Electric Submersible Pumps

The production rate range for ESP is 100 bopd to 90,000 bopd, but is used mostly for large production rates. Most systems produce under a 1000 bpd of fluid. It is very good when large amounts of water is produced with the oil. It is used in many water wells today. ESPs are not good for wells with a large gas cut. This is a very expensive system in install and to maintain.

Fig. 7.1—Typical submrgible pump application.
ESP Components

Motor – The prime mover of the system is an electric motor that is a two-pole, three phase, squirrel cage induction motor that runs at 3500 rpm at 60-Hz. The formation fluid moving by the motor housing cools these motors. So the flow must be adequate and the pump must not be set below the perforations. The motors come in four different diameters, 3.75, 4.56, 5.4 and 7.38 inches. Several motors may be arranged in tandem configurations to supply the required horsepower to pump the desired flow rate.

Pump – A multistage centrifugal type pump is used for ESP systems. The impellers used are bronze or plastic for corrosion protection. They have a “bolt on” design so that several pump stages are used to get the capacity and the head needed for the well.

Protector – Primary purpose to isolate the motor oil from the well fluid while balancing BHP and the motor internal pressure. The other functions are 1) connecting the pump to the motor, 2) house the thrust bearing to absorb pump shaft axial thrust and 3) allows thermal expansion of the motor oil.

Power Cable – To supply the electric power to the motor downhole. Two configurations of power cables, flat (parallel), and round are used. Mechanical protection is given by armor of galvanized steel.

Switchboard – Is the surface control of the system. It basically a motor control panel for outdoor use. It also has a recording amp meter that is used to monitor the operation of the pump and motor.

Wellhead – A special type of wellhead is used, to pack off the tubing and the power cable.

Selection Data

Mechanical Data
1) Casing and tubing size
2) Well depth, measured and true vertical
3) Perforations depth, measured and true vertical
Production Data
1) Oil production rate
2) Water production rate
3) GOR
4) Static BHP and fluid level
5) Producing BHP and fluid level
6) BHT
7) System backpressure

Fluid Data
1) oil viscosity, paraffin and sand content
2) water gravity, chemical content
3) gas gravity
4) FVF

Power Supply
1) Voltage available
2) Capacity of the system
3) Quality of the system