

Optimized coiled tubing string design extends lateral length, improves time to bottom

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The North American land market has changed substantially over the past decade, with the rise of shale signaling a concurrent shift in both well design and completion methods. With extended-reach laterals becoming more commonplace, the need for a change in coiled tubing string design has become more apparent. To address this need, National Oilwell Varco (NOV) recently launched an expansion of their True-Taper™ string design, optimized for extended-reach applications. The improved version, called True-Taper XR, minimizes the number of bias welds in the tapered string and assures a gauge-to-gauge bias weld in each instance, achieving a linear taper by gradually varying the thickness of the flat steel strip over almost the entire string length.

Patriot Well Solutions (Patriot), a premier provider of coiled tubing, nitrogen, pumping, and wireline logging and perforation services operating in the major North American basins, began research into potential ways of extending lateral lengths using coiled tubing in unconventional shale plays. Recognizing the need to adapt to an evolving coiled tubing market, they chose NOV's new True-Taper XR string design and began implementing it on select Bakken shale projects. The Bakken proved a fertile testing ground for the improved string design, as Patriot was seeing lateral lengths of three miles or more in the region. Furthermore, the total depths (TDs) being reached by various companies in the Bakken often exceeded 26,000 feet. Patriot's primary objective when using the new string design was to establish the type and magnitude of performance benefits possible versus traditional designs.

Patriot first noted that the True-Taper XR strings were able to overcome the challenging weight restrictions of North Dakota, particularly with regards to stringent frost laws in the spring months. Tailoring the coiled tubing string design to the extended-

reach laterals effectively allowed Patriot to keep the weight in the string where it was necessary, i.e., Patriot achieved a better balance between lighter-weight sections and heavier sections, with the string appropriately light or heavy based on actual wellbore conditions. Previously, longer taper lengths made achieving such precise string-weight distribution in the lateral significantly more difficult, if not impossible.

Performance improvements across two major categories were made possible through implementation of the optimized True-Taper XR string design. First, Patriot noted that by using True-Taper XR, the company was able to regularly increase the length of the lateral – and thus the ultimate production zone – by 800 to 1,200 feet on average. Secondly, and not to be underscored in importance, the True-Taper XR design helped operating companies get to the bottom quicker than with traditional string designs. Though this varied based on the company involved and other factors, Patriot noted that a broad trend was in the reduction of time to TD from 24 hours to 19 hours or less. The greatest improvement was seen on the last 20 percent of in-hole time; in other words, the improvement in time to TD aligned with the extended-reach portion of the wellbore. Though Patriot noted that there was no reduction in the number of sections versus previous designs, each tapered section was shorter, allowing for a quicker transition in pipe wall thickness.

Coiled tubing will continue to be an important component of the oil and gas industry, but it will also face new challenges as well paths and geologies change, and companies enter uncharted formations with new campaigns. Companies like Patriot that choose to embrace technical change and innovation will find themselves increasingly far ahead of the competition in the coming years. ▀