



Vortex DX-I Tool with Gas Lift Valves *Reduced Liquid Slugging in Heel-Toe Dip in Lateral*

Summary

During a gas-lift valve modification and installation workover, a Vortex (end-of-tubing) DX-I tool was installed at ~9,500 feet in a Cotton Valley deviated (49.65°) gas-lift operated well in Louisiana. The addition of Vortex provided significant increased recovery of stagnant liquids (oil and water) in the lateral and improved overall fluid production from a 22% lower injection gas rate:

- Increased oil by 4% with flatter long-term decline curve and improved EUR
- Produced 295 barrels of additional oil production in first 30 days (a 37% increase)
- Increased daily gas to sales by 18% while daily injection gas also reduced by 22%
- Lowered tubing pressures by 10% (than pre-install levels) and stabilized at 100 PSI

Pre-Vortex

Original completion had 13 gas lift valves and no packer. Reported pressures were 610 PSI (casing) and 110 PSI (tubing). Average daily production was 25 BOPD, 80 BWPD, and 65 MCFD to sales with 740 MCFD injection. After the gas lift failure, the operator decided to pull the tubing and redesign/replace the gas lift system, with the addition of a packer and a Vortex DX-I tool deployed at the end of tubing.

Vortex Install / GL Redesign

The Vortex DX-I tubing tool was installed at end of 2 & 7/8" tubing (9,495 feet and 49.65° of deviation in the lateral) with seven gas lift valves and packer. After installation, the reported casing pressures were 760 PSI and tubing pressures were 100 PSI. Injection gas per day was reduced to 500 MCF. For the first 30 days post-installation, average production was 37 BOPD, 112 BWPD, and 110 MCFD (net gas to sales).

Five-Month Lookback

Vortex provided the expected flush production from static fluids in the heel-toe dip. Daily oil increased within three days from 25 BOPD to 58.35 BOPD / 169.95 BWPD with 234 MCFD of gas to sales. This increase in fluids was sustained well beyond flush production with 36.7% increase in daily oil production in the 30 days after Vortex was installed.

Daily injection gas rates were reduced after installation of the new gas lift system to 500 MCFD. At the time of this report, the most recent injection gas rate is reported at 580 MCFD, which is a reduction of 22% from pre-installation injection gas rates.

Tubing Replacement

After finding a hole, the tubing required replacement in September 2018. Again, the customer saw flush production from evacuating static fluids in the heel-toe dip initially on start-up. Daily oil increased within three days from 25 BOPD to a high of 54 BOPD and 147 BWPD with 197 MCFD of gas. Again, this increase in fluids was sustained well beyond flush production with an 87% increase in daily oil production in the first nine days after the tubing workover was completed.

Flush Production: First 30 Days of Post-Install (May 2018)

Oil, gas, and water production were all much higher in 30-day period immediately after installation of the Vortex DX-I tubing tool. Oil increased by 36.7% and gas to sales increased by 76.5%, while injection gas was reduced by 33%.

Daily Production	Before Vortex	After Vortex	Change
Oil	26.75 BOPD	36.58 BOPD	+ 36.7%
Gas to sales	62.43 MCFD	110.21 MCFD	+ 76.53%
Water	81.08 BWPD	112.46 BOPD	+ 38.7%
Injection Gas	700 MCFD	500 MCFD	- 28.6%

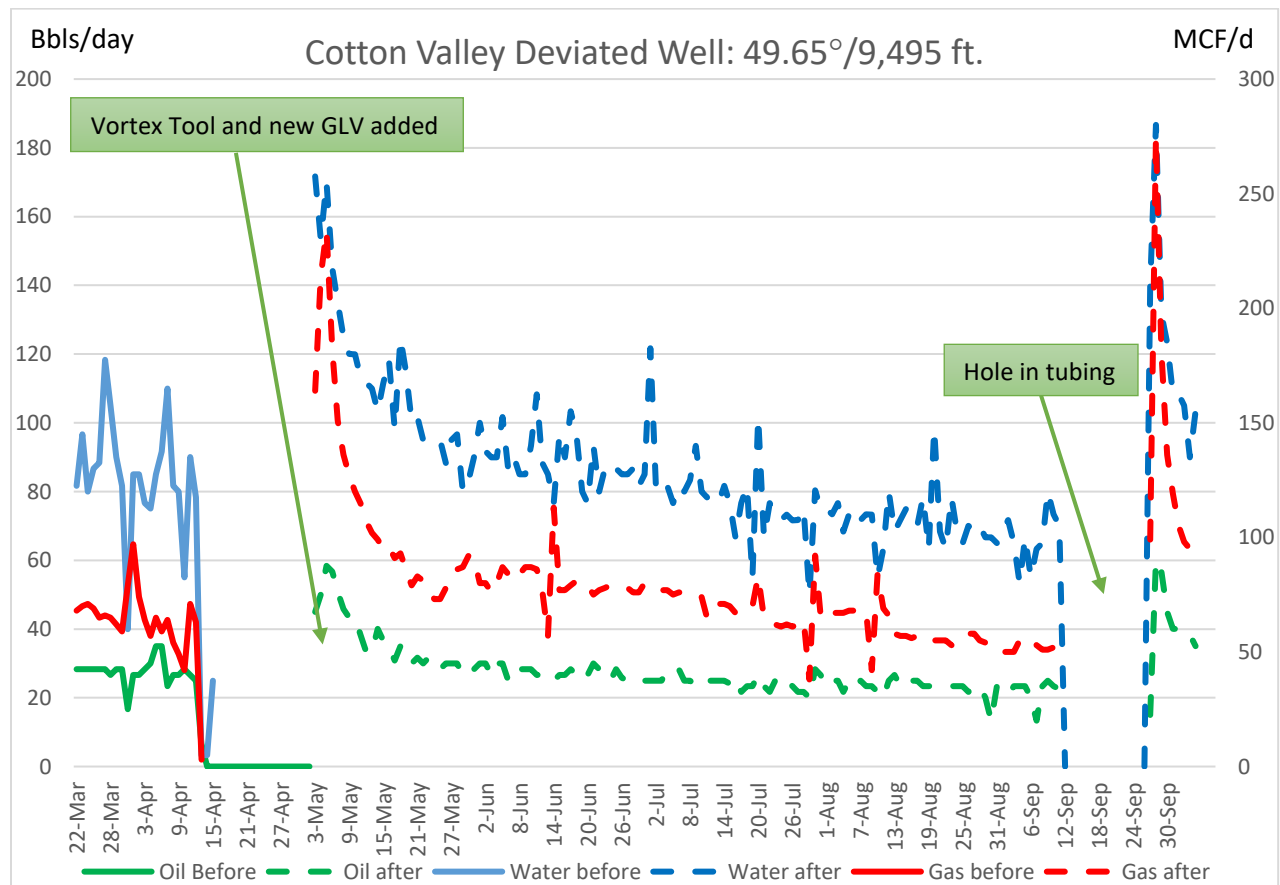
An additional 295 barrels of oil was recovered in the first 30 days after Vortex, with CapEx of Vortex tool recovered in less than 10 days.

Flush Production After Workover: First Nine Days After Tubing Replacement (September 2018)

Oil, gas, and water production were all higher in the nine-day period immediately after the tubing was replaced. Oil has increased by 36.7% and gas to sales by 76.5%, while injection gas was reduced by 33% (when compared to daily rates before workover).

Daily Production	Before Workover	After Workover	Change
Oil	21.95 BOPD	41.12 BOPD	+ 87.3%
Gas	52.67 MCFD	133.11 MCFD	+ 152.7%
Water	65.74 BWPD	121.85 BWPD	+ 85.4%

An additional 173 barrels of oil was recovered with Vortex in the first nine days after workover.



Vortex Tools: reduce slugging and improve liquids production below the gas-lift valves