Baker installs all-electronic intelligent well system

Kevin Jones, Baker Oil Tools

INTELLIGENT WELL SYSTEMS technology recently achieved a major milestone in Brazil.

Baker Oil Tools successfully installed the world's first all-electronic, multi-zone Intelligent Well System for Brazilian operator Petrobras. The InCharge™ system was deployed onshore in an injection well in the Varginha field near the northern Brazilian town of Mossoro.

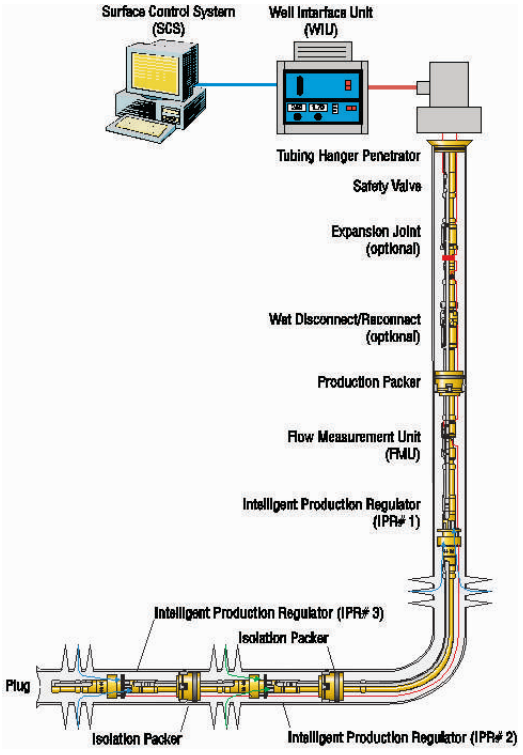
The system allows Petrobras staff to remotely monitor and control the well through a satellite link from the company's operational base in the city of Natal, 165 miles (265 km) from the well site.

The Varginha dual-zone water injection well was drilled and cased with 9" casing to depth and two intervals were perforated. Each of the intelligent tools was made-up with pre-installed lengths of TEC cable in order to reduce rig time.

At every critical point during the installation, a system test was performed to verify the functionality of the downhole equipment.

The InCharge system has been in operation for over six months. In June 2002, the system is expected to be removed from the Varginha well and re-installed in a deepwater well in the Campos Basin, offshore Brazil.

Baker Oil Tools technicians make up the world's first downhole electric wet disconnect tool.



REAL-TIME FLOW CONTROL

Intelligent Well Systems are designed to optimize flow from critical wells without shutting in production or performing costly well intervention procedures.

The InCharge system monitors, in real time, pressure, temperature and flow conditions at the sandface levels in both the tubing and the annulus. The system's infinitely variable chokes allow selective control of flow rates from individual zones.

By managing production or injection conditions in real time and selectively controlling individual zonal flow rates, the operator can ensure continuous well optimization in response to changing downhole conditions.

Flow contribution can be properly allocated, water and gas breakthrough can be controlled, multiple target zones can be pre-completed to be selectively brought on stream or shut off at will from the InCharge PC-based control system. The InCharge system is equally applicable to vertical, deviated and horizontal wells, completed on land or offshore, from platforms or subsea.

The versatility and operational simplicity of the InCharge system brings value to the client by managing segmented production and/or injection in real time.

For example, if the operator's production model recommends that for a 221-psi (13.79 bar) drawdown is need in Zone #3 for optimal oil production, then he can easily adjust the downhole choke until he has precisely a 221-psi differential pressure between the two onboard pressure sensors.

This flow control is accomplished without shutting-in the well, in a matter of minutes rather than weeks or months with conventional well intervention techniques.

CONTROL 12 ZONES IN 12 WELLS

One aspect of the InCharge system that is particularly valuable to subsea operators is that a single control line penetrates packers and wellhead.

This simple design provides power and data transmission, command and control through a single ¼" penetration, enhancing safety without sacrificing functionality.

From this control line, the operator can monitor and control up to 12 zones in a single well. Each surface control system can monitor up to 12 wells.

The InCharge system incorporates the world's first electrical downhole wet disconnect anchor system.

The system eases maintenance and repair in the upper portion of the completion string through an electric umbil-

Final testing of the InCharge system prior to commissioning the satellite link.

ical to the surface that can be repeatedly disconnected and re-connected.

SOLID STATE RELIABILITY

The all-electronic design of the InCharge system offers multiple benefits to the operator: Elimination of hydraulics from subsea dynamic systems and the use of electronic controls enhances safety and reliability. Electrically powered and controlled valves and infinitely variable chokes enable precise control of flow rates.

PC-based control system enables a user-friendly operator interface and future upgrades.The development of the InCharge system was a joint, collaborative effort of two Baker Hughes divisions — Baker Oil Tools and Baker Atlas.

The complementary expertise of Baker Oil Tools in the area of downhole systems engineering and Baker Atlas in the area of electronics and software resulted in the industry's first fit-for-purpose, all-electronic intelligent well system. ■

Installing and testing the world's first downhole electric wet-mateable connector system.