Technologies Optimize Artificial Lift

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Whether it is new solutions for downhole problems or innovative ideas to increase production, improve efficiency and reduce cost, manufacturers and service companies continue to develop technologies to optimize artificial lift operations.

Higher-horsepower pumps capable of moving more fluid at lower cost, progressing cavity pumps that can lift heavy crude oil, software that can integrate numerous applications to improve the diagnosis of potential well problems, a plunger that aerates fluid to lighten the load as it lifts, a gas lift check valve that meets new standards, or a variable speed drive that matches the pumping speed to the reservoir are only a few examples of what is new in artificial lift.

Low-Voltage Drive

The Schlumberger SpeedStar™ 519 SWD is an 18-pulse, low-voltage sine wave variable speed drive (VSD) that Adun Ige, product champion for surface equipment and downhole sensors, Schlumberger Artificial Lift, calls “the next generation of oil field low-voltage drives.”

The drives build on Schlumberger’s medium-voltage drives, which meet strict IEEE 519 guidelines with 24-pulse and 36-plus front end standards, Ige points out. “Our 18-pulse solution is an attempt to offer a method of achieving IEEE 519 guidelines in an all-inclusive package, reliably and economically, specific to low-voltage drives. This supports our belief in supplying equipment that helps provide clean line power, and at the same time, full lift system control and protection.”

Ige says that could mean thousands of dollars a year in energy savings. “Where generators are used as auxiliary or primary supply, it minimizes oversizing the generator, which is a costly process,” she remarks. “It also streamlines installations by reducing overall cost and footprint because it requires only three-phase electrical conductors into the drive, compared with nine in a traditional approach.”

Regarding ESP system protection and control, the SpeedStar 519 sine wave drive also comes standard with a patented sine wave output filter that requires no well site tuning independent of the well depth/cable length, transformer taps and motor type, she says.

“The near-sinusoidal output waveform all but eliminates voltage stress, resulting in better motor efficiency, lower motor temperature, lower vibration and a longer run life for the total downhole system,” Ige explains. “We have sold more than 3,500 low- and medium-voltage drives.
Schlumberger ran a field trial demonstration for a U.S. customer in 2009 where the power system characteristics feeding the location were closer to a stiff system response in which the IEEE 519 current distortion limits were less stringent (8-12 percent, compared with 5 percent, which is the strictest compliance), according to Ige. Measurements were taken at the drive’s input terminals.

“Results showed dramatic improvements in harmonics when switching the six-pulse to the 18-pulse low-voltage drive,” she comments. “At similar loading levels, there was more than an 80 percent reduction in total harmonic current distortion and a 75 percent reduction in total distortion voltage. It is likely that if it were possible to load the field trial drive to near full load, the current distortion levels would be near or even below the IEEE 519 strict level of 5 percent.”

Ige notes that Schlumberger is offering enhanced control using the UniConn universal ESP control and protection controller as the single user interface for all well site control and data acquisition requirements. Standard features enhance downhole and surface operations, she says.

“The rocking-start function switches the motor direction to start pumps that are stuck, particularly in abrasive environments,” Ige explains. “The current pressure mode allows pumps to be set to a target load or pressure, and their speed to be adjusted as operating conditions change. This speed flexibility helps stabilize operations in gassy and viscous environments and maximizes uptime. The controller now comes enhanced with a Modbus master to poll and alarm any number of modbus slave devices.”

**High-Pressure Gas Lift**

Another new development at Schlumberger is a series of barrier qualified check valves for the XLift™ high-pressure gas lift system that lets operators complete deepwater or subsea gas-lifted wells, and operate at higher injection pressures and deeper injection points to improve well performance.

“Valve operating injection pressures for these environments range from 2,000 to 5,000 psi,” says Thomas White, global business manager for gas lift systems, Schlumberger Artificial Lift. “Wells can be completed with fewer mandrels and valves. A robust, reliable barrier-qualified, positive-sealing check valve system replaces the standard systems used in other gas lift valves.”

The XLift valves are designed for long-term endurance, which is key when considering the high cost of intervention in deep water, White notes. “The XLift XLI gas valve has a patented edge-welded bellows system that reduces the required internal gas charge while increasing the operating injection pressure,” he states. “Offshore, where subsea wet tree facilities are utilized, you can inject high-pressure gas below the mud line manifold system and significantly improve the depth of injection required to maximize drawdown and increase production.”

White explains that Statoil introduced a new test program in 2004 to quality gas lift valves as a barrier element. Several gas lift valves were tested at that time, but with no gas lift valve designs meeting the requirements, Schlumberger initiated a new product development initiative to develop gas lift valve check systems to meet Statoil’s criteria. According to White, the most recent design project culminated last October in the successful qualification of Schlumberger’s 1½- and 1¾-inch gas lift valve check systems.

“The entire project was completed within eight months, followed by the introduction of several gas lift valve types,” he adds. “The barrier qualified back check systems have been incorporated into the common Schlumberger 1½- and 1¾-inch gas lift valves typically utilized in the North Sea and other demanding offshore areas around the world. It is not just specific to XLift, either. We offer standard, field-proven Camco gas lift valve products married with the new barrier check valve application. It has flexibility to work with a number of our other systems.”