i-Opener CEM TD

Industry's only ISO 14998, V0-qualified cycling toe sleeve saved a North Sea operator $3M USD over the course of eight wells

Background

A major operator in the North Sea is currently drilling deep wells with long horizontal laterals that are typically completed with multistage frac completions. The toe of the well is normally perforated to establish injectivity, allowing frac balls to be pumped to open ball-drop frac sleeves in the lower completion. Due to the length and trajectory of the wells, the perforation guns are conveyed on a wireline tractor, a costly and time-consuming operation. An additional challenge is that poor injectivity resulting from perforation tunnel-skin damage has occasionally led to requiring multiple tractor-conveyed perforation runs. Conventional hydraulic-actuated toe sleeves from various companies were evaluated as an alternative method to tractor-conveyed perforation. Conventional hydraulic toe sleeves, however, did not meet the multiple pressure cycling and deep barrier envelope requirements for well integrity.

Solution

NOV Completion Tools worked with the operator's engineering team and technical hub to define all the requirements for a hydraulic-actuated alternative to tractor-conveyed perforating. After defining the scope of requirements, it was agreed to proceed with the i-Opener™ CEM TD (time delay), which the NOV engineering team developed based on an existing cemented sleeve technology.

The i-Opener CEM TD was manufactured, tool functionality validated, and qualified in a comprehensive test program to make it ready for field trial. The tool was qualified according to **ISO 14998 Annex A, to V0** validation grade, allowing it to be used as part of the well barrier. The first field installation was in early 2019. The liner with the i-Opener CEM TD was successfully run to planned depth and cement was pumped as normal through the shoe and displaced around the liner. The cement plug was bumped on time, and the liner hanger was set and released according to plan in heavy oil-based mud (OBM). After the cement job was completed, a clean out run was performed, and the well was displaced to light fluid for inflow testing. This allowed the entire lower completion liner to be used as the deep barrier for subsequent completion operations.

After the upper completion had been run and Christmas tree installed, it was time to operate the i-Opener CEM TD. The cement pump was used to pressure cycle the i-Opener open in offline mode. An injectivity test was performed, confirming excellent injectivity through the flow path created by the i-Opener.

Results

- Savings of $3M USD over the course of eight wells achieved by not having to perforate with a wireline tractor
- Reduced HSE risk as explosives are no longer needed for perforating
- Improvements in time to complete the well as the lower completion can be used as a deep barrier after inflow testing