eRED® Valve Aids Success of Acid Stimulation Operation

PROGRAMMABLE BARRIER VALVE PROVIDED OPERATIONAL FLEXIBILITY, SAVING RIG TIME

NORWAY NORTH SEA

OVERVIEW

An operator was looking for a reliable method of selectively perforating and acid stimulating two independent zones. The zones were straddled by a liner with a nipple positioned between them allowing a zonal isolation barrier to be easily deployed and positioned.

CHALLENGE

With the lower zone already perforated and stimulated with acid, a traditional plug and prong assembly was deployed to isolate the two zones. With this temporary isolation barrier in place, the upper zone could be perforated and stimulated without affecting the lower zone. After this was completed, the barrier was removed. However, often times during the perforation and stimulation of the upper zone, the plug became clogged with debris and retrieval was difficult and time consuming.

SOLUTION

Halliburton proposed deploying an eRED® valve and running-in-hole in the closed position. After the stimulation operation was complete, the eRED would be remotely opened without any form of intervention. Debris could then be washed through the large flow ports aiding later recovery.

CHALLENGES

The operator was looking for a reliable method to selectively stimulate two independent zones.

» Normal plug and prong operations were getting clogged by debris, making retrieval difficult and time consuming.

» Additionally in this case, suspected cross-flow from lower to upper zones was preventing the lock from setting

SOLUTIONS

Deployed below a standard lock, the Halliburton eRED® valve was used to straddle the two zones.

» The valve could be remotely opened or closed during the operation

» On-board data logging provided valuable information of downhole conditions

RESULTS

The eRED valve allowed the operator to successfully perforate and acid stimulate two separate zones.

» The eRED valve provided valuable downhole data that allowed the crew to successfully re-plan the operation

» Valve deployed in open position to aid setting of the lock in cross-flow

» Once the stimulation operation was completed, the valve was remotely opened facilitating debris cleanup prior to retrieval saving wireline runs and rig-time

An eRED® valve deployed below a lock (or bridge plug) can be programmed to remotely open and close many times during an operation providing operational flexibility and reducing the number of wireline runs.
The flexibility of the eRED® valve allowed it to be reprogrammed at the well site to suit the unexpected well conditions.

**Initial Operation:** The eRED valve was deployed on a lock and run in the closed position. The pressure of the upper zone stimulation against the valve would trigger a countdown timer for the valve to open. Once open, flow through the lock system would remove any debris resulting from the perforating and stimulation operation. The lock assembly complete with the eRED valve would then be pulled back to surface.

During the initial stage of the operation, the lock would not set in the nipple. It was noted that perforations had been performed above the nipple possibly causing some cross-flow from the lower zone to the upper zone. This suggested that cross-flow could be the problem with setting the lock.

With the assembly pulled back to surface, the log from the eRED valve was downloaded and confirmed that there was a 140 psi differential pressure across the zones. This meant the lock would have to overcome a 1,800 lbs force before it could be set.

**Revised Operation:** Data from the eRED valve provided the confidence that cross-flow was the problem. The toolstring configuration was changed, the valve reprogrammed, and run in the open position to give flow-through and therefore reduce the load pushing the lock out of the nipple. The eRED valve was programmed as follows:

**Trigger 1:** A hydrostatic depth of 4,000 psi (8,000 ft TVD) initiated a six-hour countdown for the eRED valve to close, allowing enough time to set the lock. The assembly was run to depth and the lock set successfully. The valve then closed to allow stimulation.

**Trigger 2:** A pressure window of 1,000 psi to 9,000 psi to be held for five minutes started a countdown timer of 18 hours. The stimulation pressure above the eRED valve activated Trigger 2. The countdown period gave time to complete the stimulation prior to the valve opening. Once the stimulation was completed, the valve opened allowing the lock to be cleaned up prior to retrieval. The eRED valve and lock pulled on first attempt, with no issues.

**RESULTS**

The eRED valve allowed the operator to successfully perforate and acid stimulate two separate zones. When unforeseen cross-flow issues between the two zones were encountered, the eRED valve provided valuable downhole pressure data that the operations crew needed to re-plan the operation. Once the stimulation operation was completed, the eRED valve opened as programmed allowing cleanup of the debris created during perforation and stimulation. The ability to reprogram the eRED valve onsite saved on logistics and downtime, making this a very successful operation.