Hydraulic Diaphragm Insert Pump

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Outline

- Project Needs
- Background
- Solutions
- Field Results
- Conclusion
Project Needs

• ConocoPhillips San Juan operates approximately 10,000 gas wells

• A significant number of wells are < 6,000’ and < 100 BBLD

• Approximately 11% of well are lifted by rod pumps
Project Needs – a pump capable of:

- Deploy/Retrieve without conventional pulling unit
- Deploy in 2-3/8” tubing – vertical or horizontal wells
- Safe and consistent with environmental objectives
- Improved System Reliability (rod parts, tubing wear, piston wear, rod pound, etc.)
- Max gas rates by pumping off – no damage to pump
- Surface driven without electricity
Background – Diaphragm Pump Advantages

- Well fluid isolated from moving parts
- No gas locking issues
- Very good solids handling
- Positive Displacement
- Low net positive suction head
Background – Operation

- **Hydraulic lines** – concentric coil tubing or plastic
- **Power section** – powers the hydraulic section of pump
  - 2-3/8” production tubing or larger
- **Reservoir** - Communicates power fluid to diaphragm
- **Casing**
- **Diaphragm section** - Pumps the well fluid
- **Seating Nipple** – land in any standard “no-go” nipple
Background – Operation
Solutions – Current 2-3/8” Insert Capabilities

Hydraulic Diaphragm Insert Pump Work Window
(2 3/8 tubing insert capabilities)
Solutions – “Rigless” deployment

- Concentric steel coiled tubing: .75” inside of 1.5”
- Once “married” – single string pull and run
- One day turn around – pull and run pump

Concentric Coiled Tubing  Plastic Dual String
Solutions – Deploy in existing 2-3/8” tubing

• Standing valve deployed in 2-3/8” tubing
• Production tubing loaded with water - first barrier
• Pack off at well head - second barrier
• Casing does not need to be loaded with kill fluid
• Bottom Line: No need to kill the well
• All installs to date have been done with live wells
Solutions – Vertical, deviated, or horizontal

- Coiled tubing allows horizontal or deviated installs
- No reciprocating rods or rotating shafts in tubing
- No electrical cable
- Installed – Corkscrew with dog leg of 10° / 100 ft
- Installed – Deviated “S” curve
- To be installed – Horizontal dual lateral at 65°
Solutions – Safe, environmental objectives

- Dual barrier options available
- Sealed well head – no moving parts
- Extremely low profile (54”)
- Extremely small footprint
- Surface unit distanced from wellhead
- Multiple wells with one surface unit
Solutions – Reduced mechanical failure

- All moving parts isolated from well fluid / solids
- No reciprocating rods or spinning shafts at well head
- No down hole electricity / cable
- Diaphragm design eliminates fluid pound
- Diaphragm design eliminates rod / piston wear
- Solids – no barrel to plunger / piston interface with produced fluid
Solutions – Maximize gas/pump off

• Pump can run completely dry without damage
• Pump off indefinitely without pump damage
• No electrical motor down hole (cooling)
• Excellent resistance to gas locking / interference
• Extremely easy to adjust flow rate
Solutions – Surface unit power options

Compressor and Casing Unit units
(Compressed Gas, Propane, etc.)

Electric Power Unit

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Field Results – Well Case Studies

- 6 pumps currently running with COP
- Learning curve
- Longest run with COP is 6 months and running
- Longest run to date is 9 months and running
- Pumped off multiple wells
Field Results – Well A

Well A
(HDI Pump Installed 9/28/2007)
Conclusion – HDI Pump

- “Rigless” insert deployment – deviated or vertical
- Environmentally and operationally safe
- Eliminates or reduces mechanical failure
- Maximizes gas rates – pump off
- Multiple surface power options
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