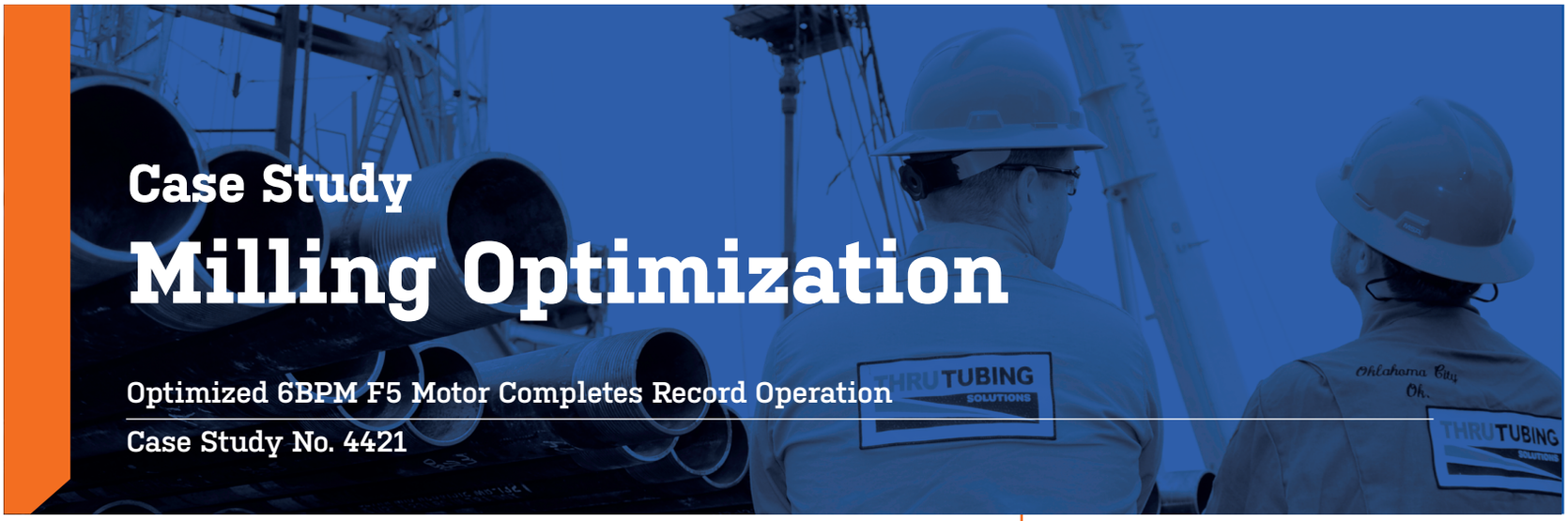

Case Study
Milling Optimization

Optimized 6BPM F5 Motor Completes Record Operation

Case Study No. 4421

DETAILS:

Location:	**Washington County, PA**
Formation:	**Marcellus**
Casing Size:	**5-1/2" | 20#**
Conveyance:	**2-7/8" | 7.9#**
Total Measured Depth:	**15,812'**
Lateral Length:	**8,377'**
Well Orientation:	**Horizontal**
Fluid:	**Fresh Water**
Operation Type:	**Drill-Out Composite Plugs**
Tools Used:	**3-1/8" TTS Milling Assembly**

RESULTS:

One of the largest operators in the NE wanted to push the boundaries of tri-cone bits. Working with our in-house engineering team, TTS was able to rapidly modify the power section of our F5 downhole motor to operate with 6 BPM of flow which allowed for optimum well cleaning. This lower RPM motor was designed specifically for wells with a high number of bridge plugs where debris management is critical to the success of the job. The optimized motor design, in conjunction with a roller cone bit, successfully milled out 141 composite bridge plugs in a single run with an average mill time of 17 minutes; placing the motor in hole for 102 hours. During drill-out operations, the total volume and size of plug parts produced was sufficient in successfully reaching TD. This completion of 141 plugs in one run was a record for the customer and for TTS at the time of the operation.

HIGHLIGHTS

- Milled thru 141 Plugs in a Single Run
- Average Milling Time of 17 min/plug
- Increased Flow Rates with Larger OD Tools
- Improved Annular Velocity and Debris Cleaning due to Larger Flow Rates