

Electric Submersible Pumps: A Step Up From Mechanical Lifts

The Problem

A mechanical lift works great for pushing fluids up to the surface when there isn't enough pressure in a new or natural well, but over time, it may become less effective. When this happens, there are a few different tricks you can try:

- Adjust the length of the stroke on the pumping unit.
- Change the sheaves to increase the strokes per minute.
- Install a long-stroke unit with lighter counterweights.
- Waterflood—inject water into one well to drive hydrocarbons to the other wells.

However, these are only temporary fixes. Over time, water production will continue to increase and oil production will decrease. This will cause the pumping time to increase until the lease pumper is producing the well 24/7.

The Solution

When a mechanical lift no longer works, the best way to improve production is to install a system with greater capability, like an electric submersible pump. A submersible pump is one that is completely submerged in the fluid that needs to be pumped. These pumps are ideal for high-volume waterflood operations.

How an Electric Submersible Pump Works

An electric submersible pump is made up of an electric motor with a pump on top and an electric line attached to the outside of the tubing. The whole assembly is lowered into the hole and set below the liquid level, motor, pump and all. When the motor turns, it turns stack of liquid-lifting cups (or disks) in the pump. The more cups you have, the higher the pump will lift the liquid.

Parts of an Electric Submersible Pump

- **The motor** sits at the bottom of the well and is designed to lift the estimated volume of production.
- **The protector** is attached to the top of the pump. It seals the motor and allows the drive shaft in the center to drive the pump.
- **The gas separator** separates the liquid from the gas for pumping.
- **The pump** uses a rotary centrifugal action to carry the fluid load. The shaft may be made of Monel, and the stages may be made of a corrosion- and wear-resistant material.
- **The cable** leads out of the top of the motor to the side of the pump. It is connected to the outside of every joint of tubing from the motor to the surface of the well and extends on the surface to the control junction box. The cable is made up of three strands of continuous wire and may have a metal shield for protection. It starts out flat with the wires side-by-side as it reaches from the motor to the tubing, then it becomes round.
- **The tubing head** supports the tubing string and provides a seal that allows the electrical line to pass through the head. The seal normally holds a minimum of 3,000psi.
- **The chart meter** is an optional component that records the daily performance of the well. It is easy to read and can provide information that helps identify a wide range of possible problems.
- **The control box** controls the flow of electricity to the motor. You can use it to operate the well either continuously or intermittently or shut it off. The control box also protects the pump from power surges and any other changes in the flow of electricity.

- **The transformers** are usually located at the edge of the lease site. They convert the electricity from the power lines into the right voltage and amperage for the pump.
- **The electrical supply system** is the commercial power distribution system. The higher the voltage, the better the performance.

Advantages of Electric Submersible Pumps

- They can pump very large amounts of fluid at shallow to medium depths.
- Casing size doesn't affect the volume of fluid that can be pumped.
- They are easy to automate and can pump continuously or intermittently.
- The investment for shallow wells is relatively low.

Disadvantages of Electric Submersible Pumps

- "Gyp," a buildup of scale deposit, can cause problems for the pump.
- Electricity costs can be very high, especially in remote areas.
- They have limited flexibility in certain conditions.
- If a problem occurs, the whole system must be pulled up.

Tips and Tricks

- To protect your pump's cable from damage, try running it through a joint of pipe from the well to the control panel. This will allow you to walk or drive vehicles over the conduit without damaging the cable.
- To lower the pump without having to splice the cable, place a post and hanger near the control panel. This will give you a place to hang a few extra loops of the cable.