

RFID-Based Keystone™ System Provides Intervention-Free Upper Completion That Reduces NPT, Personnel, Rig Time, and Costs

Objectives

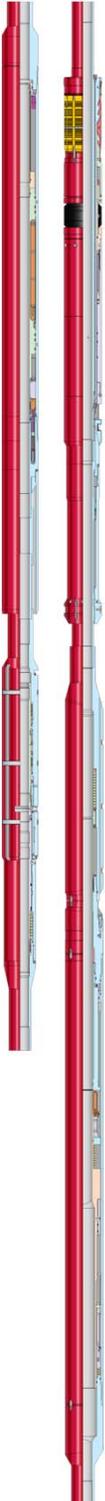
- Deliver a system that can be remotely operated from the surface without the need for washpipe, intervention manipulation, or control lines to the surface and perform the following tasks:
 - Isolate the reservoir
 - Set production packer in 7-in. casing
 - Displace tubing and annulus to inhibited diesel
 - Open the isolation valve and bring on the well
- Perform all of the above in a safe, efficient, and controlled manner.
- Minimize nonproductive time (NPT).

Our Approach

- Weatherford delivered the radio-frequency identification (RFID)-based Keystone system comprising four elements:
 - The RFID-hydraulic power unit is the master command unit and consists of the RFID antenna, battery pack, and electronics. This unit supplies hydraulic power to the connected components via a microhydraulic pump and spool valve for selective tool operation.
 - The circulation valve is a metal-to-metal sealing system that enables tubing-to-annulus communication for displacement operations.
 - The production packer, rated up to 5,000 psi (34.4 MPa), is a unique shuttle valve mechanism that enables pressure testing the tubing without setting the packer.
 - The fall-through-flapper (FTF) barrier valve is a reservoir isolation device used to provide a single-seal face that holds pressure from above and below, eliminating the need for a deepset plug.
- The Keystone system was run in the wellbore with the flapper open to a total depth of 6,300 ft (1920 m). Then an RFID tag was dropped to close the flapper.
- The tubing was successfully tested without setting the packer.
- A pressure pulse provided communication with the packer, enabling the packer to be set.
- After a successful annulus test, a second pressure pulse opened the sliding sleeve, and the annulus and tubing were displaced to completion fluid. RFID tags were then dropped to close the sliding sleeve.
- The successful installation enabled the operator to deploy completions without relying on industry experts. The only skill sets required were the ability to drop tags and apply pressure pulses.



The Weatherford Keystone upper completion system (right) uses RFID tags (above) to enable entirely remote operation. The system isolates the reservoir, sets a production packer, opens a circulation valve, displaces the annulus and tubing to a lighter completion fluid, closes the circulation valve, pressure tests the tubing for integrity, and finally opens the isolation valve to bring on the well.



LOCATION

Saudi Arabia

WELL TYPE

Onshore, vertical

TEMPERATURE

212°F (100°C)

DEPTH

6,300 ft (1920 m)

PRODUCTS/SERVICES

- Keystone system
- RFID-hydraulic power unit
- Circulation valve
- Production packer
- FTF barrier valve



RFID-Based Keystone System

Provides intervention-free upper completion that reduces NPT, personnel, rig-time, and costs

Value to Client

- Using the Weatherford RFID-based Keystone system enabled the operator to control the well remotely, from the surface, which saved a day of rig time and associated costs.
- By eliminating the need for wireline, slickline, or coiled tubing and the crews associated with those technologies, the operator will have the potential to significantly reduce operational costs in those services.
- The debris-tolerant design of the Keystone System is insensitive to changes in downhole conditions, which improves operational reliability.



The hydraulic power unit (HPU) shown above is a tubing-mounted, self-contained, remotely operated, multifunctional downhole unit that provides interventionless actuation of any hydraulically operated device, including actuation for packer setting, sleeve operation, and valve operation.



The circulation valve (above) is a metal-to-metal sealing system that opens with pressure pulses and closes with RFID tags, eliminating surface control lines.



The production packer (above) is equipped with a cut release zone for workover flexibility and is set with 4,000-psi (27.5-MPa) applied tubing pressure.



The fall-through-flapper isolation valve (above) provides bi-directional isolation capable of withstanding a differential pressure of 7,500 psi (51.7 MPa). The FTF can also serve as a deepset barrier.

