Prevent Fluid Loss in Deepwater Well

Case study: Successful use of FIV Formation Isolation Valve in subhydrostatic deep water saves operator time and money

Challenge
Provide fluid-loss isolation in a high-overbalanced environment without evacuating the marine riser.

Solution
Install FIV* Formation Isolation Valve, and open it without intervention to isolate the formation and prevent fluid loss.

Results
Successfully installed the valve and actuated it remotely without incident, preventing fluid loss and saving the operator time and costs.

Challenging environment requires innovative solution
A subhydrostatic deepwater reservoir had produced for years. Although production rates continued to be economical, reservoir pressures were depleted below the hydrostatic equivalent of seawater. An infill well had been completed with seawater, resulting in a 103,421-kPa [1,500-psi] overbalance. The operator needed to isolate the reservoir without evacuating the marine riser. Spotting fluid loss pills after the sand-control installation would have reduced the flow rate and ultimate recovery and would have severely complicated the well unload from this low-energy reservoir. Conventional fluid-loss devices could not be used because their success depended mainly on a minimal fluid-loss rate when the devices were set.

The operator had experienced failures when attempting to set mechanical fluid-loss devices (ceramic flappers and fluid-loss balls) in this high-fluid-loss-rate environment. Because a riser fill valve was in place to avoid evacuation, postponing setting the mechanical fluid-loss device until after the well reached equilibrium was not an option. The subsea blowout preventer system’s ability to impose reverse pressures on critical components was limited, and therefore other methods were not suitable. For example, it was not desirable to strip the drillpipe through the annular while concurrently allowing the wellbore fluid to come to equilibrium and then pulling the wash pipe out of the gravel-pack assembly.

Completions
The last five pressure cycles required to open the valve are shown. Cycles 1 through 5 were carried out during previous well operations. The long sixth cycle occurred during a pressure test on the safety valve. On the pressure bleed-down from the 10th cycle, the valve opened as designed.
The operator had Schlumberger install the FIV Formation Isolation Valve because of the valve’s track record of success and its ability to meet the operational parameters for the well conditions. The well experienced a steady fluid-loss rate of 6 bbl/min after the sand-control installation. This fluid-loss rate was substantially higher than the recommended rate for setting the mechanical fluid-loss devices that the operator typically used in its deepwater subsea completions. Even so, the rate was below the 25 bbl/min maximum fluid-loss rate of the FIV valve. The wash pipe was pulled from the gravel-pack assembly, and the shifting tool (located at the end of the wash pipe) closed the FIV valve uneventfully, stopping all fluid loss.

**FIV valve opens with high differential pressure**

With the FIV closed, the upper completion was safely installed in the well without concern for fluid loss and reservoir damage. The next challenge was to open the FIV valve. The FIV valve’s Trip-Saver® one-time opening mechanism was designed to operate with a maximum of 1,000 psi delta pressure across the ball. Unfortunately, well scheduling issues did not allow enough time to acquire the equipment needed to test whether the FIV valve could be opened at the higher pressure differential in this well. Therefore, because of the concerns about whether the valve would open with the high differential or close with the high fluid loss rate, several contingency plans were developed. If the valve failed to open, a tractor stroker would be used to mechanically shift it on electric line. If electric line was unable to open the FIV valve, the FIV ball would be milled. If the valve failed to close, the plan was to spot a fluid-loss pill inside the gravel-pack assembly, install the completion, and use coiled tubing to wash the pill out of the screen and acidize the well.

**Successful valve operation allows operator to exceed goals**

The Trip Saver mechanism actuated and opened the valve uneventfully, as designed. Communication with the reservoir was established on the bleed-down from the 10th cycle.

High-overbalance completions are becoming more frequent in the deepwater arena as reservoirs deplete and fields continue to mature. It is increasingly important to find reliable and cost-effective ways to capture a reservoir’s late-life reserves. In the case described, the FIV valve was an effective tool that enabled the well to be completed without the need to spot potentially reservoir-damaging fluid-loss pills. The valve was selected as the desired fluid-loss device for this high-overbalanced completion because the valve:

- could be installed below the gravel-pack packer
- would close under a high-fluid-loss rate condition
- could be actuated hydraulically without intervention
- met the required differential pressure ratings for the intended service.

The valve successfully closed and sealed at a fluid loss rate in excess of the design parameters for the conventional fluid-loss device that the operator customarily used in its subsea wells, thus allowing the operator to run a riser fill valve to avoid evacuating the marine riser. The valve also was successfully opened hydraulically with the Trip Saver mechanism, avoiding additional runs to establish communication with the reservoir before the well was placed on production. The successful installation and use of the FIV valve ultimately saved the operator valuable time and operating costs.