

Coil Rod Adoption Grows In Permian

By LJ Guillotte

In a traditional rod string, couplings are the primary point of failure. These failures often come from improper handling or makeup, so many companies adopt strict procedures to protect the couplings from damage and prevent over- or under-torquing during makeup. Even so, couplings remain a concern.

That is largely because the curves in horizontal wells create contact points where the rod string will inevitably rub against the tubing wall as the string moves up and down. Because couplings have a

larger diameter than the rods, they tend to be the point of contact. In a traditional string, the side loads the string applies to the tubing rest entirely on the couplings, which is a recipe for rod parts.

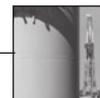
If the couplings last, production engineers still need to worry about holes in the production tubing. Historically, they have had two primary techniques for preventing rod parts and protecting the tubing. The first is installing rod guides on the string to keep it away from the tubing and spread the load across several points of contact. The second is using production tubing that contains an internal plastic

coating or a thermoplastic liner to protect the underlying metal from corrosion and reduce friction. Both rod guides and internal barriers can significantly increase the meantime between failures. They tend to be worth investigating once side loads exceed 150-200 pounds.

In deep horizontal wells with high production, a less common technique for addressing side loads is gradually gaining popularity: continuous rod strings. Also called coiled rod, these strings replace traditional sucker rods with steel coils that have been welded together, heat treated (austenitized, quenched and tem-



By significantly extending the meantime between failures, coiled rod strings can enable operators to use rod pumps in deep, highly deviated wells where severe side loads make traditional sucker rod strings impractical. In the Permian Basin, some operators leverage coiled rod to convert from ESP to rod pump earlier in a well's life.



pered) and attached to a six-meter spool for deployment. Continuous strings eliminate every coupling except the two pin ends that attach the string to the polished rod and connect the string to the pump.

Eliminating rod couplings disperses the side loading over a longer area of contact that generates less friction when it slides against the production tubing. Whether it is used alone or with a liner, this allows the continuous string to increase rod and tubing life. The longevity gain varies widely based on downhole conditions, pump speed and dogleg severity, but some coiled rod strings have endured historically problematic conditions for three to five years.

The difference in longevity before and after coiled rod can be stark. For example, one rod pump well that used to fail three times a year has now operated for more than three years with a continuous string and thermoplastic liner.

Accelerating Transitions

By using a continuous sucker rod to minimize friction, artificial lift engineers gain the freedom to lower the pump further into the curve. In some wells, the pump can be set close to 70 degrees, which allows it to draw down the formation more effectively.

Another benefit of eliminating couplings is that coiled rod is lighter than its stick counterpart. This allows the pump to lift higher volumes without requiring as big a pumping unit or gearbox. Recognizing this, some Permian Basin operators have begun using continuous strings to transition wells from electric submersible pumps to rod pumps earlier, as rod pumps tend to be less expensive to operate.

A few years ago, that transition would generally only happen once the well's production had fallen to an average of 300 barrels a day. Depending on the well's architecture, downhole conditions and the pumping unit, continuous rod strings raise the limit to somewhere between 400 and 800 bbl/d.

Barriers to Adoption

Despite their advantages, continuous strings remain a niche tool. They are best utilized in deep wells—meaning ones beyond 7,500 feet—that have enough de-

viation to create extreme side loads. This is where eliminating the concentrated pressures associated with couplings yields a huge difference in rod and tubing life.

Within their niche, continuous strings are gradually gaining popularity. Coiled rod costs about as much as a traditional rod string with guides, so deployment can be easy to justify so long as service companies address the biggest barrier to widespread adoption: the need for specialized service equipment.

Fortunately, that is happening in the Permian. A decade ago, there were only two companies in the basin with the equipment and expertise to deploy, pull, and repair coiled rod. Today, there are three, with the newest entrant arriving in 2024. That is a testament to interest in the technology.

As service infrastructure has expanded, operators who want to deploy coiled rod across fields of a meaningful size no longer need to worry about waiting weeks for equipment when a well needs service. In fact, one company with more than a decade of experience in the basin guarantees that it can get equipment to site within 24 hours.

Enabling Predictive Repairs

Aside from service infrastructure, the traditional concern about coiled rod relates to inspections. The metallurgy for coiled rod resembles that of stick rod, so it has a similar run life before the friction reductions and other benefits come into play. However, until recently, coiled rod had to be inspected visually. Even with experienced inspectors, this method yields imprecise and often inaccurate results. This made it difficult for operators to balance risk mitigation with the desire to

keep the coil in use as long as possible.

Today, the industry has a far more precise and consistent way to evaluate coiled rod. Thanks to a portable electromagnetic scanner (EMI) developed for use with coiled rod, operators can check the condition of the string as they pull it out of the well during workovers (whether those relate to the rod string or other parts of the well). The scanner looks at all 360 degrees of the rod surface and does not introduce any delays.

Much like a sucker rod shop, the scanner can reveal surface defects and quantify cross-sectional wall loss. It also picks up fatigue from compression and buckling, which would be undetectable visually, by looking at changes in the rod's molecular structure.

Once the scan is done, the service company will provide a report with details on the condition of each part of the string. The threshold for repairs varies by operator, but because coiled rod frequently sees use in deep, highly deviated wells, most operators become cautious once wall loss reaches 7% and replace a section once wall loss passes 15%. The replacement can be done on site using truck-mounted welding equipment.

Deploying the EMI scanner takes less than five minutes. The scanner is comparable in size to two shoe boxes and in shape to a half-clamshell. Before the workover begins, the service company simply clamps the scanner to the rod. It gathers the information it needs without requiring any change to operating procedures, and once the operation is done, it can be removed in a few minutes, put in a truck, and taken to the next site.

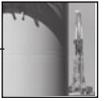
The scanner's accuracy and reliability have been validated through three years

LJ GUILLOTTE

President, CEO

Lightning Production Services

LJ Guillotte is the president and CEO of Lightning Production Services, a Texas-based company that manufactures and deploys coiled rod, thermoplastic liners, rod guides and other aids for rod and progressive cavity pumps. Guillotte has led Lightning since 2012. Earlier in his career, he served as president of Great Plains Oilfield Rentals, where he oversaw the frac water supply business' expansion into new areas of South Texas, the Mid-Continent, and Ohio. Before that, he spearheaded a turnaround at the production optimization company vMoitor Inc. and spent 10 years as vice president of production optimization for Latin America at Weatherford.



of field testing. While the technology is patented, the developer is commercializing the scanner and making it available to operators and other service companies. By performing scans whenever they pull the string and comparing the newest results to historical data, these companies can determine how quickly the string is wearing out and predict when it will need to be repaired or retired.

Decades of History

Coiled rod originated in the early

1970s. It has a long history of rotating progressive cavity pumps to lift viscous oils in Canada, California, and Venezuela, as well as a much shorter but equally impressive record in shale plays. I'm not aware of any published tallies of how much coiled rod has been deployed, but in the continental United States, the number likely exceeds 8 million feet.

Most of those installations took place in California. Continuous rod strings are gaining popularity in other plays, but growth has been slow—about 1% or 2% a year—

because of concerns about serviceability.

In the Permian Basin, those concerns are beginning to fade as service providers expand their fleets and facilities. They have a strong incentive to do that, with operators eager to reduce costs by transitioning to rod pumps earlier in a well's life.

In many deep, highly deviated wells, coiled rod is the best and sometimes only way to achieve that goal. It has proven time and again that it can place the pump deeper into the curve while extending the meantime between failures. □