

Proteus System Simplifies Flow Control for Five-Zone Multilateral Well in the Middle East

Fully integrated system monitors and rapidly controls production flow with only three control lines and saves 3.6 hours on well startup

CHALLENGE

Monitor and rapidly control production flow from each leg of a multilateral well while minimizing completion complexity.

SOLUTION

Streamline well startup and subsequent multilateral management by deploying Proteus* electrohydraulic flow control and monitoring system.

RESULTS

- Installed five-zone system with only three control lines in less than 1 week.
- Saved 3.6 hours of rig time in opening all zones of the well, compared with conventional hydraulic flow control systems.
- Enabled the operator to monitor and rapidly control production flow from each lateral.

Rapidly control production in each lateral

A Middle East operator planning a well with five laterals through a reservoir with a gas cap asked for an intelligent completion system that would enable remote monitoring and control to maximize recovery and mitigate the uncertainty of undesired fluids production. In particular, if any lateral started producing unwanted gas, the system should be able to choke back or shut off production from that lateral without disrupting production from other laterals.

The operator considered a conventional hydraulically controlled valve system but excluded the option because of the complexity of installing six hydraulic control lines needed for such a system. In addition, the operator wanted a solution that would minimize rig time by adjusting each lateral more rapidly than the approximately 45–50 minutes per valve required to actuate hydraulically controlled valves.

Minimize installation and operational complexity

Schlumberger recommended the Proteus system to minimize complexity and expedite well startup. The Proteus system's electrohydraulic multiplexing technology enables monitoring and control of up to nine zones with only two hydraulic lines and one electrical line, depending on well configuration. The electrical line delivers data from surveillance sensors (pressure and temperature gauges and valve position sensor) and actuates control valves. Also, the Proteus system monitoring technology enables dynamic testing of individual zones or compartments without intervention, minimizing the impact on well production. The downhole hardware can be integrated at the surface with WellWatcher Advisor* intelligent completion software for zonal allocation of production or injection.



The five-zone Proteus system required only three control lines, simplifying the installation.

CASE STUDY: Proteus system separately monitors and controls five laterals in a Middle East well, saving 3.6 hours on startup

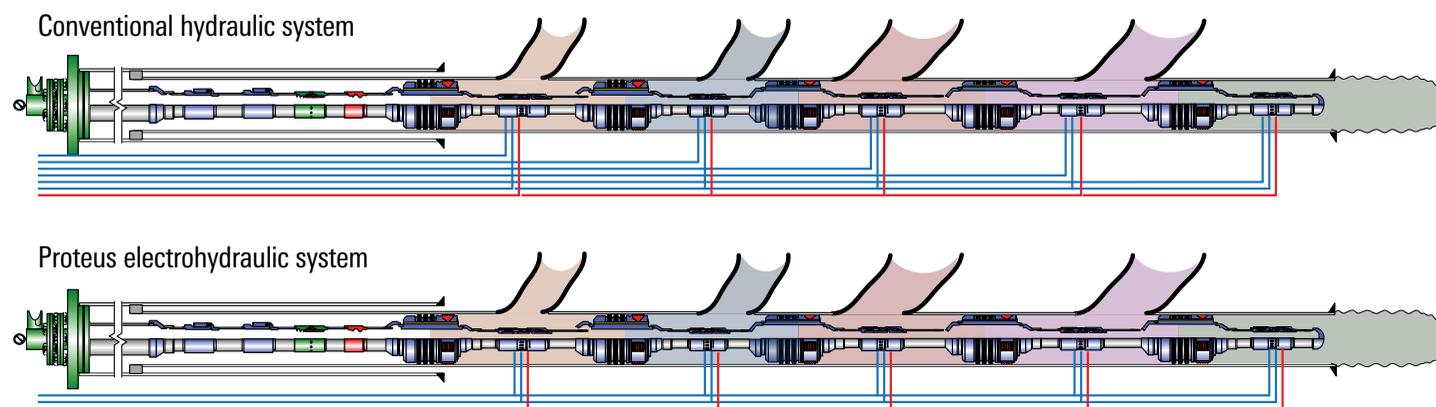
The Proteus system includes a multiposition flow control valve that can be adjusted from any position to any position in a single actuation, allowing rapid adjustment of choke position without having to cycle the valve through all positions. The choke section is designed to ensure that well-defined flow characteristics for various choke positions are achieved with minimal erosion even at high-flowing differential pressures.

Open all five zones in less than 7 minutes

To ensure reliability over the life of the well, the Proteus system and individual components were extensively tested. For instance, solenoid valves were qualified to more than 20 times the expected valve actuations during the life of the well. Fluid and material compatibility testing was

conducted on all components. Choke seals were validated up to 5,000-psi unloading pressure, while retaining 100% of their sealing performance after multiple unloading cycles. The system was also validated with a surface system integration test and a well system integration test.

Installation and onsite testing were completed in less than 1 week, demonstrating the system's installation efficiency and simplicity. Upon successful installation, each of the five valves was cycled to open the well in less than 7 minutes, saving 3.6 hours compared with a conventional, purely hydraulic intelligent completion system.



The Proteus system, shown on the bottom, monitors and rapidly controls production flow from five separate laterals in a Middle East well, using just three control lines. A conventional hydraulically controlled system, illustrated at top, would need seven control lines (six hydraulic for valves and one electrical for pressure and temperature gauges), which increases the complexity of running and operating such a system.

slb.com/intelligent