Artificial Lift R&D Council

2021 Gas Lift Virtual Workshop

June 7-11, 2021

Intermittent Gas Lift

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Agenda

- **Overview of Intermittent gas lift (IGL)**
- **Injection control methods: intermittent gas lift**
- **Differences: Gas-Assisted Plunger Lift (GAPL) and IGL**
- **Intermittent Gas Lift Equipment**
- **Optimization benefits of intermittent gas lift**
- **Key takeaways**

OVERVIEW

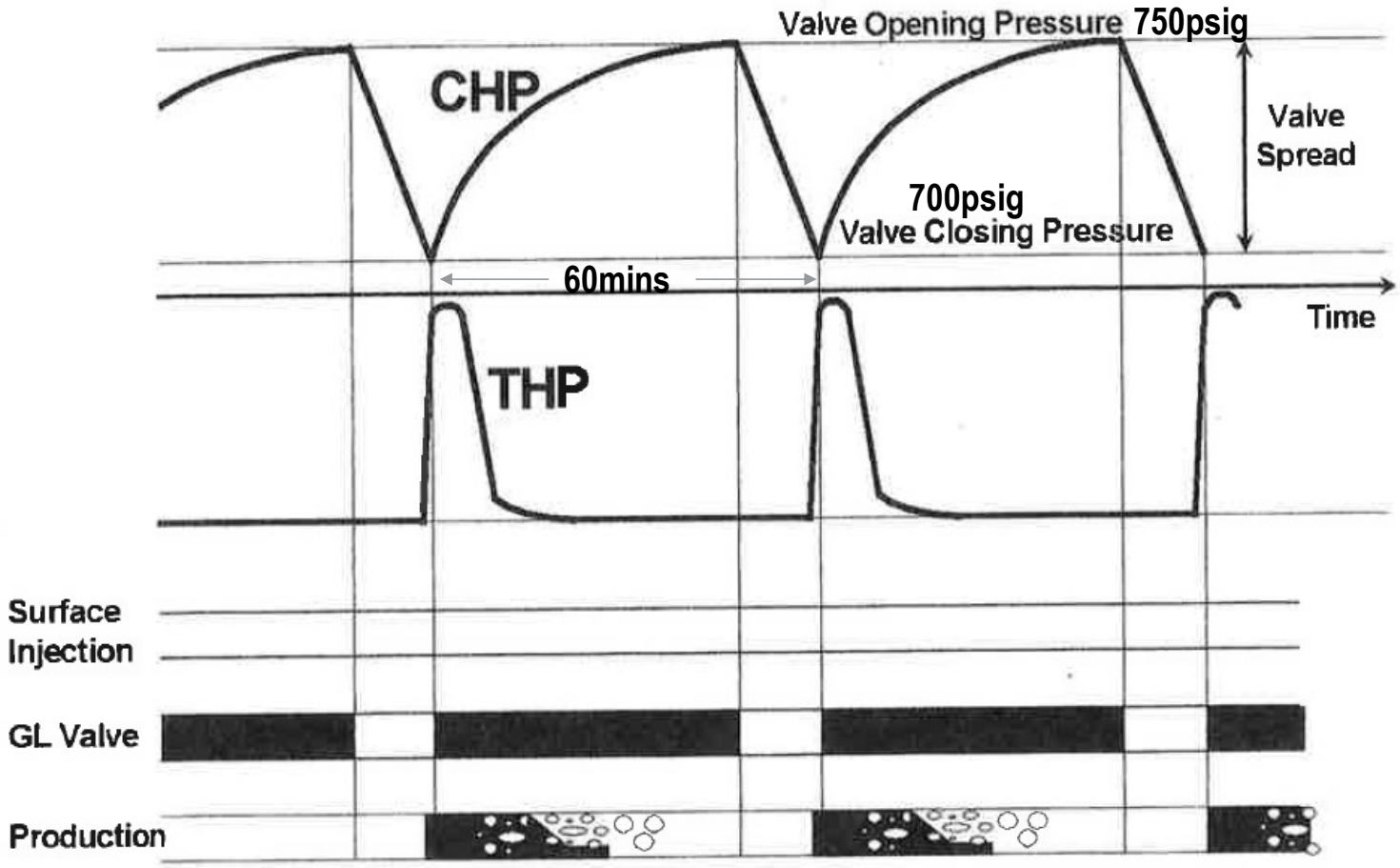
INTERMITTENT GAS LIFT

Intermittent gas lift conditions:

- Production on continuous gas flow <350 BFPD
- Need to reduce the injection GLR
- Other methods of lift are uneconomic
- Low GLR plunger lift not feasible
- FBHP cannot support vertical flowing gradient

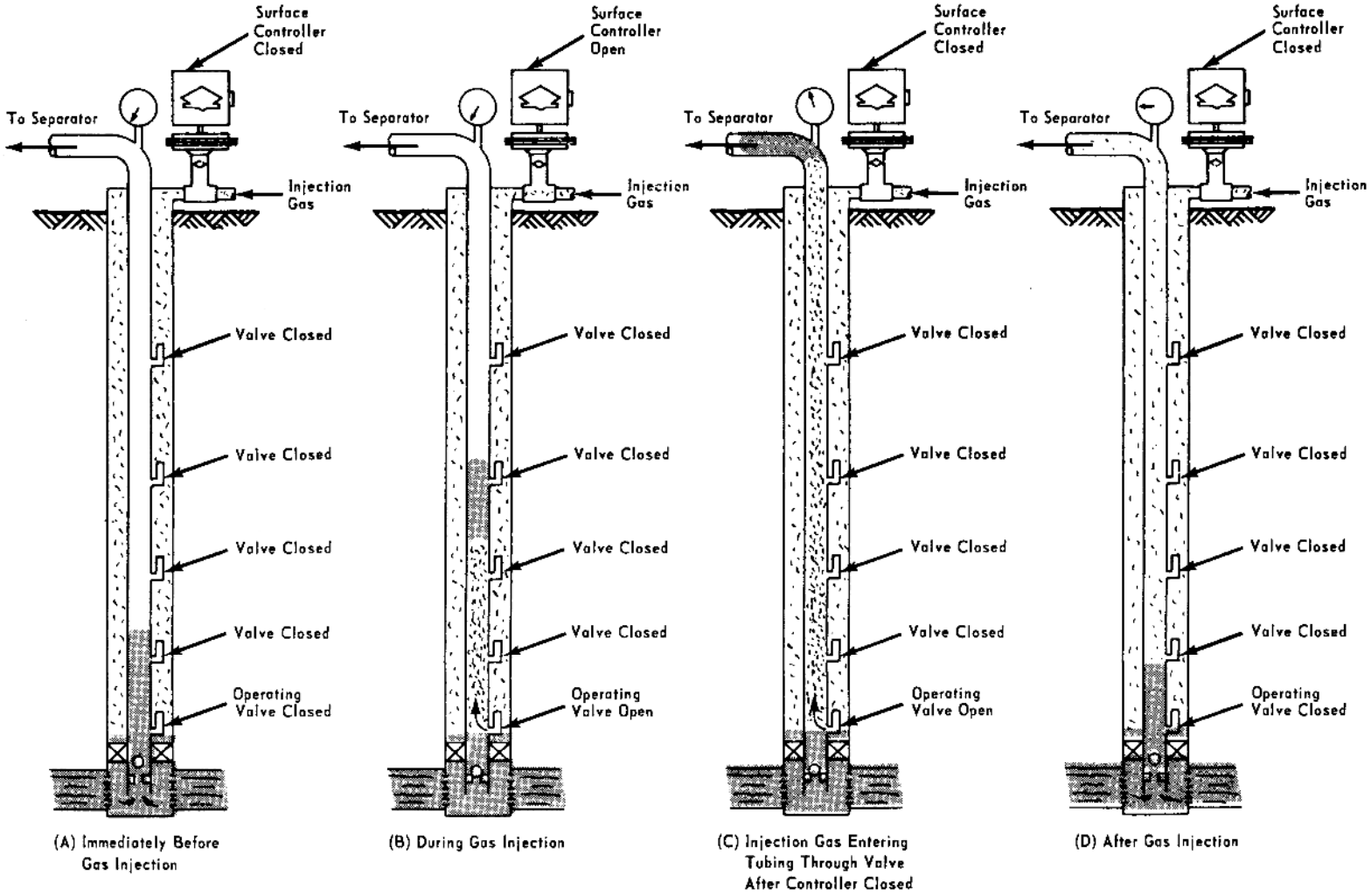
Intermittent gas lift, what is it?

- Method of controlled gas injection
- Requires high instantaneous gas volumes
- An “on-off” need for high-pressure gas
- Default lift method to continuous flow
- Method where a packer is essential



Description of the intermittent cycle for choke control

Intermittent Gas Lift Operation Description



GAS INJECTION CONTROL METHODS

INTERMITTENT GAS LIFT

Time cycle intermittent injection control

- Controller opens and closes gas injection
- Injection delivered consistently each injection cycle
- Motor Valve: pneumatic or electronic actuator
- Intermittent cycle controlled at the surface
- Intermitter controls rate, injection duration, frequency

Surface injection choke control

- “Fixed” or “adjustable choke”
- IGL influenced by IPR and valve
- Daily injection frequency cycles are controlled
- Casing-tubing annulus used as gas storage
- IPO or a Pilot-operated valve used

DIFFERENCE BETWEEN GAS-ASSISTED PLUNGER LIFT (GAPL)

AND INTERMITTENT GAS LIFT (IGL)

GAPL & IGL

Intermittent Flow

GAPL

- Operates with a screen orifice on bottom in conjunction with a flow through bypass plunger
- Relies on the pressure differential created between the reservoir and the wellbore. A surface flowline valve is closed and opened to initiate an intermittent upward cyclical movement

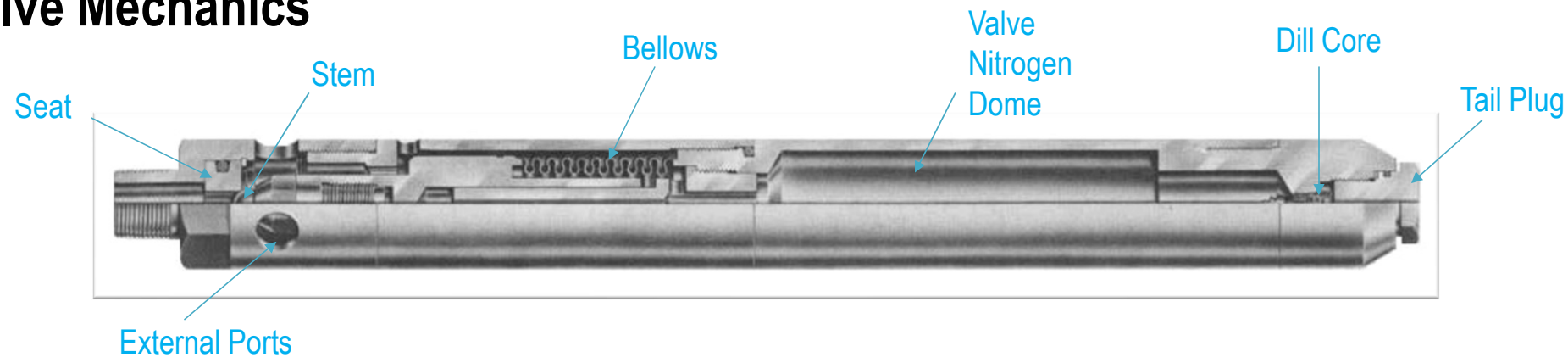
IGL

- Operates with an Injection Pressure Operated (IPO) gas lift valve on bottom
- Relies solely on the expansion of high pressure injected gas to propel a liquid slug, above the point of injection to the surface
- No flowline shut in devices or surface flow controller is used

INTERMITTENT GAS LIFT EQUIPMENT

Injection Pressure Operated Valve (IPO)

Valve Mechanics



- Original CAMCO valve design
- Bellows is heart of valve
  - Welded bellows housing instead of just O-ring
- 316SS Material
- Multiple port sizes 3/16” – 5/16”

GAS LIFT INSTALLATION WITH SIDE-POCKET MANDREL

RECOMMENDED FOR INTERMITTENT GAS LIFT INSTALLATIONS

Advantages of a Side-Pocket Mandrel

- Cost savings: valves installed without intervention
- Conversion ease from continuous to intermittent
- IPO or a Pilot-operated valve interchangeable
- Wells produced to less than 15 stb/d
- Economically feasible option to rod-pump

WHY AN IPO VALVE IS USED INSTEAD OF A SCREEN ORIFICE FOR INTERMITTENT GAS LIFT

(BOTTOM OPERATING GAS LIFT VALVE)

Reasons not to use a screen orifice

- Screen orifice port size too small
- Surges and slugging effects are intensified
- Higher FBHP across the screen orifice
- Above issues are worsened with depths

OPTIMIZATION BENEFITS

INTERMITTENT GAS LIFT

Optimization benefits of Intermittent Gas Lift

- Maximum production at reduced injection volumes
- Maximum drawdown at lowest wellbore pressure
- Enhanced Liquid slug recovery per cycle
- Increased lift efficiency
- Minimize operating costs

Typical intermittent gas lift cycle

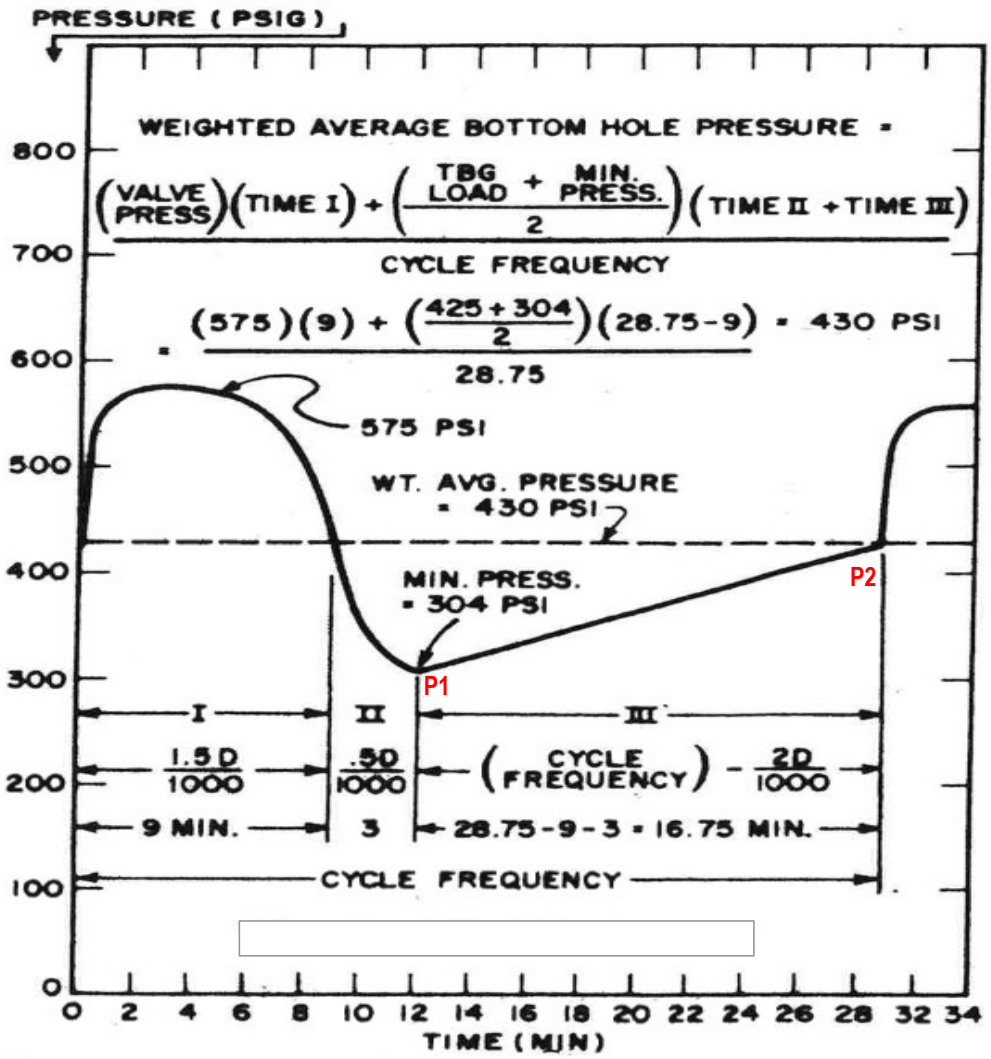
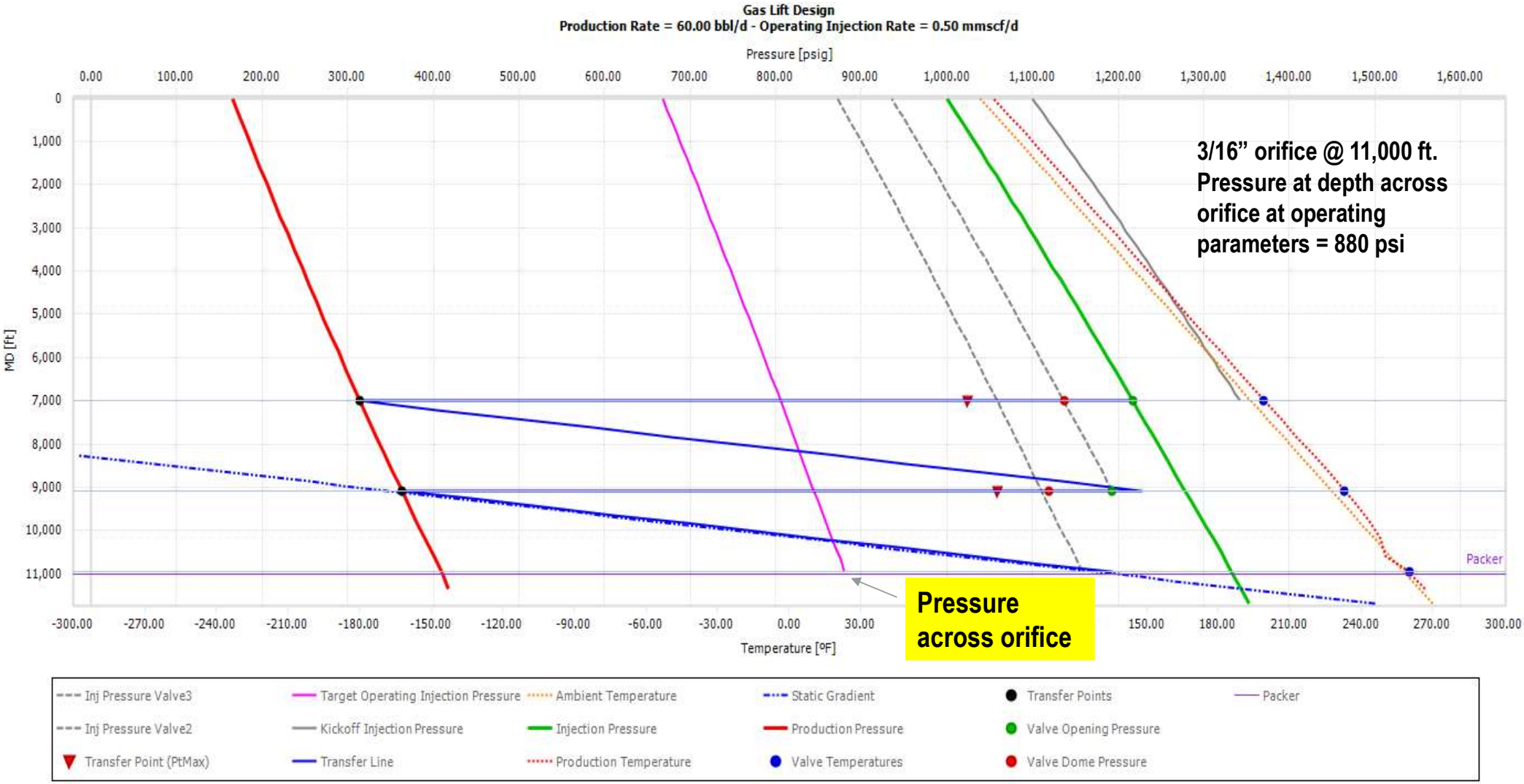
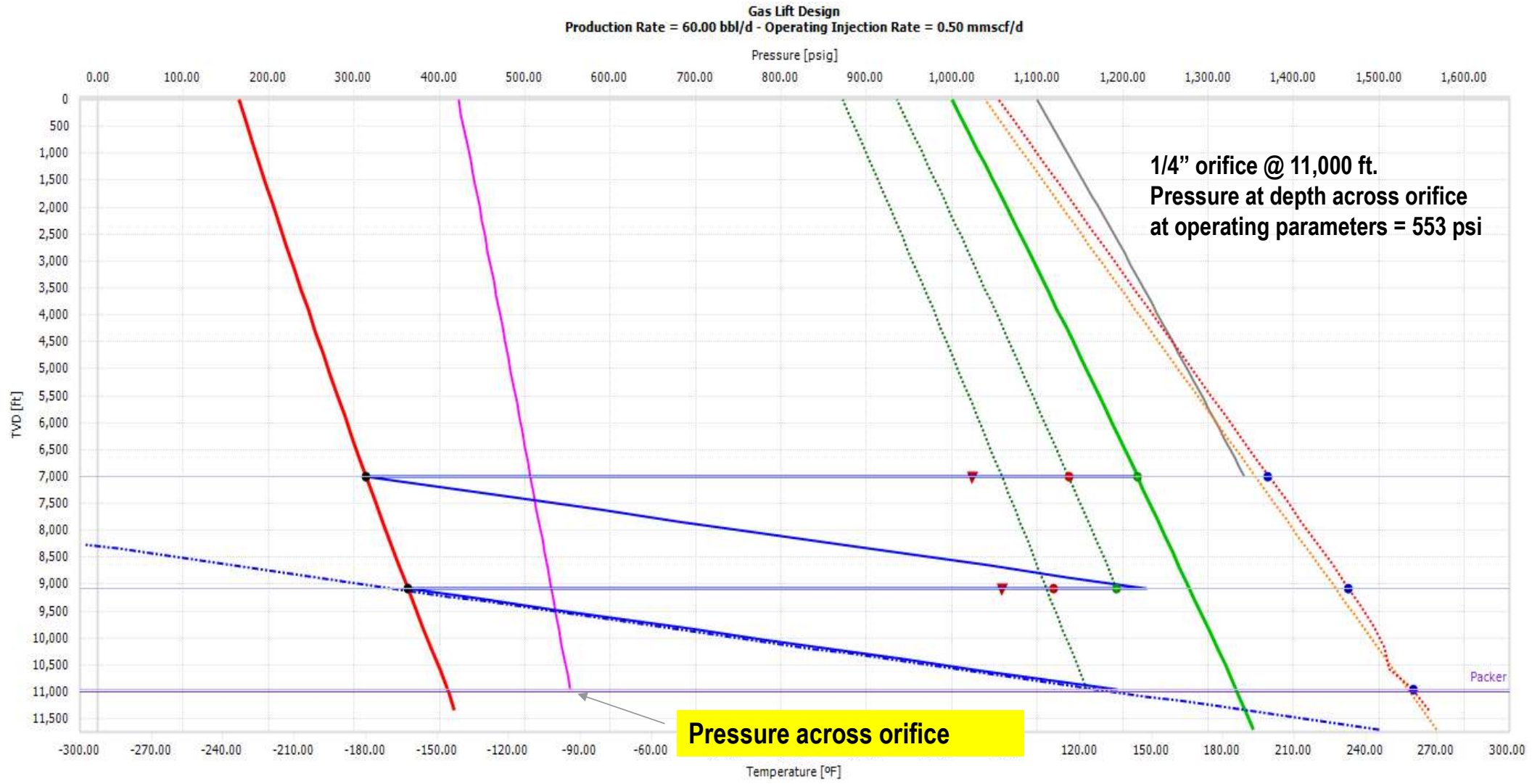


Fig. 3.4150 Time Periods and Weighted Average Flowing BHP for a Typical Intermittent Gas Lift Cycle (after Beadle,

The Technology of Artificial Lift Methods Vol.2A: Dr. Kermit Brown



SNAP: System Nodal Analysis Program


Gas Lift Design
Production Rate = 60.00 bbl/d - Operating Injection Rate = 0.50 mmscf/d
Pressure [psig]
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
1,000.00
1,100.00
1,200.00
1,300.00
1,400.00
1,500.00
1,600.00
TVD [ft]
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
5,500
6,000
6,500
7,000
7,500
8,000
8,500
9,000
9,500
10,000
10,500
11,000
11,500
1/4" orifice @ 11,000 ft.
Pressure at depth across orifice
at operating parameters = 553 psi
Packer
Pressure across orifice
-300.00
-270.00
-240.00
-210.00
-180.00
-150.00
-120.00
-90.00
-60.00
120.00
150.00
180.00
210.00
240.00
270.00
300.00
Temperature [°F]

Benefits of Intermittent gas lift:

- Increased reservoir drawdown and maximized production
- Reduced Lease Operating Expense
- Maintained with little user intervention
- Less lift gas volume needed
- Intermittent lift has few moving parts

Key Takeaways

Intermittent gas lift (IGL)

- GAPL installations are inefficient
- Intermittent installation carry IPO/PPO valves
- An installed packer is essential
- IGL is more efficient than GAPL
- Significantly less injection volumes using IGL
- Studies show production gains using IGL

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Thank You & Questions

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