Batch Pumping – A New Method to Solve Downhole Liquid Holdup

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Batch Pumping for Rod Pumped Gas Wells

- Gas flows from casing annulus
- Liquid is pumped up tubing
- Some fluids rise with gas due to ineffective gas/liquid separation in small diameter casing
Identifying and Solving Liquid Holdup

- Problem: Casing and liner sizes smaller than 5-1/2” have an annular area that is too small for effective downhole separation of gas and liquids.
Identifying and Solving Liquid Holdup

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• What is happening?
  – Fluid is prevented by turbulence around perforations from falling
  – Cross-Sectional area too small to effect separation
  – Gas velocity not high enough to lift fluids, but will drag fluid
Identifying and Solving Liquid Holdup

• How to Identify?
  – Wells pumping at 15% or less
  – Wells that initially responded well to rod pumping, but dropped off over a period of several days
  – Wells that are erratic producers
  – Wells producing at rates greater than 40% of Coleman
Identifying and Solving Liquid Holdup

- Test to see if it is a problem
  - Note length of normal pumping cycle
  - Prior to start of pumping cycle, manually shut-in casing for 10 minutes. Time length of this pumping cycle
  - Note if normal pumping time changes appreciably, you have holdup
  - Open casing valve when pumpoff completed
How to Solve Liquid Holdup

• Install automated valve to perform this process
  – Pneumatic or electric powered of sufficient diameter
  – Give consideration for POC makers to add this ability to product, as well as the sale of actuated ball valves and solenoid for gas operated motor valves
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- Field experience in East Texas suggests shut-in times of 6 to 8 minutes prior to starting pumping unit.
Separator Sizing Comparison in Comparison to Coleman Modified Mist Flow

- Conventional industry separator calculations used to determine capacity of annular area to provide separation.
- Coleman Modified Turner calculations used at same temperature and pressure using cross-sectional area of annulus.
- Coleman values on average 9 times higher than separation values.
- Conclusion: Fluid will not separate in annular area, but velocity too low to lift fluids, predicting Liquid Holdup.

2/7/8" w/ 1.90"

![Graph showing flowrate (MCFPD) vs. casing pressure (Psig)]
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4-1/2" w/ 2-3/8"

Flowrate (MCFPD)

Tubing Pressure

25 Psig  50 Psig  75 Psig  100 Psig

Separation
Mist Flow
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- Conclusion: Separation capacity between 90 and 140 MCFPD, and may be adequate.
Well A – Panola County

MCFPD

Install pumping unit

Begin “Batch Pumping”
Well B- Panola County

Begin "Batch Pumping"
Install pumping unit
Well C – Panola County

Install pumping unit

Begin “Batch Pumping”
Sales Chart! EFM a Necessity
Opportunities to Improve Batch Pumping Concept

- Increase flow period by opening casing valve before pumpoff occurs
  - Like plunger lift, a goal is to maximize flow time
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  – Like plunger lift, a goal is to maximize flow time
• If adequate rathole exits below perforations, valve can be opened whenever majority of fluid has fallen past perforations
  – Purposely run extended tubing below the perforations into an extended rathole
  – Alternatively oversize pump capacity to get the fluid removed quickly, minimizing the shut-in time
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• How long does it take for the fluid to fall past the perforations?
  – A good topic for another meeting
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