What’s new in artificial lift?

Part 2: In this second of two monthly reports, new innovations that improve operations and/or reduce expenses are described in the categories of ESPs/downhole pumps; chemical and injection pumps; and measurement/surveillance devices, along with recent items that arrived after Part 1 went to print.

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Continuing last month’s listings of new innovations in artificial lift, this second-half report will cover 19 developments in the categories of electrical submersible pumps (ESPs)/downhole pumps; chemical and injection pumps; and measurement and surveillance devices and systems, including several items that arrived after Part 1 went to print.

In the category of ESPs and downhole pumps, there are eight items, ranging from a new, high-temperature ESP system to a hydraulic deliquification system. As regards chemical and injection pumps, offerings include a solar-powered chemical injection system and a linear drive injection system. Finally, in the broad category of measurement and surveillance devices and systems, new developments include such items as wellhead management; tank level measurement; and a lift management platform featuring monitoring, diagnostics and optimization. Continuing the rod/beam pumping category from last month, an innovative cage insert with better flow characteristics is described.

High-temperature ESP system extends run life and reliability. Operators in Canada’s heavy oil fields and in the Middle East are hoping to reduce workover costs through the use of the REDA HotlineSA3 high-temperature ESP system. The pre-assembled design (Fig. 2) inherent in this system positively impacts reliability and speeds installation. This new-generation, high-temperature system incorporates an integrated design aimed at effectively extending the ESP operating envelope and run life. This ESP, designed to produce from wells with bottomhole temperatures up to 250°C, can be installed during the early stages of development, giving the operator control, when pressure and temperature are highest.

Integrated surveillance and control through reliable fluid pressure, temperature and internal motor temperature measurements help to reduce sub-cool and steam/oil ratio. The system motor is comprised of high-temperature materials rated to 300°C and is factory-filled with specially treated, ultra-dehydrated di-electric oil.

The system includes the multifunction motor unit, thermally compensated pumps, downhole monitoring gauges for pressure and temperature, power cables, and a surface controller. A plug-in, high-temperature motor lead extension has a dual, elastomeric seal. The motor electrical port connection has a positive pressure system that prevents fluids from escaping or entering during connection.

Protecting ESP system integrity protected by MVD/VSD. Variable speed drive (VSD) systems are used to protect and control ESPs, as well as surface pumping systems. Low-voltage and medium-voltage VSDs are designed to extend ESP life while cutting operational costs. The Schlumberger SpeedStar MVD/VSD NEMA 3R option (Fig. 8) is a medium-voltage drive (MVD) designed for outdoor installations. For high-horsepower, high-value applications in a single package, this MVD is designed to provide reliable, efficient control.

The MVD does not require installation in a climate-controlled environment.
which the company claims is an industry first. Additionally, the system is engineered to fit remote applications, where building infrastructure is unavailable or nonexistent. The MVD includes an optional marine version that is suitable for outdoor use in nonhazardous and harsh environments, typical with platforms or offshore applications. An integral, application-insensitive sine-wave output filter eliminates resonance, regardless of variations in cable length and motor type. This produces nearly sinusoidal output voltage and current, that ensure speed control without a speed-sensing device.

The MVD also comes equipped with a high level of safety that includes a visible disconnect switch interlocked with Kirk keys, to protect personnel and assets.

**Software platform delivers lift management monitoring, diagnostics and optimization.** Reservoir conditions change over time, and meeting production targets is a continuous challenge. The Avocet production operations software platform from Schlumberger delivers a broad range of solutions to see a clear, complete, up-to-date picture of operations, and understand the root causes of production shortfalls to enable action to maximize output through optimization. The platform now includes an option for online artificial lift management capabilities for both ESP pumps and gas lift operations.

The lift management solution within the platform incorporates map-based navigation and alarm notifications for monitoring purposes, as well as an ability to track downhole ESP configuration and related run life operational activity. The software can determine operating conditions and estimate flowrates on the surface. Patented algorithms within the software platform are used to optimize production rates, based on available power to run ESPs, or with available gas for gas-lifted wells.

Surveillance of incoming data and the retrieved results can be run continuously. Resulting set points can be published back to the operator, displayed in any remote engineering desktop or displayed using a Web client that displays alarms and key performance indicators. Reports can be generated automatically or on demand. Longer-loop cycles are also considered as part of an integrated service, with analysis of results and production history for optimized strategic decision-making.

The identification of production opportunities using an integrated management system can increase potential per well by an average of 20%.

**Optimizing pump and production performance.** Aimed at addressing the need to analyze lift performance, comprehensive data on downhole pressure, temperature, current leakage and vibration is provided with the Phoenix Multisensor xt150 digital well monitoring system (Fig. 20) for subsurface pump completion. The lift management solution within integrated monitoring and control. The new gauges are available in two configurations. The Type 0 configuration has a base gauge that fits the ESP motor, either directly or through a simple motor-base crossover. The monitoring system measures intake pressure and temperature, motor oil or motor winding temperature, vibration and current leakage.

The Type 1 configuration measures pump discharge pressure, which is used to evaluate pump performance, and provides all the measurements made by the Type 0 monitoring system. Using the pump discharge measurement, pressure across the pump can be calculated, and the points on the pump curve can be plotted. These values aid in diagnosing problems in the pump or elsewhere in the completion. The level of monitoring appropriate for each ESP completion can be selected.

Compatible with other monitoring and control technology, the new monitoring system is SCADA-system ready, with a remote terminal port and RS-232 and RS-485 ports for continuous data access. The unit, the controller, a surface choke assembly, computer software for data retrieval and a memory key, can all be combined with other equipment to achieve integrated monitoring and control.

![Fig. 20. The Phoenix Multisensor digital well monitoring system is helpful in solving instability problems and improving well intervention planning.](image)

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