Successful Auto Gaslift Implementation in PDO

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Outline

- Background & business case
- Auto Gaslift Technology
- Field Implementation
- Results & discussion
- Future work
- References
Background

- ‘B’ field is already developed with gas recycling.
- Around 40 wells drilled with 4 injectors
- Many surprises after drilling – Sand development, Channel connectivity, sand continuity, orientation, faults……
- 300 bar compressor and 4 gas injectors to inject 3 MM m3/d gas into two reservoirs
- Eventual gas blow down by 2Q 2012
- Reservoir studies indicated no artificial lift requirement for this field
- Few wells abandoned due to poor sand development
‘B’ Field
‘B’ Field
Field Production

- Average oil rate 60-70 m³/d with some wells 150 m³/d
- Around 20 wells main contributors
- GOR ranging from 40-2000 m³/m³
- Many wells dying due to depletion, gassing out due to recycling – major production challenge
- High CO₂ in the gas calling in for duplex SS pipelines
- Gaslift would require extensive pipeline network at high cost and not planned
Gaslift is the ideal mode of lift for this field (high GOR, fluctuating rates..)

Auto gaslift was proposed as an innovative alternate to conventional gaslift

Gas pressure in the reservoir being maintained by gas injection

Completions can be re-used elsewhere

Installation relatively simple

Cost effective ($400 K + hoist cost for recompletion)

6 wells identified
Auto Gaslift concept
Challenges

- Auto gaslift was never done in PDO
- Very tough field conditions
- Formation highly sensitive to workover fluids
- No success in stimulation
- Hoist crew with little experience in intelligent completions
- Stringent contract regulations
Auto Gaslift Technology

Pressure Drop vs. Gas Flow Rate: 3-1/2 HVC GL
Pupstr = 22200 kPa  Temp = 95 C  Gas S.G. = 0.70

Note: These results are estimates only and have not been calibrated or confirmed. They are to be used for information purposes only.
Auto Gaslift Technology

Control lines feed through

Surface hydraulic pump

Encapsulated control lines

ICV cross section

Accu pulse control system

2011 Gaslift workshop
The Technology

Surface control of ICV

ICV Operation

Orifice
Nozzle (Movable)
Collar (Static)
Arab-D Gas
Hanifa Production
Choke performance model

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B – XX Techlog
Auto GL completion in B-XX

Poil = 200 bar
Pgas = 240 bar
Qoil before quitting = 15 m³/d

B-XX Re-Completion with AGL

SSSV @ ~ 50 mTBF

9 5/8” Casing, shoe @ 968.58 mTBF

Perforation: 2628-2637 mTBF
BLAST JOINTS TO COVER 10M ABOVE & BELOW PERFS
SPECIAL PROTECTION FOR THE CONTROL LINE TO PROTECT AGAINST EROSION ACROSS PERF INTERVALS & SSD
Perforation: 2742-2747 mTBF

Oil

Gas

SSD @ 2580 mTBF
7” WD packer @ 2600 mTBF
SSD @ 2615 mTBF
ICV @ 2700 mTBF
L/N with Blanking plug @ 2720 mTBF
SSD @ 2580 mTBF
SSSV @ ~ 50 mTBF

9 m

5 m

7” Casing, shoe @ 2917 mTBF
Field implementation

- Good support from the vendor
- Re-completed the wells as per plans – no surprises!
- Oil zone re-perforated to improve efficiency
- Activated the gas zone and flowed for clean up, plug installed and took the flow through ICV (100% open)
- Opened the oil zone
Field implementation

- It takes 1-2 weeks for stabilizing the well
- ICV tuning for controlling the gas injection into the tubing
- PLT and multi rate well testing for production optimization
- Function test ICV once in a year.
Field implementation

**Well Trends during start up**

**After Stabilization**
Sensitivity analysis on GOR

Reservoir GOR

Auto Gas Lift GOR

Inflow (IPR) v Outflow (VLP) Curves

Variables

\( \text{GOR (m3/m3)} \)

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PVT Method

- Black Oil
- Fluid Oil
- Flow Type: Tubing
- Well Type: Producer
- Artificial Lift: None
- Lift Type
- Predicting Pressure and Temperature (offshore)
- Temperature Model: Rough Approximation
- Rate
- Inflow Type: Single Branch
- Completion: Cased Hole
- Gravel Pack: No
- Gas Coating: No
- Reservoir Model: Vogel
- Relative Permeability: No
- Formation FI: 0.61936 (STB/day/psi)
- Absolute Open Flow (AOF): 724.2 (m3/day)
Results

- All the wells delivered as expected
  - 1.3 MM USD per well for recompletion with AGL
  - 40% increase in total field production
  - Significant capex saving
  - Stable well performance
  - Reduced HSE exposure
  - Minimum well interventions
Conclusions & Recommendations

- Auto gaslift proved successful in B field
- One more candidate field identified for full field implementation
- It is beneficial to have an ICV in the oil zone also
- Operations are relatively simple
- More fields under review for potential application
- Potential for game changer
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