WHITE PAPER

ABSTRACT

The ToughMet® alloy is an advanced bearing material, long-established in oil and gas applications and notable for its high strength, anti-galling qualities that act to reduce tubing wear over standard coupling materials. Since 2016, 35 operators have installed ToughMet® 3 TS95 sucker rod couplings in over 1000 oil wells located in the Bakken and Permian Basin to address tubing leaks and coupling failures. These operators have seen compelling results showing improved run life by targeting deviated sections in the well that have elevated tubing wear rates.

During these pilots, operators noticed that placing an increased number of ToughMet couplings in the well could give rise to significant benefits not just for failure reduction, but for the operating performance of the well too. Specifically, if the ToughMet couplings were installed in longer sections of the rod string that extended beyond the targeted, deviated areas in the wellbore, the overall frictional loss of the machine could be significantly decreased. Minimizing the friction between the sucker rod string and production tubing gives rise to decreased mechanical loads on the surface equipment and the energy consumption of the system - ultimately increasing the output of the well. To determine and quantify this further, several operators partnered with Materion Corporation to run field trials specifically designed to assess the changes in well performance that result from coupling material substitutions.

A broad sample size of twenty wells was acquired to alleviate variations in operating practices among operators. At the start of the test program, operational and production characteristics were defined and measured for each of the field trial wells. After workover and installation of ToughMet couplings, these sameparameters were monitored and measured after flush production when the wells stabilized.

This paper reports the results of this pilot, which targets well optimization by using ToughMet couplings in either large sections of the sucker rod string or throughout the entire well. Although this study has not concluded, the outcomes reported through 2018 indicate that wells running with ToughMet couplings operate with improved sucker rod string movement, greater downhole stroke, increased pump fillage, accelerated fluid production, and increased system efficiency. Most notably, operators reported measurable load reductions on both the gearbox and polished rod, which suggests the installed surface equipment life can be extended and reduced energy consumption is possible.

By simply switching sucker rod couplings from standard T or spray metal to ToughMet in these wells, the following improvements have resulted:

- Oil production increased 12.6% on average.
- Downhole stroke increased 16% on average.
- Pump fillage increased 6.4% on average.
- Peak polished rod load decreased 13.1% on average.
- Alternating stress on the polished rod decreased 12.1% on average.
- Gearbox loading decreased 12.5% on average.
- Fluid level above the pump reduced by 23.8% on average.
- System efficiency increased by 20.6% on average.

A preliminary statistical analysis of the entire well population also corroborates these conclusions. Paired sample t-test analyses concluded statistically different results for all the important measured performance parameters following the installation of a full, or nearly full, string of ToughMet couplings. By drawing conclusions from the large data set rather than the case-by-case results, potential clients can better be reassured that the deployment of larger quantities of ToughMet couplings in this fashion will lead to performance improvements unachievable with a more conventional approach.

Download the Full Advanced Sucker Rod Coupling Material White Paper