Hydraulic Systems

OVERVIEW
The Halliburton surface hydraulic system (SHS) supplies pressurized hydraulic fluid to the downhole SmartWell® systems and provides automatic and manual control of downhole interval control valves (ICVs).

A standalone self-contained unit, the SHS consists of an electro-hydraulic or pneumatic supply capable of delivering pressurized fluid up to 10,000 psi. It is housed in a single stainless steel enclosure that includes one main hydraulic supply module (HSM) and up to six well control modules (WCMs) with expansion capabilities.

Part of the Digital Infrastructure system, SHS units are available in a range of designs for every environment.

» The integrated system consists of the SmartWell Master supervisory application and an SHS consisting of an HSM and WCM per well. Data acquisition and control is managed either locally at the SmartWell Master server or remotely.

» The automated system is an SHS, which includes an HSM and WCM per well. If the SmartWell Master application is not used for control, the SHS can be controlled via a distributed control system (DCS) through direct Modbus® interface to the programmable logic controllers (PLCs).

» The manual system consists of the same basic hardware as the automated or remote control. Manually operated valves are used throughout.

In subsea applications, SmartWell system control is provided by hydraulic functionality from the third-party subsea controls company.

FEATURES
» A variety of physical configurations for well type, number of zones, and completion details
» Modules that allow for remote control and monitoring by the SmartWell Master supervisory application

BENEFITS
» Remote operation of well and automated tool moves
» Logging and monitoring of well conditions
» Modular system allows cost to be distributed between multiple wells

ENCLOSURE FEATURES
The surface hydraulic system features several modules that can be enabled according to the operator’s specific needs, including:

» 316 stainless steel, built to NEMA 4X
» Removable latching doors
» Sloped drip pan
» 4X lifting eyes
» Flame arrestor
» Ergonomic design
» Lexan door windows
» Durability for harsh environments

Modbus® is a registered trademark of Schneider Automation, Inc.
The HSM consists of:
» Clean supply reservoir (typically 220 L)
» Return reservoir (typically 95 L)
» Main hydraulic supply pump
» Recirculation pump
» Accumulator (up to 10,000 psi)
» Filters (1 micron)
» Relief valves
» Tubing/fittings (up to 10,000-psi rated)
» Hydraulic control unit junction box

The SHS is designed for hazardous area applications, including IEC/Cenelec Zone 1 (ATEX 2), NEC Class 1 Division 1, NORSOK. Automated systems can be controlled and monitored remotely by the SmartWell Master supervisory application or from a third-party computer by the Modbus system over TCP/IP communications to the PLCs in the hydraulic and well control units.

In single-well cabinets, the hydraulic supply module (HSM) and well control modules (WCMs) are combined into a single unit. For automated systems, hydraulic control and well control functionality is also combined in single programmable logic controller (PLC).

The hydraulic control/well control unit firmware, developed in IEC 61131-3 standard language, automates the sequences and levels of pressure necessary to operate the SmartWell system completion and receives feedback from the interval control valve (ICV) movement from surface sensors.

HYDRAULIC SUPPLY MODULE
The HSM provides control fluid to the WCM at the required pressure and cleanliness. Material selection for some HSM components can change according to the type of pressure and control fluid used.

The HSM contains the tanks necessary to store and filter control fluid. For optimal performance of downhole equipment, all HSM designs are provided with a recirculation capability for managing control fluid cleanliness. Although the standard product contains two tanks and two pumps, several variations — including one tank and one pump — are available, depending on the number of wells and operational philosophy.

The HSM provides all the electrical/hydraulic connections for connection to the WCMs. The HSM controls and manages system operation manually (switches) or automatically (pressure transmitters and PLCs). In automated systems, the hydraulic control unit houses the PLC and its accessories. The unit may also be housed in a remote electronics cabinet with cable connecting between the two.
WELL CONTROL MODULE

A well control module (WCM) provides a means of applying pressure sequences to hydraulic control lines and therefore a manner of manipulating the downhole tools. Pressurization and venting of the control lines is achieved using manual or automatic control by positioning the valves into supply/block/vent modes as required.

Designed for both reliable performance in the target environment and quick installation for future expansion, WCMs are interchangeable modules that can be combined with the same cabinet for multi-well applications, thus providing a flexible base for future expansion.

In automated systems, each WCM is controlled by a dedicated well control unit programmable logic controller (PLC).

The number of hydraulic lines required to operate a particular SmartWell completion system depends on the selected control system (Digital Hydraulics™ or Direct Hydraulics systems) and the number of downhole valves in the well.

A WCM contains the following components:
» Solenoid directional control valves
» Pressure transmitters (24 VDC, 4-20 mA, 1-5 VDC for low power)
» Hydraulic pressure gauges (up to 10,000 psi)
» Three-way manual control valves
» Relief valves and bleed valves
» External connection bulkhead
» Well control module junction box

PHYSICAL CONFIGURATIONS

The surface hydraulic system (SHS) comes in various physical configurations, depending on well type, number of zones, and completion details. For example:

» Eight-well expansion cabinet
» Six-well cabinet
» Two-well cabinet
» Four-well expansion cabinet
» One-well cabinet

Both automated and manual versions of the SHS are available.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com