Schlumberger

Customized ESP Solution Optimizes Operations in the Unconventional Eagle Ford Shale

Schlumberger and Magnum Hunter Resources establish innovative ESP approach in new environment

CHALLENGE

Optimize the long-term production of unconventional, liquid-rich Eagle Ford shale wells, manage changes in production rate, define and manage reservoir deliverability from the stimulated reservoir volume (SRV) within a low-permeability reservoir, and assess the viability of ESP systems as the transitional artificial lift method in a completion-integrated program to maximize production efficiency.

SOLUTION

Implement an unconventional ESP solution comprised of customized equipment, special operating practices, and real-time optimization with dedicated experts.

RESULTS

Enhanced lifting efficiency; performed in unconventional, cyclic ESP operation with more than 10 times the starts of a typical ESP installation; increased operating time of more than one year and running.

"Cooperation between service provider and operator has allowed both companies to succeed in developing an artificial lift program that has maximized production efficiency for the unconventional Eagle Ford shale."

H.C. Kip Ferguson, III
EVP, Exploration
Magnum Hunter Resources, Corp.

Issues with conventional ESP systems lead to detailed investigation

Following conventional ESP practices for the design and operation of a gassy well, an ESP system was installed at Gonzo North 1H in July 2011 targeting an aggressive drawdown. While the high production achieved was encouraging, it became evident that the fluid characteristics and flow behavior in the unconventional, liquid-rich reservoirs, producing from hydraulically fractured horizontal wells, were unique. Production quickly declined. Within a 20-day period, production of the first installation went from 965 bbl/day to 339 bbl/day. Two additional ESP systems with similar configurations were installed in this well and also operated as per conventional ESP practices. Upon dismantle and inspection, the systems showed some unusual wearing and severe overheating in the motors, power cable, and motor-lead extensions, even within those with less than a week of operation.

These failures prompted a detailed investigation that involved a collaboration of Schlumberger artificial lift and reservoir engineers and a Magnum Hunter Resources (MHR) Eagle Ford team.

Since implementation of the transitional artificial lift method in the Eagle Ford shale, MHR has installed Schlumberger ESP systems in eleven wells.

Combined SLB technologies provide unconventional system with maximum flexibility

Upon carefully studying the characteristics of the Eagle Ford challenges, Schlumberger provided a systemic approach. The ESP solution included customized ESP design, configuration of downhole and surface equipment, surveillance services using LiftWatcher* real-time monitoring, and performance analysis with experts dedicated to the project.

The tools chosen allowed the ESP systems to cope with and adjust to the dynamic operating conditions. The configuration of equipment included mixed flow, abrasion-resistant pumps; Poseidon™ gas-handling devices with compression-type construction to provide extended

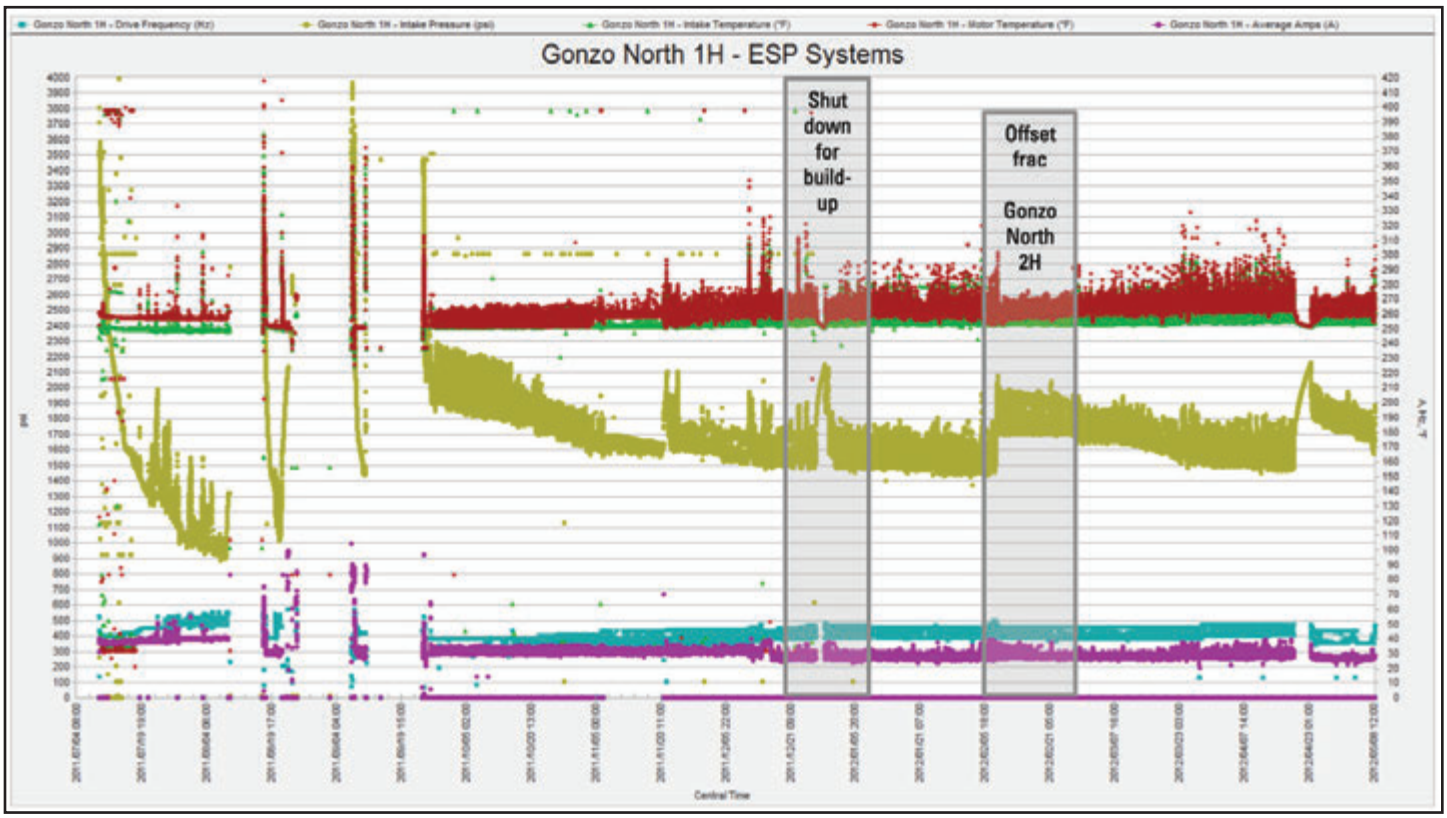
operating ranges; variable rating motors; and a Sinewave variable speed drive (VSD) to minimize potential harmonics and stress on the ESP electric system.

Special ESP field service and operating procedures were developed and implemented. LiftWatcher real-time surveillance service was configured in all ESP wells, allowing Schlumberger to control and adjust the operation of the systems remotely, at any time necessary. This also allowed operators to adjust the target low pump intake pressure (PIP) to meet the controlled drawdown approach. While ideally an ESP system should be run continuously, some of the ESPs in the Eagle Ford shale wells shut down several times a day—either to protect the system or when the drawdown reaches the low PIP defined. The motor controller of the ESP system is programmed to operate in a closed-loop control, based on the motor amperage or target PIP, but the ESP also trips when additional key parameters reach undesirable levels. One of these key parameters is the motor winding temperature. When this parameter reaches the maximum value set for the specific well, the controller shuts down the ESP. Having real-time data proved to be essential for the operation, as both MHR and Schlumberger operations teams receive automated alerts when an operating parameter falls outside the notification threshold. The ESP system can then be remotely adjusted as needed to optimize the system performance.

Unconventional solution provides customer with a successful production management strategy

Modifying various aspects of the ESP system, in order to control versus maximize drawdown, proved to be instrumental in executing the transitional artificial lift. This unconventional approach, which has been extended to benefit more wells in the shale, improved productivity and significantly increased system run life.

The unconventional ESP system, installed on September 23, 2011, in the Gonzo North 1H well, was pulled from the well on September 22, 2012, after completing its one-year journey. The ESP system operated, at most times, in a cyclic operation regime. Due to its unique flow behavior, an intermittent cyclic natural flow was achieved while the ESP was off. The ESP accumulated a total of 1,478 starts. This is more than 10 times the starts a typical ESP would accumulate in its full lifecycle. MHR has continued to install unconventional Schlumberger ESP systems throughout their Eagle Ford shale operations to initiate the transitional artificial lift phase. LiftWatcher surveillance service and Schlumberger downhole monitoring gauges have also been installed in four additional wells: two with gas lift and two with pumping units. MHR can now closely monitor flow pressure and also optimize operations on non-ESP wells.



MHR reservoir engineering's analysis of flowing pressure and corresponding production data using real-time data has been instrumental in the continuous improvement of their artificial lift systems.

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