i-MILL TT Mill Powered by Neyrfor TTT Turbodrill
Removes 5,707 ft of Cement in One Run in HT Well

The fit-for-purpose intervention mill coupled with a thru-tubing turbodrill milled for more than 100 h in temperatures up to 346 degF

**CHALLENGE**
Mill out 5,907 ft of cement remaining inside the horizontal section of a 5½-in casing from 13,791 ft to 19,698 ft with a bottomhole temperature (BHT) of 346 degF.

**SOLUTION**
Deploy a 4½-in i-MILL TT* intervention mill driven by a 3¾-in Neyrfor TTT* thru-tubing turbodrill.

**RESULTS**
Removed 5,707 ft of cement in one run at an average ROP of 60 ft/h.

**Withstanding elevated temperatures in long cement sections**
In an Eagle Ford Shale well in DeWitt County, Texas, an operator sought to mill nearly 6,000 ft of cement that remained in the horizontal section of the 5½-in casing with a BHT of up to 346 degF. Milling this amount of cement using a standard positive displacement motor (PDM) and conventional mills at such an extreme temperature would not be possible on a single trip due to wear and degradation of mills and motors. In an offset well in which 2,000 ft of cement had to be milled out, the operator used conventional milling technology not suited for the environment and required four trips in the well at an average ROP of 25 ft/h to complete the operation.

**Delivering fit-for-purpose intervention mill performance in extreme conditions**
Schlumberger recommended a 4 ½-in i-MILL TT mill powered by a 3¾-in Neyrfor TTT turbodrill to deliver a longer on-bottom time to complete the cement milling operation in one run.

Specifically designed for the removal of hard scales and cement, the i-MILL TT mill operates optimally with high-speed drive systems. Using the IDEAS* integrated drillbit design platform, Schlumberger designed the mill to allow for force balance at the cutting structure, reducing lateral vibrations to deliver higher ROP and reduced mill wear and damage. The Neyrfor TTT turbodrill is a unique drive system with no elastomeric components, making it ideal for HT applications or interventions requiring extended milling times with conventional or nitrified fluids.

**Milling 5,707 ft of cement in a single run**
In this well, the operator first milled out the cement wiper plug on top of the cement with a conventional PDM and a junk mill. The BHA was then switched to the i-MILL TT mill and the Neyrfor TTT turbodrill, and the remaining 5,707 ft of cement was milled out in one run at an average ROP of 60 ft/h. The i-MILL TT mill finished the job after more than 100 h of milling then completed the operation to TD with acceptable wear. Throughout the job, turbodrill performance was maintained and the tool was fully functional when pulled back to surface. The job was conducted on jointed pipe with a surface pressure of 4,700 psi, flow rate of 4 bbl/min, and average weight on mill of 2,000 lbf.

With the increased ROP and extended time on bottom, overall intervention cost was significantly reduced compared with similar interventions performed in an offset well. By deploying the i-MILL TT mill, the operator was able to eliminate approximately 120 h of NPT by avoiding the estimated 10 trips out of hole that would have been required using conventional milling technology to complete the same work.

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