Plunger Lift Optimization for Horizontal Wells

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PLUNGER LIFT OVERVIEW
Plunger Lift Overview

Plunger lift is one of the most economical ways to optimize well production

- Low installation costs
- Low operating costs
Plunger Lift Advantages

- Removes accumulated liquids in gas wells, allowing them to produce
- Increases efficiency of gas lift systems
- Minimizes down time and blowing to the atmosphere
- Provides an alternative to surfactants
- Controls paraffin and hydrate buildup
- Removes and prevents scale buildup
Plunger Lift Optimization

Plunger lift may be the most logical choice, but optimization is key

- Site Evaluation
- Plunger selection
- Shut-in method
- Turn-on method
Site Evaluation

- Wellhead design
- Facility design
- Adequate pressure / flowline
- Vessel pressure requirement
## Plunger Types

<table>
<thead>
<tr>
<th>Conventional</th>
<th>Continuous Flow</th>
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</thead>
<tbody>
<tr>
<td>Needs shut-in time</td>
<td>Minimal or no shut-in time</td>
</tr>
<tr>
<td>4:1 GLR</td>
<td>High gas and liquid volumes</td>
</tr>
<tr>
<td>&lt;130 Bbl/day</td>
<td>Up to 200 Bbl/day</td>
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<tr>
<td>&lt;350 Mcf/day</td>
<td>Minimum of 350 Mcf/day</td>
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<td></td>
<td>Optimum operating angle is 40-45°</td>
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TURN-ON METHODS
Turn-on Methods

- Time
- Differential Pressure
- Build-up Pressure
- Load Factor
Time

Utilizes a set of time-based values to operate the well

• Open, closed
• Delay (sales)
• Fall time
• Mandatory shut-in time
Differential Pressure

Evaluates differential pressure between two or more values

- Casing – Line
- Tubing – Line
- Casing – Tubing
Load Factor

Looks at the instantaneous well data available before the well turns on

- \((\text{Casing} – \text{Tubing} / \text{Casing} – \text{Line}) \times 100\)
- Rule of thumb: less than 50% should result in successful plunger operation without venting
SHUT-IN METHODS
Shut-in Methods

- Casing Dip
- Flow Rate (Critical K)
- Time
- Absolute Pressure
- Differential Pressure
Casing Dip

- High GLR Wells have better success
- High PI well don’t work well
- Reservoir Strength is factored in
Flow Rate (Critical K)

• Works well in most cases
• High GLR wells can often be run more aggressive
• Constant well flow calculation
• There can be a lag between EFM and Well Control Device
• Vertical Well Assumptions
Time

- Are you guessing at after flow?
- Can cause well to load up if parameters change
- Requires more time on location to optimize
- May lose production if sharing facilities
Absolute Pressure

• Known operating values are a must

• Criteria can change

• Good results if used in the right application
Differential Pressure

• Tubing – Line
• Casing – Line
• Casing – Tubing
• May not be as effective as Critical K or Casing Dip
CASE STUDIES
Case Study A – Well Specs

- Horizontal well
- 6300 ft.
- Plunger set @ 45 degrees
- Packerless completion
- Sand and known tubing restrictions present
Case Study A – Well Specs

- Sporadic production caused by dramatic swings in line pressure
- Sand
- 1.875 X Profile nipple
- Periodic unloading/venting
- Conventional plunger
- Turn-on method: Tubing-Line
- Shut-in method: Critical flow and Casing Dip

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Case Study A – Results

• Changes Made:
  – Unsuccessful continuous flow operation
  – Used stand-alone LAP plunger
  – Turn-on and shut-in methods unchanged

• Results:
  – Successful plunger operation
  – Predictable production
  – Stabilized flow rates
Case Study A – Results
Case Study B – Well Specs

• Horizontal Well
• 6300 ft.
• Plunger is at 45 degrees
• Packerless completion
• Sand production and tubing restrictions present
Case Study B – Well Specs

- Sporadic production caused by dramatic swings in line pressure
- Sand
- 1.875 X Profile nipple
- Periodic unloading/venting
- No plunger lift
- Turn-on method: Tubing-Line
- Shut-in method: Critical Flow and Casing Dip

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Case Study B – Results

Graph showing data from 2/1/2013 to 5/3/2013 for Gas Volume (MCF), Static Pressure (PSI), Water (BBL), Casing Pressure (PSI), and Tubing Pressure (PSI).
Case Study B – Results

Changes Made:

- Tried conventional but moved to continuous flow plunger
- Turn-on and shut-in methods unchanged

Results:

- Fluid recovery
- Additional gas sales
- Lower bottom hole flowing pressure
Case Study B – Results
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