY TECHNICALLY QUALIFIED PERSONNEL. FAILURE TO INSTALL IT IN COMPLIANCE WITH NATIONAL AND LOCAL ELECTRICAL CODES AND WITH FRANKLIN ELECTRIC RECOMMENDATIONS MAY RESULT IN ELECTRICAL SHOCK OR FIRE HAZARD, UNSATISFACTORY PERFORMANCE, AND EQUIPMENT FAILURE. RETAIN THIS INFORMATION SHEET WITH THE EQUIPMENT FOR FUTURE REFERENCE.



It is a good idea to keep an accurate record of your installation. Be sure to record your data below:

Date of Installation:				
Pump	Model No.*:			
	Date Code*:			
	Serial No.:			
Motor*	Model:			
	Date Code:			
	Serial No.:			
	Amps	HP	Volts	pH
Drive	Model No.	HP	Volts	
Control Box	Model No.	HP	Volts	
Sensor	Model		Full Scale	
Well Inside Dia. (mm/in):				
Depth of Well (m/ft):				
Pump Set Depth from Surface (m/ft):				
Target Water Level:				
Static Water Level:				
Water Flow (BPD/LPM/gpm):				
Drop Pipe Size:				
Wire Drop Cable Gauge:				
Drop Cable Length	Well Head to Motor		Drive to Well Head	
Power Supply (Line/Generator)	Volts		Hz	

* This information is on your pump or motor tag. It will help us identify your pump in case of later inquiries.

SUITABILITY OF WELL

Only install the pump in a properly developed well. Fluid from undeveloped wells often contains an excessive amount of sand, dirt, and abrasives that can damage the pump. Check that the well is large enough to set the pump at the required depth. Do not set the pump below the casing perforations or well screen unless you ensure an adequate flow of fluid over the motor for cooling purposes. Determine the correct pump setting from the driller's record by taking into account the well inclination if survey data is available (see installation instruction for additional details). A rat hole is recommended from 10 to 30 m (30 to 100 ft).

DROP PIPE

Submersible pumps can be installed on metal pipe, fiberglass pipe, or lay-flat hose. Observe the manufacturer's recommendations when using fiberglass pipe or lay-flat hose.

1. Install motor and pump in a shroud when possible. Always have a method to center the motor and pump within the shroud. The shroud is used depending on the well conditions and is different for every well. There are bottom open shrouds and inverted shrouds—each has its own place. The shroud is used for:
 - a. Motor cooling by controlling the water flow past the motor.
 - b. Limiting the amount of gas that can get into the pump.
 - c. Keeping large sand and debris from getting into the pump.
2. If a shroud is not used in a vertical well, attach a torque arrestor/motor guide to the bottom of the motor to prevent rubbing against the casing when the pump and pipe twist during the starting and stopping cycle.

Take great care to keep pipe threads clean and free from pebbles, scale, and thread chips. Make sound, airtight connections at all fittings. Pipe sealant is recommended.

CHECK VALVES

Franklin Electric ESPs and ESPCPs do not come with a check valves. Suitable check valve should be added at least 3 m (10 ft) above the pump. Contact Franklin Electric for recommendations in selecting and placing of check valves.

⚠ WARNING

Fluid draining back through the pump can cause the pump to rotate backwards. This can cause excessive backspinning, resulting in damage to the motor and pump. If the motor starts during backspinning, damage to the motor and pump can occur.

Figure 1
Typical ESPCP Installation

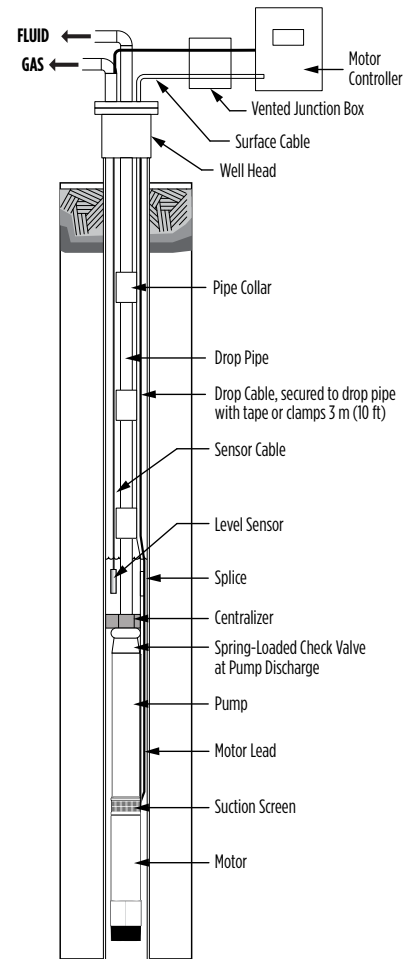
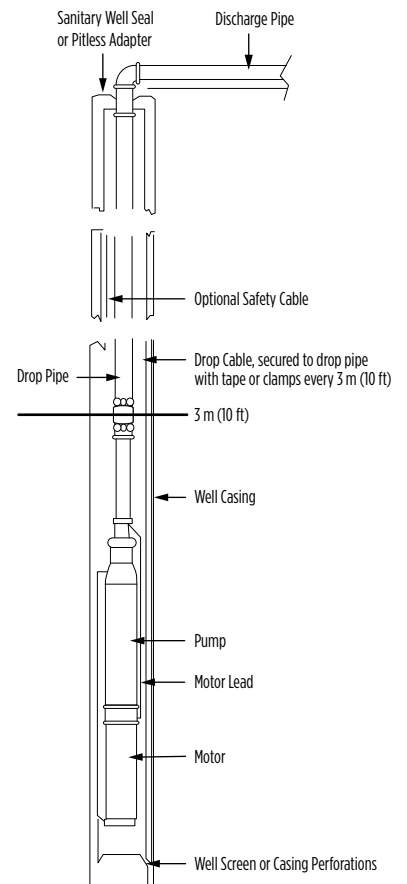


Figure 2
Typical Centrifugal ESP Installation



INSTALLATION

Installation of Pump in Non-Vertical Wells

ESP: Franklin Electric allows the installation of ESP systems at any angle between vertical and 15 degrees from horizontal. These products must be installed with the discharge of the pump above the motor. Installations beyond 45 degrees from vertical require a flow sleeve to ensure fluid flows over the motor. The motor should be centered within this flow sleeve.

ESPCP: Franklin Electric allows the installation of ESPCP systems at any angle between vertical and horizontal. These products should not be installed beyond horizontal (where the discharge of the pump is below the motor). Installations beyond 45 degrees from vertical require a flow sleeve to ensure fluid flows over the motor. The motor should be centered within this flow sleeve.

CAUTION There are associated risks with gas and debris the closer you set the pump to 90 degrees from vertical.

Installation of Pump, Drop Pipe, and Associated Equipment

Figure 1 illustrates a typical in-ground well installation. Franklin Electric recommends the following procedure when installing the pump and drop pipe:

1. Install the lead into the motor. Spin motor shaft several rotations to lubricate bearings. Apply coupling grease included with the motor shaft splines.

If installing an ESP, skip to step 5.

ESPCPs are delivered with the rotor/flex shaft assembly in the same box.

In Figure 3 (page 7):

- a. The rotor and stator are a matched set and must be kept together.
 - b. The flex shaft is fitted to the rotor with a key and is bonded in place.
2. Lubricate the rotor with supplied silicone grease and insert into its stator. Leave about 25 mm (1 inch) of coupling protruding from motor bracket.
 3. Push pump to move the rotor into the stator.
 4. Stand motor vertically when mounting the pump to ensure proper seating of the flange. Ensure the power lead of the motor and the lead opening of the pump are lined up properly.
 5. Install the supplied lock washers and nuts using a star pattern when tightening the motor nuts to 24 Nm (18 ft-lb). Ensure the pump is seated flush to the motor when tight.

6. For ESP pumps, if cable guard is supplied with the pump, pull motor leads taut over pump and attach guard with supplied screws. Damage can occur if the lead wires are overlapping under the cable guard. On longer cable guards, a low-profile cable tie is included. Attach this around the cable guard at the middle of the pump.

Note: There is not a guard for ESPCP pumps. Lay the motor leads flat over the pump and tape for install. Ensure the breather holes are not covered when taping.

7. Fit centralizers every 20 m (60 ft) thereafter. If slots are available in the centralizers, run power cables through the slots to keep the cables protected.
8. For an ESPCP, install a check valve at least 1 m (3 ft) above the pump.
9. A rat hole is recommended from 10 to 30 m (30 to 100 ft).
10. If the pump and motor are set below the well screen or casing perforations, or if they are in a large diameter well where the recommended flow past the motor cannot be achieved, a flow sleeve or shroud is required. A shroud is also recommended if the pump and motor are set between horizontal and 45 degrees. This will ensure that the motor and pump do not rub against the casing.
11. Splice the cable per the splicing instructions in the splice kit. If the drop cable is colored, record connection colors between motor leads and drop cable. If the drop cable is not colored, mark each cable clearly on both ends. Each lead needs to be identified from the motor to the drive so you can determine the proper motor rotation when hooked to the output of the drive. Forward rotation is equal to drive output.

Drive Output	Motor Wires
U	black or phase 1
V	yellow or phase 2
W	red or phase 3

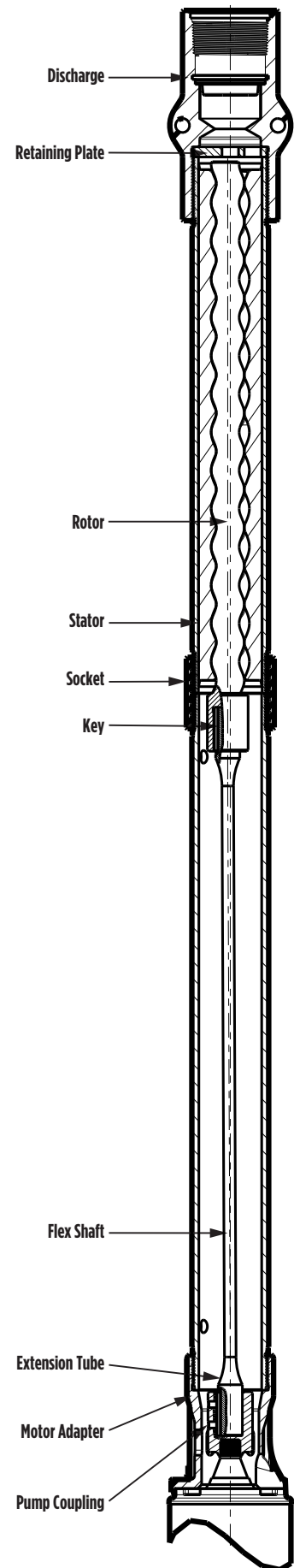
12. Place reinforced cable protectors over cable and secure cable to the column pipe with stainless steel strapping. The cable must be secured every 10 m (30 ft) to the drop pipe as a minimum. Consider the stretch of your drop pipe when attaching the motor cable to ensure you do not over stress the cable.

CAUTION Do not overtighten the steel strap, but be firm enough to avoid cable slip along the column.

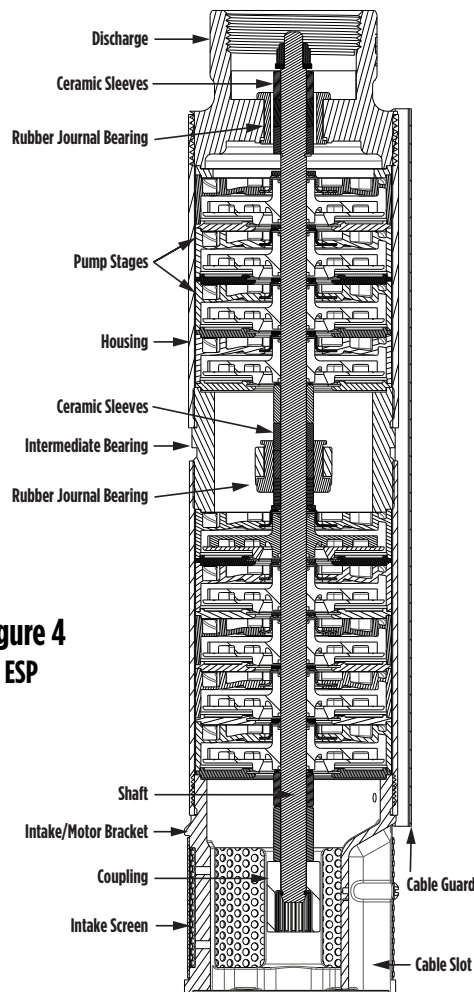
13. Trim cable strap neatly to avoid any possible catching while lowering the pump into the well.
14. If used, mount the pressure sensor approximately 5 ft above the pump. Tape the sensor to the drop pipe and protect with centralizers or other protective device. Route the sensor cable on the ground side of the drop cable for better noise immunity.

15. Use separate sheaves for power cable and transducer cable, and guide them carefully alongside the riser main into the well. Use a cable sheave where possible.
16. Never force the pump into the casing. Be extremely careful not to scrape or damage the drop cable and transducer cable when lowering the pump.
17. Before connecting the drop cable to the control panel:
 - a. Phase orientation is critical. Drive phasing (U, V, W) must coincide with the motor phasing chart on page 6.
 - b. Using a 1000/500 V megger, take a resistance reading between the drop cable conductors and ground to ensure that the cable insulation or splice was not damaged during installation. It is good practice to do this at regular intervals during installation to detect any cable damage at an early stage. It is also good to check the phase-to-phase and phase to ground resistances. Downhole sensor readings can be taken as well to ensure sensor functionality.
 - c. Measure the phase to phase resistance of the drop cable and motor circuit and compare to the Franklin Electric specifications in the AIM manual cable resistance chart.
 - d. Be sure to connect the leads as they were marked to obtain correct rotation.
18. Proceed with commissioning the system per the control system manual.

**Figure 3
ESPCP**



**Figure 4
ESP**



ASSEMBLY/DISASSEMBLY INSTRUCTIONS

Dismantling the Pump

If it is necessary to dismantle the pump, this should be guided by the following considerations:

- The threaded housing joints at the ends of the shaft spacer tube are left-hand threads, and the threads of the stator housing at the top end of the pump where it attaches to the discharge casting are right-hand threads.
- All threaded joints are adhesively bonded. In order to take them apart, heat should be applied to the OD of the parts with female sockets before attempting to loosen them.
- The pump rotor has a left-hand helical shape, so removing it from the stator may often be assisted by rotating the rotor clockwise.
- The shaft is bonded at both ends to the mating parts. The rotor assembly may be dismantled by heating the socket ends of the coupling and rotor where they fit over the shaft.

Assembling the Pump

In rebuilding an ESPCP from its constituent parts, the following procedure may be used:

1. Verify that the parts are clean and that the threads have not been damaged. Refer to the drawing to verify all constituent parts are available.
2. Screw the bronze shaft retaining plate fully into the right hand thread at the pump end of the discharge.
NOTE: The “pump end” of the discharge is opposite the direction that the arrow points.
3. Apply thread sealant/locker to the long right-hand thread at the end of the stator and screw on the pump discharge assembly, keeping the arrow pointing away from the pump stator. Torque to 350–400 Nm (250–300 ft-lbs).
4. Apply thread sealant/locker to the left-handed thread at the bottom end of the stator and screw the socket collar fully onto the stator thread. The threaded stator end will reach approximately to the center of the socket collar.
5. Apply thread sealant/locker to the left-handed thread at one end of the shaft extension tube and screw it into the socket collar previously installed onto the stator. Torque to 350–400 Nm (250–300 ft-lbs).
6. Apply thread sealant/locker to the left-hand thread at the bottom end of the shaft extension tube and screw it into the motor bracket socket. Torque to 350–400 Nm (250–300 ft-lbs).

SPECIAL CONSIDERATIONS FOR ESPCPs

Franklin Electric ESPCPs should only be used on Franklin Electric CBM+ motors. These motors are specially designed to handle the demanding nature of direct-coupled Progressing Cavity pumps. Operation of these pump/motor systems must be limited to the range of 15 to 40 Hz for 1000 m pumps, and 15 to 30 Hz for 1500 m pumps. For 2-pole Franklin Electric CBM+ motors, this represents a speed range between 900 rpm and 2400 rpm. Operation outside of this range may result in damage to the pump and motor.

Control of this pump can be accomplished with a down hole fluid level sensor. This should be a 4-20 mA device connected into a PID loop feeding into the variable speed drive. The PID loop must be inverted such that the motor slows down as the pressure (level) reduces. The loop should be set up to control to a target level and to shut off at a minimum level set below this target level. It is important to control the pump in such a way that it does not run dry.

Target levels should be set, keeping well casing pressure in mind. If the well casing pressure is significant, it should be compensated for. This can be done manually if there is no significant variation in the pressure. Conversely, it can be done automatically by using the differential between the down hole fluid pressure and the casing pressure measured.

Franklin Electric ESPCPs must rotate in a counterclockwise direction when viewed from the discharge end of the pump. Care must be taken to ensure that the drive phasing (U, V, W) lines up with the motor lead phasing. This phasing must be tracked as splices are made. Operation in the incorrect direction for more than a few seconds may cause damage to the pump.

Franklin Electric recommends that the ESPCP be set up with the appropriately sized Franklin Electric drive. This will ensure that the operational range of the system will be adhered to and that the drive parameters will be optimized for the Franklin Electric product. For those installations where a Franklin Electric drive is not used, the following general guidelines should be used.

Franklin Electric CBM+ Control Data

Drive Parameter	Value
Motor Rating	11.2 kW (15 hp) 7.5 kW (10 hp) 5.5 kW (7.5 hp)
Rated Voltage	460/400 V
Rated Frequency	60/50 Hz
Poles	2
Motor Speed at 50 Hz	2850 rpm
Motor Full Load Current	11.2 kW (15 hp) – 26.5 A 7.5 kW (10 hp) – 17.1 A 5.5 kW (7.5 hp) – 12.6 A
Current Limit The lowest of Drive Maximum Amps or: (See Notes 1 and 2)	11.2 kW (15 hp) – 125 A 7.5 kW (10 hp) – 99 A 5.5 kW (7.5 hp) – 77 A
Torque Limit	300%
Minimum Operational Frequency	15 Hz
Maximum Operational Frequency	40 Hz*
PID Proportional Gain	10 initial setting (Can be adjusted for application.)
PID Integral Gain	0
Motor Control	Scalar
Operating Voltage	Linear V/Hz
Torque Boost (if scalar mode is used)	Activate (Motor ramp-up must meet “Acceleration” requirement below.)
Motor Rotation	CCW only (Looking down on motor shaft)
Restart Time	Minimum off time of 10 minutes between start and stop
Acceleration and Deceleration	1 second maximum

* C depth pumps max out at 30 Hz

Notes

1. The drive must be set up to deliver the maximum current below 15 Hz in order to generate maximum torque at start-up.
2. If there is a stall feature, set stall limit to 10 seconds while below 15 Hz. This will allow for maximum torque, but will still detect a true locked rotor condition. If possible, allow the drive to try starting the pump several (3 to 5) times with a minimum of 10 minutes between restarts.
3. Set up drive to shut off at a minimum fluid level in the well (as measured by a down hole level sensor). This minimum should be at least 3 m (10 ft) from the intake of the pump.
4. Consider the voltage drop across cable from drive to the motor when configuring the drive.

This is not meant to be a complete list of drive settings as every brand of drive has different settings. Please contact a Franklin Electric representative if you have questions regarding the installation and application of the Franklin Electric ESPCP.

WELL TEST

Check the pump and well performance before making the final connection to the discharge system.

1. Open a discharge valve at the top of the well to check for proper flow.

⚠ WARNING Never close off the surface valve when an ESPCP is running. These pumps are capable of developing high pressure under shutoff conditions that can result in damaged plumbing.

2. Start the pump.
3. **Checking for correct rotation – ESPCP only**
When the pump is first started, it may take some time for fluid to appear at the surface. Check for air being expelled with your hand or a plastic bag held in place around the discharge of the valve. If you feel air being expelled, or if the bag inflates, the pump is operating in the correct direction. If you feel air being sucked inward, or the bag deflates, immediately stop the pump.

⚠ WARNING Never run the pump unless it is completely submerged in fluid. If run without fluid, the pump and motor will be damaged.

TROUBLESHOOTING

Problem	Probable Causes
Pump fails to start	Electrical trouble; call dealer or electrician.
	Drawdown protection device turned off pump.
	Overload tripped.
	Check input AC voltage before and during startup to ensure the voltage levels drop less than 10%.
	Check starting torque at startup to see if pump is locked.
	Make sure all motor phases are connected properly.
	Damaged cable.
	Downhole pressure sensor malfunction.
	Water has not recovered above the restart level.
Pump fails to deliver fluid	Clogged intake screen.
	Incorrect rotation.
	Well fluid level is not above pump.
	Incorrect rotation (for PC pumps this needs to be determined at first startup or pump can be damaged).
	Pump worn/damaged.
	Pump shaft locked.
	Tubing leak.
	Motor speed too low for pump performance.
	Downhole sensor malfunction.
Pump gives reduced output	Overpumping the well.
	Worn pump.
	Clogged intake screen.
	Low voltage.
	Incorrect rotation (ESP only).
	Pump speed too slow.
	Tubing leak.
	Broken coupling.

STANDARD LIMITED WARRANTY

Except as set forth in an Extended Warranty, for twelve (12) months from the date of installation, but in no event more than twenty-four (24) months from the date of manufacture, Franklin hereby warrants to the purchaser ("Purchaser") of Franklin's products that, for the applicable warranty period, the products purchased will (i) be free from defects in workmanship and material at the time of shipment, (ii) perform consistently with samples previously supplied and (iii) conform to the specifications published or agreed to in writing between the purchaser and Franklin. This limited warranty extends only to products purchased directly from Franklin. If a product is purchased other than from a distributor or directly from Franklin, such product must be installed by a Franklin Certified Installer for this limited warranty to apply. This limited warranty is not assignable or transferable to any subsequent purchaser or user.

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- c. Franklin's liability arising out of the sale or delivery of its products, or their use, whether based upon warranty contract, negligence, or otherwise, shall not in any case exceed the cost of repair or replacement of the product and, upon expiration of any applicable warranty period, any and all such liability shall terminate.
- d. Without limiting the generality of the exclusions of this limited warranty, Franklin does not warrant the adequacy of any specifications provided directly or indirectly by a purchaser or that Franklin's products will perform in accordance with such specifications. This limited warranty does not apply to any products that have been subject to misuse (including use in a manner inconsistent with the design of the product), abuse, neglect, accident or improper installation or maintenance, or to products that have been altered or repaired by any person or entity other than Franklin or its authorized representatives.
- e. Unless otherwise specified in an Extended Warranty authorized by Franklin for a specific product or product line, this limited warranty does not apply to performance caused by abrasive materials, corrosion due to aggressive conditions or improper voltage supply.
- f. With respect to motors and pumps, the following conditions automatically void this limited warranty:
 1. Mud or sand deposits which indicate that the motor has been submerged in mud or sand.
 2. Physical damage as evidenced by bent shaft, broken or chipped castings, or broken or bent thrust parts.
 3. Sand damage as indicated by abrasive wear of motor seals or splines.
 4. Lightning damage (often referred to as high voltage surge damage).
 5. Electrical failures due to the use of non-approved overload protection.
 6. Unauthorized disassembly.

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