Case study: Acid stimulation, pressure pumping, Middle East

TeleCoil integrated sensor pinpoints optimal friction reduction tool for extended-reach stimulation jobs

To improve field productivity, the operator planned an acid stimulation campaign on the openhole sections of more than 20 wells.

These were extended-reach wells with horizontal sections ranging from 8,000 to 12,700 ft, and openhole sections varying from 3,000 to 3,800 ft. In addition, the wells operated under highly sour conditions (up to 15% H2S), which added safety risks and threatened to shorten the performance life of downhole stimulation equipment.

Each well included a 4.5-in ESP completion, a 7-in liner, and a 6.125-in openhole section. The operator planned to perform the acid stimulation via coiled tubing (CT), the most efficient design, which could fit through the Y-tool (ESP bypass) system with an overall 2.441-in restriction. This CT size, coupled with the well length and large completion size, limits the CT string's reach to the desired stimulation zones.

A friction reduction tool (FRT) was required to extend CT reach and effectively execute the stimulation jobs. To select the right FRT for the campaign, the operator asked Baker Hughes for a solution to evaluate the performance of different tools.

Baker Hughes proposed its 2.125-in TeleCoil™ intelligent coiled tubing service with an integrated **TeleCoil™ sensor package**. The multipurpose sensor package captures and relays downhole parameters like tool pressure amplitudes, consistency, and frequency in real time. This information enables the efficient and accurate evaluation of multiple FRTs to determine the most effective one in meeting project goals.

In the intense qualification testing, the TeleCoil sensors prove more robust and reliable than competitors' fiber-optic transmission systems. The sensor package also provides higher data resolution, at greater speed, than mud-pulse telemetry systems.

In more than 25 runs in other well applications, the sensors demonstrated excellent shock resistance from the most aggressive FRTs in the industry.

Efficiently evaluating multiple tools

The operator deployed the TeleCoil sensors as part of the FRT evaluation runs to constantly monitor downhole pressure and other parameters. Peak-to-peak pressure measurement versus pump rate helped benchmark the performance of each FRT and immediately highlighted situations in which the peak-to-peak values did not align.

In previous FRT runs without TeleCoil, emergency burst discs in the bottomhole assembly (BHA) prematurely ruptured. Without access to real-time downhole information, the root causes of these ruptures were misunderstood, resulting in long troubleshooting periods and nonproductive time.

But with the TeleCoil sensors, the operator successfully assessed FRT performance and gathered crucial information that helped optimize each tool's friction-reducing capabilities.

Challenges

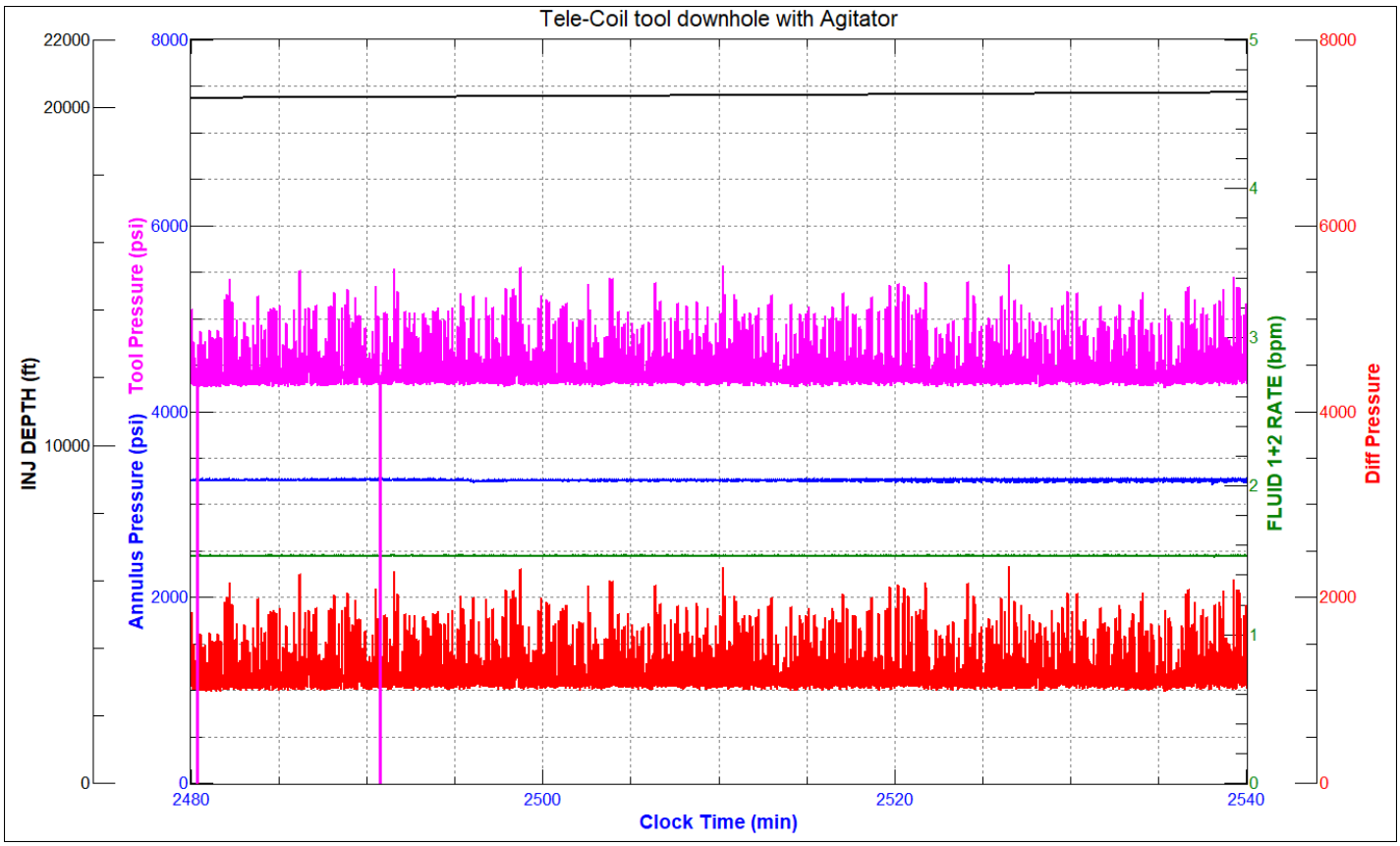
- Effectively deploy coiled tubing string through tight restriction to stimulate openhole sections of extended reach wells
- Compare performance of different friction reduction extended reach tools on a coiled tubing (CT) string
- Deploy a sensor array on the CT string that could accurately monitor FRT performance while withstanding vibrations and highly sour well conditions

Results

- Successfully assessed friction reduction tool performance
- Gathered crucial information to make informed decisions and optimize tool's friction reduction capabilities
- Reached stimulation depth to ensure 100% stimulation coverage of the openhole section

For example, during one FRT run, the TeleCoil sensors identified that an increase in pumping rate led to the tool pressure amplitude rising to a peak of 2,400 Psi, which resulted in premature rupture of the burst disc. This information allowed for faster and more accurate decisions to pull out of hole and change the bottomhole assembly.

The TeleCoil sensors withstood the highly sour well conditions to deliver the real-time data required for the operator to confidently test all extended reach tools and select the best one. The optimal FRT helped the coiled tubing string reach the targeted openhole section efficiently and ensure 100% coverage of the acid stimulation job.



TeleCoil Extended Reach Operation successfully reached TD: operational parameters validate tool efficiency in extended lateral deployment