FIELD DEVELOPMENT WINNER

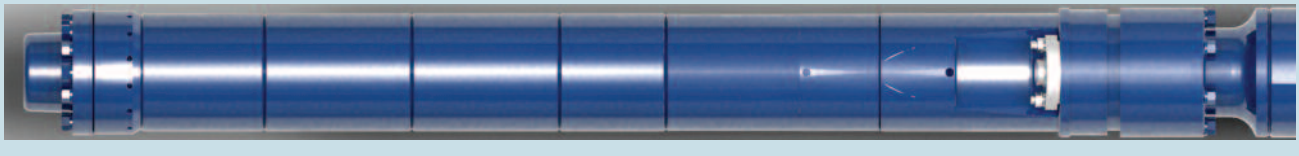
SCHLUMBERGER | REDA HOTLINESA3 THIRD-GENERATION HIGH-TEMPERATURE ESP SYSTEM

In high-temperature gassy environments common to thermal-recovery heavy oil applications like steam-assisted gravity drainage (SAGD) or steamflooding, rugged electric submersible pump (ESP) systems are conventionally unreliable. Such systems are delicate and cannot handle high bottomhole temperatures, decreasing the chances of early production and increasing the chances of downtime and intervention costs. Components of the ESP subject to mechanical stresses, such as shafts, flanges, bolts, and bearings, can ultimately reduce run life if impaired. To increase the chances of reliability and reduce downtime and intervention costs, Schlumberger designed the REDA HotlineSA3 high-temperature ESP system, which can operate reliably in wells with bottomhole temperatures of up to 250°C (482°F).

The system incorporates an integrated design that extends system run life and the ESP operating envelope, the company said. Its design is specifically for high-temperature gassy environments; for corrosive, abrasive environments; and for wells with poor cooling characteristics.

Unique to the system is the new Integrated Motor configuration, a complete rearrangement of the traditional ESP design. The Integrated Motor function comprises a shaft seal module (SSM), a motor, and a compensator. Conventional systems have a single seal section; the HotlineSA3 ESP features a seal section that is split into two parts. The shaft sealing functions are maintained on top of the motor in the SSM, while the motor oil compensation and pressure equalization functions are moved below the motor. The short shaft sealing sections are stacked on top of the motor to add redundancy and layers of protection, which enhances motor reliability. The shorter SSM increases tolerance to dogleg severity such as that found in SAGD wells. To reduce mechanical stresses, the SSM includes filters for the prevention of damage to seal components and ceramic bearings for high-load capacity to handle abrasives. Because the compensator is located at the bottom of the motor configuration, the pressure equalization and abrasives are isolated. Additionally, all nonmetallic components are able to withstand the new temperature ratings. O-rings, motor insulation, and radial and thrust bearings also were upgraded. In addition to upgrades for high-temperature environments, the Integrated Motor includes a prefilled plug-in concept that can reduce chances of human error during installation, the company said. Because the oil is prefilled at the factory, the need for filling at the well site is eliminated, which also eliminates the risk of getting water/solid impurities and entrained gas into the motor. This can result in ultra-purified motor oil, which enables increased insulation reliability and run life. To prevent fluids from escaping and entering the motor, the plug-in pothead design has a positive pressure system and dual-elastomeric seal.

In an SAGD project in the Athabasca oil sands of Alberta, Canada, a team planned to trial the REDA HotlineSA3 ESP in 55% of the SAGD wells. Because of the high-temperature gassy environment found in this particular application, aquifer pressure had to reach approximately 406 psi, not including a safety margin. One trial well completed with a conventional ESP rated to 218°C (424°F) ran for almost a year until failure. With the HotlineSA3 system lower subcools were achieved as a result of improved heat transfer, increasing emulsion rate. The testing revealed that for the lower-rated ESP systems to stay at or below 218°C, subcools were high, meaning that fluid could not be produced. The new system allowed steam chamber development at elevated temperatures, the company said, improving heat transfer, which in turn mobilized fluid more effectively. The HotlineSA3 ESP also was able to remove fluid as it accumulated, driving the subcools lower for higher flow rates. ■



The REDA HotlineSA3 high-temperature ESP system can operate reliably in wells with bottomhole temperatures of up to 250°C. (Image courtesy of Schlumberger)