

Single Trip Acid
Stimulation of 14
Individual Stages
using the iValve
CEM Completion
and Intervention
Solution



First ever cemented i-Valve completion - Acid stimulated and put on water injection successfully.

Business Need

One of the major operators on the Norwegian Continental Shelf wanted to construct a 1,090 m (3,576 ft) long horizontal water injection well to provide pressure support for offset producers. To ensure high injectivity the reservoir needed stimulation before the well was put on injection. A 14-stage selective stimulation job was planned to enable controlled stimulation of the various parts of the reservoir. A 4-1/2 in. cemented reservoir liner was planned in a 6-1/2 in. hole. Sliding sleeves in the reservoir section was preferred over conventional plug-and-perf to enable selective acid stimulation of each zone in a time efficient manner, and for future potential to control the injection profile by closing/opening the sliding sleeves.

Solution

The i-Valve 450 CEM cemented sliding sleeve from Trican Completion Solutions was selected as the best option for the job. The sliding sleeve system allows cement to be used for zonal isolation and a dedicated coiled tubing intervention tool package to selectively operate the sleeves during stimulation. All 14 stages could be stimulated in a single run with the coiled tubing BHA in the well during stimulation, dramatically reducing tripping time. There were no changes to how the liner was run, installed and cemented. A total of 14 i-Valves were installed.

Case Study Snapshot

Challenges:

- Formation stability is an issue in the depleted carbonate formation, so slim OD tools increase the chance to get the liner to planned total depth (TD). A cemented liner is therefore preferred over openhole packers.
- Liner was left with OBM after installation so a cleanout to TD was required. High flow rates were needed to lift debris.
- Depth control and verification of downhole shifting operations with surface data only.
- Difficult to interpret quality of zonal isolation and results of the stimulation from surface data.

Solution:

- The i-Valve CEM is a cemented sliding sleeve with a proven track record showing the compatibility with cement. No changes to existing running procedures for running, setting and cementing the reservoir liner.
- The i-Flow flow diversion tool was used above the CTD mill and motor, allowing increased flow rates to lift out debris by diverting the flow over the motor. The max flow rate achievable went from 1.5 BPM through the motor to 3.75 BPM when flow was diverted through the i-Flow tool. This allowed an efficient cleanup before starting the stimulation.
- Fibre optic enabled coiled tubing was used for the whole operation with the added benefit of having real time data at surface, allowing verification of shifting tools latched in sleeve, and sleeve opening and closing.
- Impact hammer activation.
- Downhole temperature sensing while stimulating each zone verified the direction of the pumped fluids and zonal isolation.

Result:

- No issues with opening/closing sleeves, with over 40 shifts performed.
- Fiber optic enabled coiled tubing was a big advantage to get real time downhole measurements.
- Stimulation went according to plan with all stages pumped as designed.
- i-Flow functioned as designed and facilitated efficient well bore clean up.
- i-Shift and i-Stroke hammer proved compatible with Active Coil.
- Efficient intervention method reducing time with approximately 50%.
- The customer will use the i-Jar as primary tool for upcoming fishing operations

