The Horizontal Rod Pumped Well’s Ultimate Production System

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Horizontal Well Production

- Steep Production Declines
- Frequent/Hard Slugging
- High or Increasing GLRs
- High Gas Spot Rates
- Solids Production Potential
- Foamed or Highly Gas Entrained
- Can Be Very Difficult to Optimize
Horizontal Wellbores

- Longstrings (various diameters; 4.5”, 5.5”, 7”)
- Intermediate w/ TOL @ KOP or Deep Set (typical 7”x4.5”)
- Tapered Casing Sizes (e.g. 7”x5.5”)
- Often High or Higher than Desired DLS
  - Big Northing & Easting Components
  - Aggressive Azimuth Swap – Corkscrewing or Reversals
  - S-Shaped (often w/ aggressive build and roll-over)
  - Aggressive Back-Builds and Under-Cuts
  - High DLS Areas in Build of Curve
What Happens When Combined?

- Intermittent Pumping Issues, Namely Those Related to Pump Fillage and Excessive Wear
  - Gas Interference
  - Fluid Pound
  - Rod Buckling
  - Tubing Wear
  - Pump Wear
  - Rod Parts

  - All lead to costly downtime, deferred production, and high cost of repair.
Corrective Actions Applied

- Over-Pumping to Make Up for…
  - Poor Gas Separation
  - Heavy Entrained Gas
  - Poor Pump Placement
  - Inconsistent Pump Fillage
  - Inability to Pull Down PIP
  - Poor POC Control Management
  - Poor VSD Control Management
In-Corrective Actions Applied

• Placing Pump and Rods Into High DLS Environment
  – Generates Accelerated/Excessive Wear of Rods, Tubing, and Various Pump Parts.
  – Shortens Avg Runtime – Increases Failure Frequency
  – Limits Separation Options
  – Can Complicate Separation Design/Function
  – Can Have Adverse Effect on Separation Efficiency
  – Potential to Increase Solids Issues w/ Placement
  – Complicates Rod String Design
  – Makes Wear Mitigation More Difficult, Yet More Vital
Why Are We Doing It Incorrectly?

- Do we understand the capabilities and limitations of our current equipment?
- Do we know the severity of the problem(s) that exist?
- Do we understand the problems’ root cause?
- Do we know that when we apply a “fix” for the problem it will be remedied completely?
- Do we fully understand the repercussions of our actions?
How Do We Solve This Dilemma?

• Improve the Flowpath of the Produced Fluid/Gas Mix
  – Create a smaller cross-section for the mix to follow via isolation
  – Manipulate the GVF (Gas Void Fraction) DOWN and the gas velocity UP without restricting the flow and increasing PBHP

• Improve the Uptake and Quality of the Fluid/Gas Mix
  – Best mixing occurs around 68 degrees in the curve
  – Cushion the slug flow from the lateral with isolation uphole

• Get Out of the High DLS Curve
  – Only necessary when a static FL cannot be sustained above KOP
  – Becomes more viable option when above items are applied

• Utilize the Best Separation Method Available
  – Diversion separation is unparalleled in its ability to separate fluids & gas more completely, more of the time versus other methods
What Would the UPS (Ultimate Production System) Look Like?

1. Diverter Separator
2. Tool Saving Device
3. Slimline TAC
4. Custom Cup-Type Isolator w/ Centralizer
5. Properly Sized & Placed Macaroni Tailpipe
Benefits of the UPS

- Increased Production
- Improved Flow Dynamics
- Exceptionally Safe & Rugged
- More Full Pump Cards
- Lower PBHP
- Lower Failure Frequency
- Keeps Pumping Equipment Out of High DLS Curve
- Unmatched Cost-Benefit
UPS Component Review

- Diverter Sep
- Tool Saver
- Slimline TAC
- Isolator

5.5” 20#: 4.778” – 4.500” = 0.278” on one side
UPS Installation Review

- ~50 Echometer Systems have been installed
- ~25 More in Queue; more data coming quickly
- Avg Total Install Costs = ~$15,000-28,000 all-in
  - Typically $4000-6000 (avg $5020 all-in) for Echometer equipment including slimline TAC and often overnight shipping
  - Hydro-testing was even included in some install costs
  - Tailpipe variables are big contributor; L80 vs J55, 1.9” vs 1.660” vs 2” w/ TPL (thermoplastic liner), and overall length (360’-1070’)
- Zero stuck equipment to date
UPS Well #1

7” Longstring Installed June 30th
UPS Well #2

7” Longstring Installed August 1st

Graph showing oil, water, and gas levels from various dates in July and August.
UPS Well #3

4.5” Longstring Installed July 30th
• Customer in Barnett Shale states:
  – All 3 wells making approximately 60-90 mcfd prior to installs
  – Production steadily increased to over 180-400 mcfd and climbing
Questions?
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