Evolution of Rod Pump Systems in Unconventional Wells Leading to Today’s Best Practice and Beyond

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Outline

- General Rod Pump (RP) Fit for Lifting Unconventionals: Yesterday, Today, and Tomorrow
- Review Progressive Series of RP Methodologies
  - Pros/Cons of the Various Steps/Methods
- Arrival at Current Best Practice
  - Simulations and Results Moving us Forward
- Next Steps for Tomorrow’s RP Technologies
Some Active Unconventional Plays

Source: Liquids Rich, Horizontal Well Play Overview – Rob Sutton
RP Systems and Unconventionals That Keep Progressing

- *Longer, faster, bigger, better…*
- *Rapid development of more liquids-rich plays*
  - Stacked pay developments
  - *Higher volatility fluids and more aggressive gas*
- *Ultimately WB design and construction capabilities have outpaced artificial lift capabilities*
RP Systems of Recent Yesteryear

- Pumping from kickoff point with poor-boy or modified poor-boy separation
  - Applying vertical well processes in unconventionals
- Running pumps and rods into curve, tangent, or landing in the flat
  - Inevitable complexities, not well documented/repeatable solutions, higher-cost material solutions
- Constant misapplication/fails of “new” technologies – widgets and non-API items
RP Systems of Recent Yesteryear
RP Systems of (Recent) Yesteryear

RP Systems of Recent Yesteryear

- Typical components with accelerated/aggressive wear

Source: Sucker Rod Lifting Horizontal & Highly Deviated Wells – Problems & Troubleshooting - Norman W. Hein, Jr.  
Source: https://www.slideshare.net/RamezMaher/managing-downhole-failures-in-a-rod-pumped-well  
Source: Minimizing Equipment Failures in Rod Pumped Wells - (SWPSC) by J. C. Patterson and J. V. Curfew
RP Systems of Today

- Better use/application of advanced materials
  - Carbide clutches, hardened metals, other rugged pump components
  - Wear resistant rod guide materials
  - Advanced thermos plastics

- Advancing surface controls

- Right parts at the right time: Improving runtime with knowledge growth and higher competencies
Today’s Best Practice?

- Going far beyond individual parts and pieces
  - The whole system and process is the answer, not the parts
- Rod pumping utilizing physics to our advantage
- Better understanding of hydrodynamics and our ability to consistently improve them
- Better understanding about what drives fluid delivery problems
- Clarity on how surging gas and turbulence has a direct effect on gas entrainment and suspension
RP Systems of Today/Tomorrow

Separator with Tail Pipe Installation Schematic showing Fluid and Pressure Distribution
RP Systems of Today

- There are an estimated +1100 rod pumps with isolated tailpipes installed in basins all over the US and Canada
- Don’t be fooled: there is devil in the details
- The seemingly simple solution has many facets that have surfaced real need for additional attention to several system details
Relying More on Advanced CFD
Aid of Rigorous Nodal Analysis

- This represents the pump w/multiple tailpipe options to 60 and the achievable outflow @ 150# PIP
- Highest outflow potential is bogus as well would be loaded
- Becomes balancing act of striving for consistency vs. sacrificing production vs. long-term fit
- 2.375” calcs to yield ~1.0 bopd vs. 2.875”, but will perform with more consistency day-in and day-out
- 1.90” calcs to yield ~1.2 bopd vs 2.375”, but again may provide more consistency if high gas rate target is not met and/or depletes over time
Aid of Rigorous Nodal Analysis

Gas Velocity

- Internal VGs at Diw Sep outlet
- Internal VGs at 2.875 CS Diverter Sep
- Internal VGs at Tool Saver
- Internal VGs at Pkr

The gas velocity across the ID of the tools in this setup will not see a “stall” of fluid movement due to the high, maintained superficial gas velocity. We are always well above 12/sec in this case at the given condition: 625 mcf/d, 1000 bfpd, 150 PIP
My answer is the nearly the same now as it was in October 2010 at SPE event in DFW…

Combination Technologies

Advances in High Skill Processes while Using Advanced Materials

Nail the Fundamentals

The be-all, end-all does not currently exist, but we are much closer to an acceptable point
Conclusion

- Recent RP developments regarding isolated tailpipe applications done correctly are the most cost-effective solution that allows real performance and profit altering results right now.

- Ease and breadth of application can provide significant low-cost/high-reward benefit in unconventional basins all over the US.

- The industry is still in need of technological advancement on the front of RP as it relates to unconventional wells; nothing is a cure all at this time.
Questions

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