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Manara

Production and reservoir management system

APPLICATIONS

- Single and multilateral wells requiring modular and scalable configurations for monitoring and control
- Extended-reach wells
- Maximum or extreme reservoir contact wells
- ESP-ready completions
- Openhole or cased hole wells
- Wells in remote, highly populated, or environmentally sensitive areas

BENEFITS

- Proactive reservoir management
- Real-time, simultaneous management of multiple zones
- Optimal production and recovery
- Reduced well and production costs for life of well
- Fewer interventions and associated HSE risks

FEATURES

- Continuous zonal measurements with field-proven sensors:
  - water cut sensor for early detection of water breakthrough
  - Venturi flowmeter
  - pressure and temperature sensors for continual profile of zonal contribution
  - valve position sensor for flow rate control
- Single electric control line
- Bidirectional, high-rate telemetry for measured and diagnostic data
- Continuously variable, quick-response, electric flow control valve
- Field-proven Intellitite* downhole dual-seal dry-mate connectors for highly reliable network connectivity
- Robust inductive coupler for multistage completions
- Minimal impact on drilling operations
- Zonal isolation via swellable or conventional feedthrough packers

The Manara production and reservoir management system is an intelligent completion system that enables operators to monitor and control multiple zones continuously, simultaneously, and in real time—for the first time, irrespective of the length of the wellbore. Informed field development strategies for optimizing production and recovery can thus be devised and implemented.

Zonal management without intervention

An integrated monitoring and control station in each zone measures water cut, fluid flow rate, pressure, and temperature at the formation face to identify the amount of oil and water being produced in each zone. Measurements are made before production from the zone commingles with the flow coming up from below.

With this information, operators can delay or prevent water and gas breakthrough using an infinitely adjustable flow control valve, while hydrocarbon zones above and below the closed zone continue producing. Placement of sensors upstream of the valve allows transient analysis of the zone without affecting other zones. Reservoir and production knowledge is enhanced and drainage across the reservoir optimized efficiently without intervention and with minimal production interference, even in heterogeneous, multilayered reservoirs. Swellable or conventional packers isolate zones and prevent cross-contamination of fluids.

Data and power transmission across multiple junctions

A single electric control line connects each station to the next and the entire system to the surface, minimizing connection points and splices, simplifying installation, and increasing reliability. Intellitite connectors eliminate potential leak paths, a common issue with monitoring systems. With more than 4,000 installations, the reliability of the Intellitite connector is unmatched in the industry—network connectivity is maintained even over thousands of feet of cable. Both the cable head and cable splices are fully pressure tested before installation; added protection is provided by a flat pack and bumper cables.

Across junctions—such as the junction between an upper and lower completion or between multilateral wells and the main bore—power and data are transmitted wirelessly via an inductive coupler. These couplers enable simultaneous monitoring and control of multiple zones across any number of junctions.

Independent installation of completion stages

The inductive coupler allows connection between the lower and upper completion. Installed as part of the tubing or casing, the coupler does not compromise the strength of the tubular. Eliminating the control line across the junction allows the lower completion to be run in on drillpipe. The pipe can be pushed, pulled, and rotated to overcome friction and reach target depth in extended-reach wells without fear of damaging control lines, removing any restrictions on the length of the wellbore.

Manara system monitoring and control station.

Manara

Subsequently, the upper completion is installed and the coupler establishes electrical connection between the two. This novel and robust connection requires no orientation or rotation.

Infinite flow control options with absolute position sensing

The electric flow control valve provides continuously variable flow control. Embedded in the valve is an absolute position sensor that sends real-time feedback about the choke's exact position. The operator can observe zonal fluctuations as they occur and take immediate corrective action, if needed, to adjust the flow from that zone in accordance with recommendations from production optimization software. The valve reacts instantly to surface commands. Measurements made by the Manara system station enable the operator to "dial in" a target production rate for each zone instead of cycling a valve to predetermined choke settings.

Decision-making without guesswork

The high-resolution, high-frequency data reach the surface before the fluid arrives. A surface controller integrates these data seamlessly into an operator's existing SCADA and business systems.

Schlumberger software filters, analyzes, and translates the data into useful, actionable information via multiple workflows for optimizing production and recovery at the level of a single zone, a single well, or the entire field. Optimal flow control valve settings for each zone and well can be identified against a set of optimization constraints (e.g., minimum water cut, production above the bubblepoint) entered by the operator.

Notifications and alarms, feedback on malfunctioning equipment, field views that capture trends over time, workflows with real-time control, and optimization options—all are presented via a common user interface.

Single wellbores to multilateral and extended-reach wells

The Manara system can be installed in single wellbores; horizontal wells with multiple laterals; and extended-reach wells, where long laterals are used to maximize production and recovery. These factors contribute to a reduced well count and make the Manara system ideal for remote, highly populated, or environmentally sensitive areas, as well as for reaching the extremities of reservoirs from existing platforms or wells.

Simplified upper completion workovers

The inductive coupler enables completion stages to be disconnected and reconnected multiple times. The debris-tolerant stab-in mechanism facilitates changeout of the upper completion tubing, replacement of an ESP, and other remedial operations without having to remove or compromise the integrity of the lower completion.

Targeted firmware and software enhancements

The station's electronics enable firmware enhancements, ensuring that the system is always operating with the most advanced technology. Updated software can be downloaded to single sensors, single stations, or multiple stations.

Support for data interpretation

Through its status updates, comprehensive workflows, and continuously updated reservoir models, the Manara system provides visualizations downhole and across the reservoir in real time. Changes can be seen as they are happening, enabling faster, more effective decisions.

Manara System Specifications	
Flow control valve	Electric, with unlimited number of positions
Control line	Single, with twisted-pair wire
Sensor capabilities	Pressure, temperature, flow rate, and water cut
Operating pressure range	Atmospheric to 5,000 psi [34.5 MPa]
Water cut	0% to 30%
Flow rate range	50–3,500 bbl/d
Absolute pressure range	Atmospheric to 10,000 psi [69 MPa]
Temperature range	32–257 degF [0–125 degC]
Sand control	Integral sand screen
OD	5.680 in [144 mm]
ID	2.992 in [76 mm]
System operation	Electric, multidrop capability per well > 40 systems
Communication	Proprietary telemetry, ESP-immune and addressable
Control line connectors	Intellitite downhole dual-seal dry-mate connectors (welded or unwelded)
Zonal isolation	Swellable or conventional feedthrough packer
Multitrip connectivity	Inductive coupler (integral to or inside casing or liner)
Surface connectivity and SCADA interface	Manara system surface unit and RTAC* real-time acquisition and control software
Production and reservoir management software	Extensive portfolio designed to enhance recovery

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