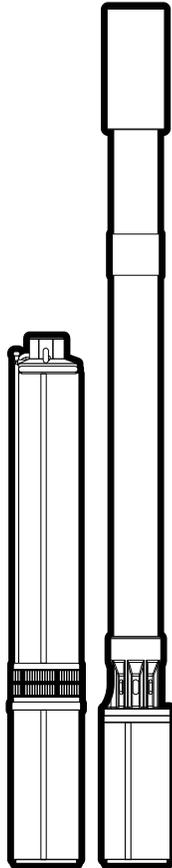




Franklin Electric

# Coal-Bed Methane (CBM) Severe Service Submersible Pumps OWNER'S MANUAL



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

**CAUTION** Fill pump with water before starting or 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**

Examine the pump when it is received to be sure there has been no damage in shipping. Should any be evident, report it immediately to the dealer from whom the pump was purchased. Please check the packages to see that they include pump, motor, and motor leads (if your pump purchase includes a motor).

## **READ AND FOLLOW SAFETY INSTRUCTIONS**

**!** 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.

The label **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.

### **! WARNING**



**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.**



**WARNING**

**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.

**INSTALLATION RECORDS**

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

<b>Date of Installation:</b>			
<b>Pump Model No.*:</b>			
<b>Pump Date Code*:</b>			
<b>Pump Serial Number:</b>			
<b>Downhole Sensor Model:</b>			
<b>Well Inside Dia. (mm/in):</b>			
<b>Depth of Well (m/ft):</b>			
<b>Target Depth of Water (m/ft):</b>			
<b>Minimum Depth of Water (m/ft):</b>			
<b>Pump Setting Depth (m/ft):</b>			
<b>Water Flow (BPD/LPM/gpm):</b>			
<b>Drop Pipe Size:</b>			
<b>Wire Size (VSD to motor):</b>			
<b>Make of Motor*</b>			
<b>Amps</b>	<b>HP</b>	<b>Volts</b>	<b>Ph</b>
<b>Make of Control Box</b>			
<b>HP</b>		<b>Volts</b>	
<b>Power Supply (Line/Generator)</b>			
<b>Volts</b>		<b>HZ</b>	

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



**WARNING**

SERIOUS OR FATAL ELECTRICAL SHOCK MAY RESULT FROM FAILURE TO CONNECT THE MOTOR, CONTROL ENCLOSURES, METAL PLUMBING, AND ALL OTHER METAL NEAR THE MOTOR OR CABLE, TO THE POWER SUPPLY GROUND TERMINAL USING WIRE NO SMALLER THAN MOTOR CABLE WIRES. TO REDUCE RISK OF ELECTRICAL SHOCK, DISCONNECT POWER BEFORE WORKING ON OR AROUND THE WATER SYSTEM.

**TEST RUNNING**

If test running pump before installation:

1. Ensure that the power supply corresponds with that shown on the nameplate of the motor and control.
2. Install pump and components appropriate for the test as shown in Fig. 1.

**WARNING** Power cables and instrument/control leads should be fed through wellhead with a sealed gas-block feed through, or a vented junction should be used if the cable or other jacketed leads are fed directly through the wellhead.

The junction box should be a minimum of 25ft (8m) from the control box.

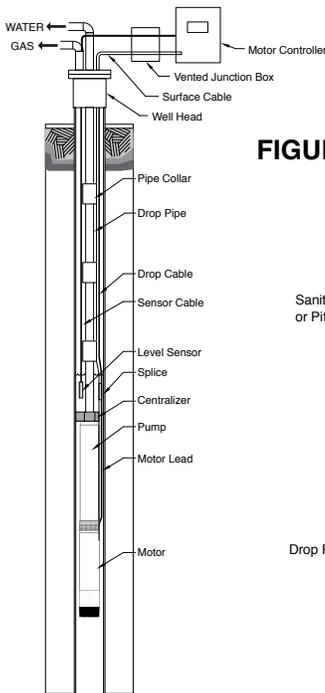
3. Make sure power supply is turned off and circuit breaker or disconnect switch is open. Make electrical connections appropriate to your motor.
4. A Franklin Electric ESP (Electric Submersible Pump) can be tested with line power. A Franklin Electric ESPCP (Electric Submersible Progressing Cavity Pump) must be run on a variable speed drive with operation limited to the range of 20-40 Hz. Follow the guidelines in the Special Considerations for ESPCP's section of this manual.
5. Phase orientation is critical. Drive phasing (A, B, C) must coincide with the motor phasing (T1-Black, T2-Gray (or Yellow), T3-Brown (or Red)). Apply power to the pump for a maximum of 2 seconds to view rotation of the coupling. Motor should rotate counterclockwise when viewed from the top of the motor shaft.

6. Fill the pump and the discharge plumbing with water.

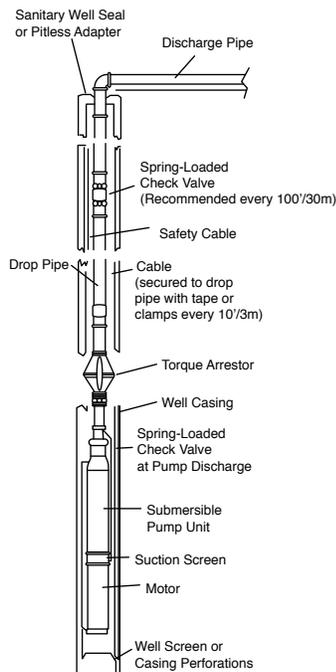
**CAUTION** Operating the system without water could severely damage system components and/or void the warranty.

7. Run pump and motor unit for a few seconds to ensure that it is in working order.

**FIGURE 1 - Typical CBM Well**



**FIGURE 2 - Typical Severe Service Installation**



## SUITABILITY OF WELL

Install the pump only in a well that has been properly developed. Water from an undeveloped well often contains an excessive amount of sand, dirt, and abrasives which can damage the pump. Check that the well is large enough to allow the pump to be set at the required depth. Do not set the pump below the casing perforations or well screen unless you make arrangements to ensure an adequate flow of water over the motor for cooling purposes. Determine the correct pump setting from the driller's record by taking into account the static water level and the drawdown at the proposed pumping rate. Keep the pump at least five feet from the bottom of a drilled well.

## DROP PIPE

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

1. A safety cable to prevent loss of pump if pipe should break.
2. Install motor and pump in a shroud when possible. Always have a method to center the motor and pump within the shroud.
3. If a shroud is not used, install torque arrestor, attached to bottom of motor, to prevent rubbing against the casing when pump and pipe twist during the starting and stopping cycle.

Take great care to keep pipes clean and free from pebbles, scale and thread chips. Make sound, air-tight connections at all fittings. Pipe sealant is recommended.

## CHECK VALVES

Franklin Electric ESPCPs have built-in spring-loaded non-return valves. The Franklin Electric Control System has an option for a Bump Mode, which can be enabled under some well conditions. When this is enabled, the built-in non-return valve should be removed and a replaced with a short section of pipe of at least 0.4 m (18 inches) should be attached to the pump discharge and a separate spring-loaded check valve should be added at the end of the pipe. Contact Franklin Electric for recommendations on when this should be used..

Franklin Electric ESPs do not come with a check valve. Install a check valve but place it at least 3m (10 ft) above the pump.

**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.

## INSTALLATION OF PUMP IN NON-VERTICAL WELLS

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

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

**INSTALLATION OF PUMP, DROP PIPE AND ASSOCIATED EQUIPMENT**

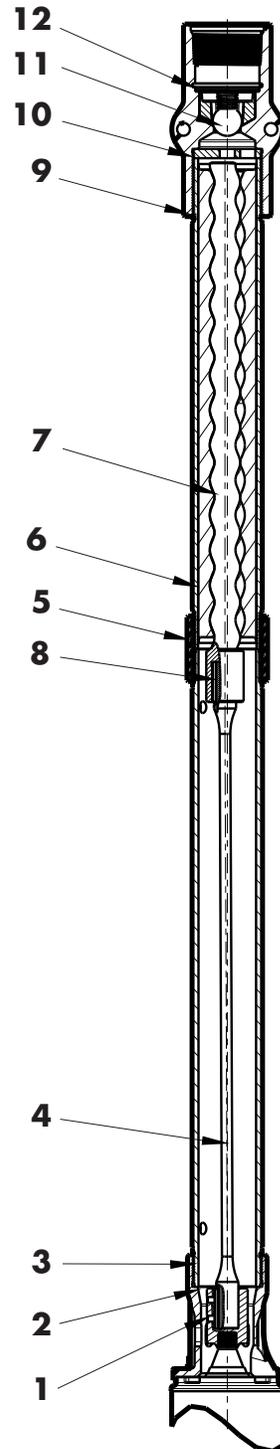
Figure 1 illustrates a typical well installation showing in-ground components. Franklin recommends the following procedure when installing the pump and drop pipe:

1. Remove sand slinger from shaft, apply grease to spline and replace sand slinger.  
If installing an ESP, skip to step 7.  
ESPCPs are delivered with the rotor/flex shaft assembly strapped to the stator.

In Figure 3:

- a. rotor (7) and stator (6) are a matched set and must be kept together.
- b. flex shaft (4) is fitted to the rotor with a key (8) and is bonded in place.
2. Fit coupling (1) to flex shaft (4) using key supplied.  
Note: remove and discard the two grub screws that are supplied with the coupling.
3. Lubricate rotor lightly with silicone grease and insert it into its stator (6) using a screwing action; leave about 25mm (1 in) of rotor protruding.
4. If rebuilding an ESPCP, follow the steps below. If the pump is new, skip to step 5.
  - a. Screw bronze retaining plate (10) fully into pump end of check valve body (9). Note: pump end of check valve body is opposite the direction that the arrow points.
  - b. Insert check valve ball (11) into discharge end of check valve body (9) and install the retaining ring to hold it in place.
  - c. Insert the stainless steel check valve ball retainer (12) fully into discharge end of check valve body (9).
  - d. Apply thread sealant/locker and screw check valve assembly onto end of stator (6) with arrow pointing upwards. Torque to 350-400 Nm (250-300 ft-lbs).
  - e. Apply thread sealant/locker and screw socket (5) fully onto stator (6) - left hand thread.
  - f. Apply thread sealant/locker and screw extension (3) onto socket (5) - left hand thread. Torque to 350-400 Nm (250-300 ft-lbs).
  - g. Apply thread sealant/locker and screw motor adaptor (2) onto extension (3) - left hand thread. Torque to 350-400 Nm (250-300 ft-lbs).

FIGURE 3. - ESPCP



5. Lubricate pump coupling and slide splined shaft of motor into pump coupling (1).
6. Push pump to move the rotor (7) into the stator (6).
7. Bolt flange of motor adaptor (2) to motor using lock washers and nuts as supplied. Tighten to 24 Nm (18 ft-lb), ensuring that the cable slot aligns with the leadout cable of the motor.

8. If cable guard is supplied with pump, pull motor cables taut over pump and attach guard with screws supplied. On longer cable guards, a low-profile cable tie is included. Attach this around the cable guard at the middle pressure isolating bearing.
  9. Fit centralizer on first drop pipe above pump and screw pipe into pump discharge.
  10. Fit centralizer every 20m (60 ft) thereafter. If slots are available in the centralizer, run power cable through slots to keep protected.
  11. For an ESP, install a check valve at least 3m (10 ft) above the pump.
  12. If no shroud is used, install a tubing centralizer just above the pump and/or a torque arrestor at the bottom of the motor to reduce the effects of twist during starting and stopping.
  13. Attach a safety cable to pump to prevent loss of pump if pipe should break.
  14. Plan your installation to make sure the pump is at least 1.5m (5 ft) from bottom of well.
  15. If the pump and motor are set below the well screen or casing perforations, or 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.
  16. Phase orientation is critical. Drive phasing (A, B, C) must coincide with the motor phasing (T1-Black, T2- Gray (or Yellow), T3-Brown (or Red)). Apply power to the pump on the surface prior to installation for a maximum of 2 seconds to view rotation of the coupling. Motor should rotate counterclockwise when viewed from the top of the motor shaft. A second motor can also be used at the surface if the motor is already installed.
  17. Splice cable per the splicing instructions in the splice kit. If drop cable is colored, record connection colors between motor leads and drop cable. If drop cable is not colored, mark each cable clearly on both ends.
  18. Place reinforced cable protector over cable and secure cable to the column pipe with stainless steel strapping. The cable must be secured every 10m (30 ft) to the drop pipe. The cable must remain slack when using flexible hose typically to allow for 2% stretching of hose when installed in the well. Stretch allowance should be verified with the tubing supplier.
- ▲ CAUTION** Do not over-tighten the steel strap, but be firm enough to avoid cable slip along the column.
19. Trim cable strap neatly to avoid any possible hooking up during the lowering of the pump down the well.
  20. Use two drum reels for power cable and transducer cable and guide carefully alongside the riser main into the well.
  21. Hold the drop cable up and away from the well casing as the pump is being lowered. 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.*
  22. After the last column pipe has been installed, install the well head and secure the eye bolt to the lifting hook. Route the drop cable and control cables through the correct holes in the well head; all these holes are threaded and the correct approved glands must be used to ensure gas tight connections to the well head.
  23. Before connecting the drop cable to the control panel:
    - a. Take a resistance reading between the drop cable conductors and ground to ensure that the insulation cable or splice was not damaged during installation - it is good practice to do this at regular intervals during installation to detect any damage to the cable at an early stage.
    - b. Measure the resistance of the drop cable and motor circuit and compare to the Franklin specifications in the AIM manual.
    - c. Be sure to connect the leads as they were marked to obtain correct rotation.
  24. Proceed with commissioning of the system per the control system manual.

## 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 20-40 Hz. For the 2-pole Franklin Electric CBM+ motors, this represents a speed range between 1200 rpm and 2400 rpm. Operation outside of this range may result in damage to the pump and motor.

Control of this pump must be accomplished with a water 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 motor slows down as the pressure (level) reduces. The loop should be set up to control to a target level, and to shutoff 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 annulus pressure in mind. If the well annulus 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 water pressure and the annulus pressure measured.

Franklin Electric ESPCPs must rotate in a counter-clockwise direction when viewed from the discharge end of the pump. Care must be taken to ensure that the drive phasing (A, B, C) lines up with the motor lead phasing (T1-Black, T2-Gray (or Yellow), T3-Brown (or Red)). 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 applying power to the motor for a short duration (<2 seconds), on the surface before installation to ensure correct rotation. A different motor can be used if the motor has already been coupled to the pump as long as motor lead phasing is observed.

Franklin Electric recommends that the ESPCP be set up with the 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 product. For those installations where a Franklin Electric drive is not used, the following general guidelines should be used.

Drive Parameter	Value
<b>Motor Rating</b>	11.2 kW (15 Hp) 7.5 kW (10 Hp) 5.5 kW (7.5 Hp) 3.7 kW (5 Hp)
<b>Rated Voltage</b>	400 V
<b>Rated Frequency</b>	50 Hz
<b>Poles</b>	2
<b>Motor Speed at 50 Hz</b>	2850 rpm
<b>Motor Full Load Current</b>	11.2 kW (15 Hp) – 26.5 Amps 7.5 kW (10 Hp) – 17.1 Amps 5.5 kW (7.5 Hp) – 12.6 Amps 3.7 kW (5 Hp) – 9.2 amps
<b>Current Limit - The lowest of Drive Maximum Amps or: (see notes 1 and 2)</b>	11.2 kW (15 Hp) – 125 Amps 7.5 kW (10 Hp) – 99 Amps 5.5 kW (7.5 Hp) – 77Amps 3.7 kW (5 Hp) – 52 amps
<b>Torque Limit</b>	300%
<b>Minimum Operational Frequency</b>	20 Hz
<b>Maximum Operational Frequency</b>	40 Hz
<b>PID Proportional Gain</b>	10 initial setting (can be adjusted for application)
<b>PID Integral Gain</b>	0
<b>PID Proportional Gain</b>	0
<b>Motor Control</b>	Vector (if available)
<b>Operating Voltage</b>	Linear V/Hz
<b>IR Compensation</b>	100%
<b>Torque Boost (if scalar mode is used)</b>	Activate (motor ramp-up must meet "Acceleration" requirement below)
<b>Motor Rotation</b>	CCW only (looking down on motor shaft)
<b>Restart Time</b>	>=8 minute delay after shutdown (~200 starts/day)
<b>Acceleration and Deceleration</b>	1 second

### Notes

1. Need to setup the drive 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 maximum torque, but still detect a true locked rotor condition. If possible allow the drive to try several times (3 to 5) to start pump.
3. Setup drive to shutoff at a minimum water level in the well as measured by a downhole level sensor. This minimum should be at least 3 m (10 feet) from the intake of the pump.
4. Set restart level so minimum cycle time is not exceeded.

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 ESPCP.

## WELL TEST

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

1. Install a gate valve on the end of the pipe. Fully open the valve; ensure that all valves are open.

**⚠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.**  
If the pump is set deep, it may take some time for water to appear at the surface. Check for air being expelled with your hand or with a plastic bag held in place around the discharge of the valve. If you feel air being expelled or 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.
4. If the discharge is not clear, let the pump run until water clears. If water does not clear in 30 minutes, stop the pump and take the necessary steps to correct the condition. After the water has appeared clear, check for sand by discharging into a clean bucket or suitable container.
5. Ensure that the output of the pump at this setting is not greater than the yield of the well. This can be checked by monitoring the well drawdown level and ensuring that the level is stable at the maximum required system flow rate.

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

## TROUBLESHOOTING

### **1. PUMP FAILS TO START**

- a. Electrical trouble - call dealer or electrician.
- b. Drawdown protection device has pump turned off.
- c. Overload tripped.

### **2. PUMP FAILS TO DELIVER WATER**

- a. Clogged intake screen.
- b. Insufficient well yield.
- c. Incorrect rotation.

### **3. PUMP GIVES REDUCED OUTPUT**

- a. Insufficient well yield.
- b. Worn pump.
- c. Clogged intake screen.
- d. Low voltage.
- e. Incorrect rotation (ESP only).

## WARRANTY

**Contact your local Franklin Electric office for warranty terms and conditions.**



**Franklin Electric**

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