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Unconventional Gas Lift

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ALRDC Gas Lift Workshop
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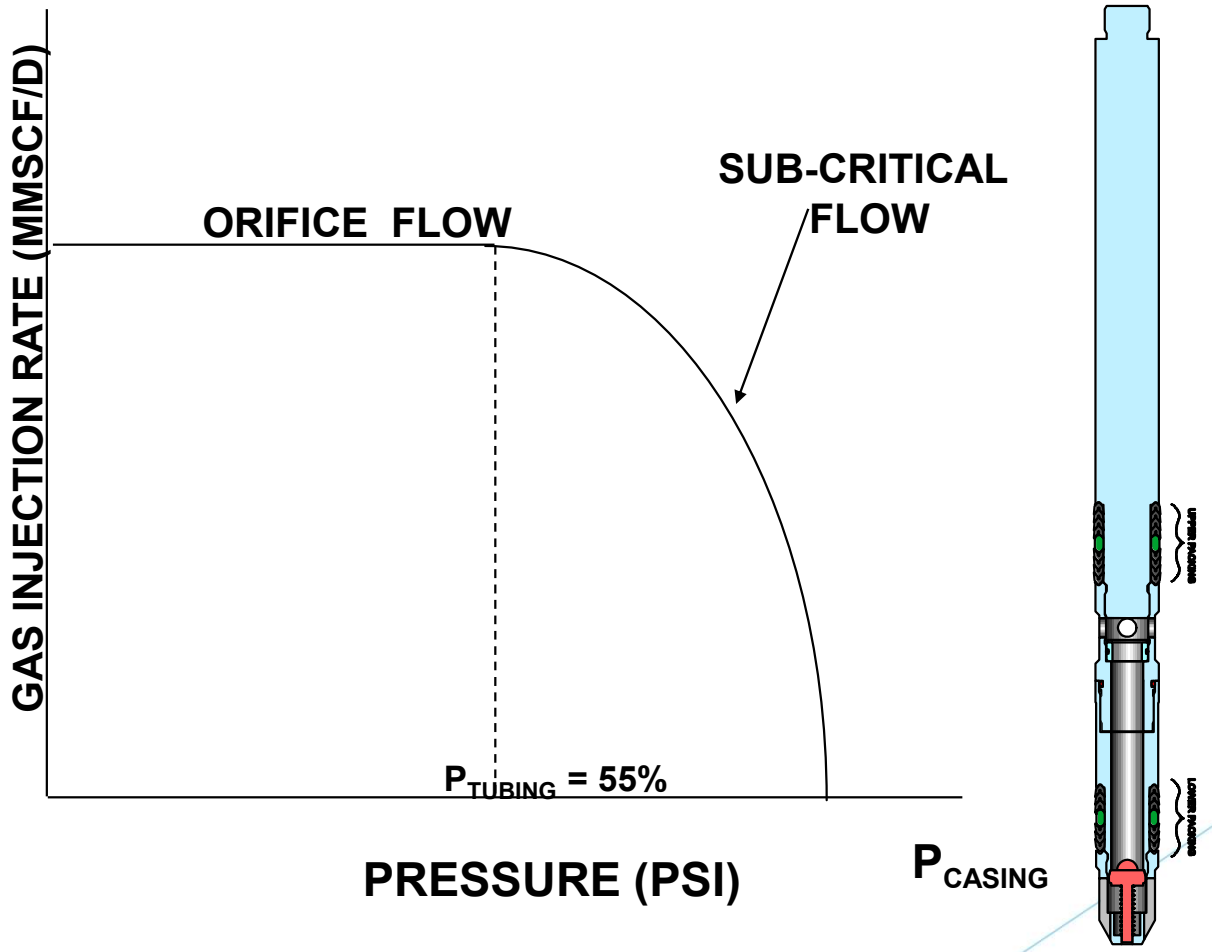
Section 4.5

True Valve Performance

Typical Performance of Orifice Valve



Typical Performance of IPO Gas Lift Valve

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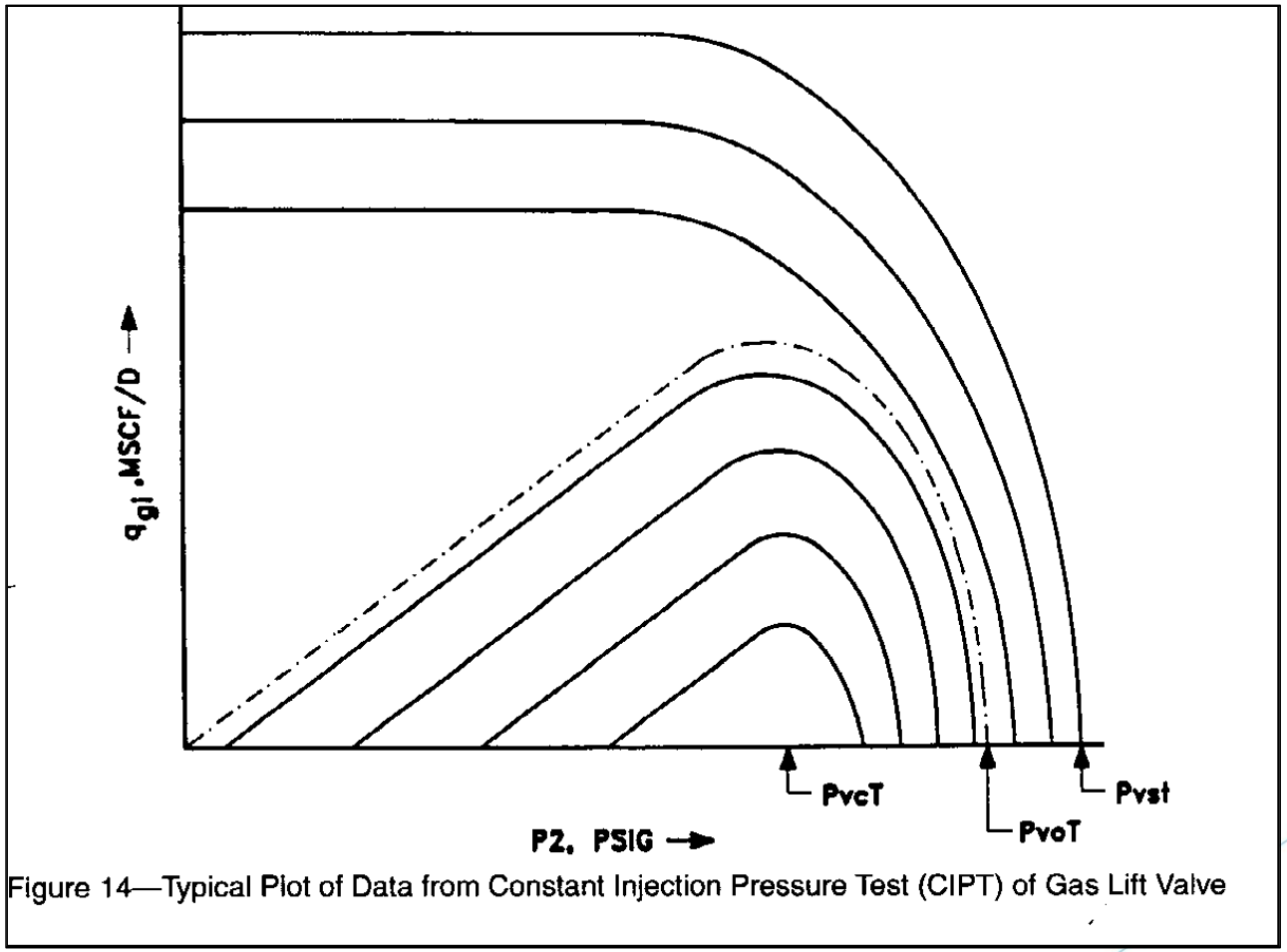

Figure 14—Typical Plot of Data from Constant Injection Pressure Test (CIPT) of Gas Lift Valve

Gas Lift Valve Sizing Methods

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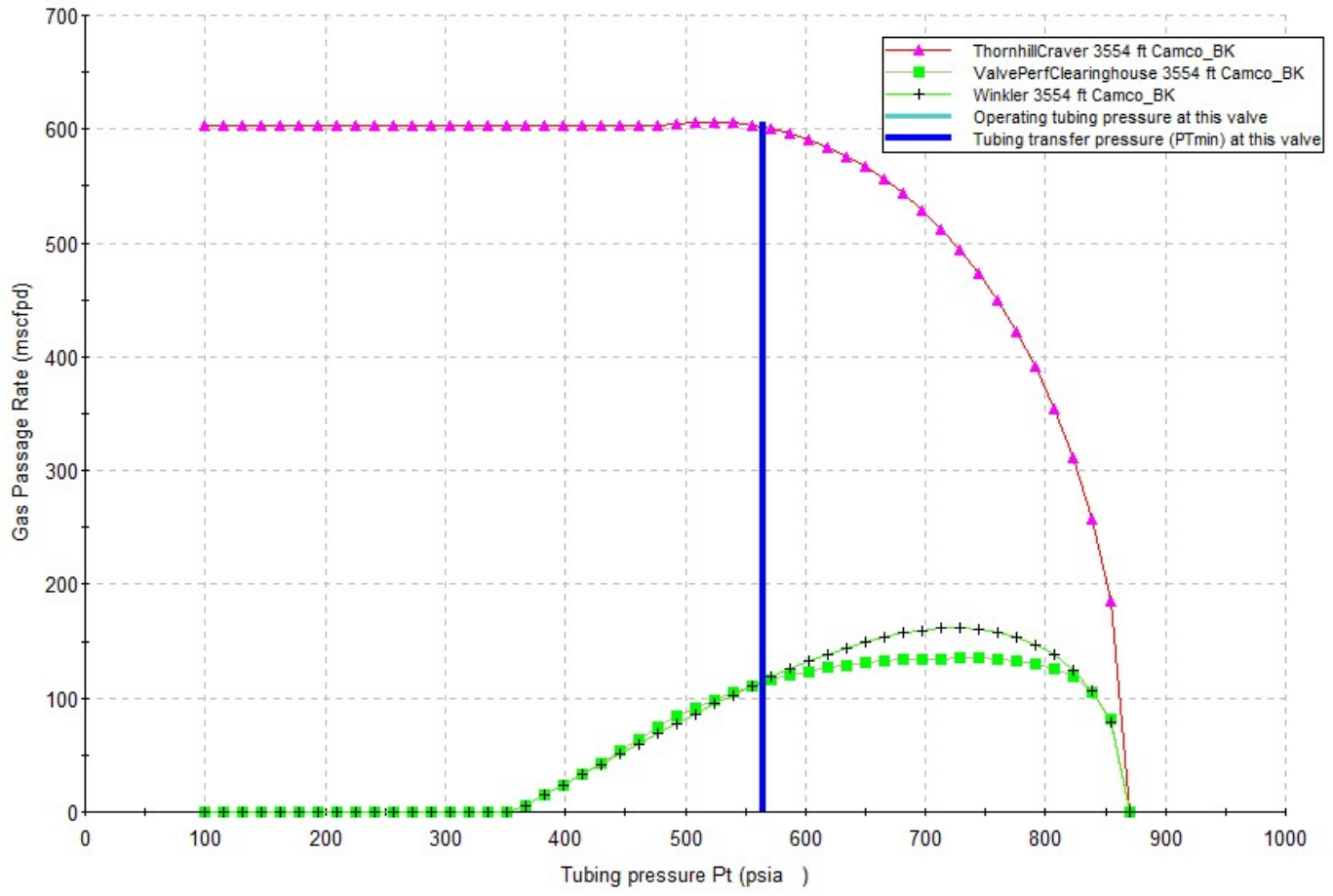
Correlation	Valve Type	Availability
VPC	All types	Proprietary
TUALP	IPO	Public Domain
Bertovic	PPO	Public Domain
API Simplified	IPO	Public Domain
Winkler-Eads	IPO	Public Domain
Thornhill-Craver	Orifice only	Public Domain

Compare Correlations



Benefits of True Valve Performance

- Better installation designs
- Quicker unloading & kickoff
- Equipment design improvements
- Easier troubleshooting

Valve Performance Clearinghouse

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Project Summary

- Consortium established in 1997.
- Full-scale testing of commercially-available gas-lift valves and development of custom correlations.
- COP member since 2004.
- 8 Member Companies.
- 4 Limited license-holders.

Benefits

- Provides true valve performance of virtually all commercially available gas-lift valves.
  - Key enabler for design, trouble-shooting and optimization of gas-lift installations.
- All 216 correlations available to any member company employee.
  - Note: Individual licensees pay $1700 per valve/port size combination.
- Proprietary software distributed to all member companies.
- Integrated with all major nodal analysis and design software.
  - Prosper, WellFlo, PipeSim, SNAP, WinGlue, WEM, OLGA.

Highlights

- 59 Valve models and 216 valve/port combinations tested since inception.
- Thousands of flow tests conducted.
- 2-3 new models tested each year.
- In 2015, administration shifted from Decker Technology to LSU.
- New flow loop at LSU.
- Greatly enhanced operating envelope at new test facility. (Higher rates and pressures.)

Participation and Contract

- $15K per year
- Cycles are annual starting January 1st
- One board meeting per year to review previous year's results and nominate next year's valves for testing. Held in Houston area at member facility.
- At-will termination. Following termination, renewal requires payment of following year's dues plus previous year's dues. ($30K total)

Dynamic Flow Loop

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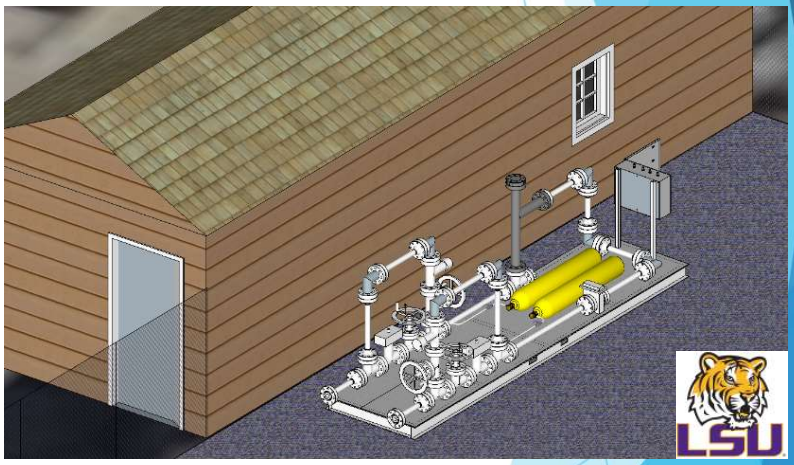


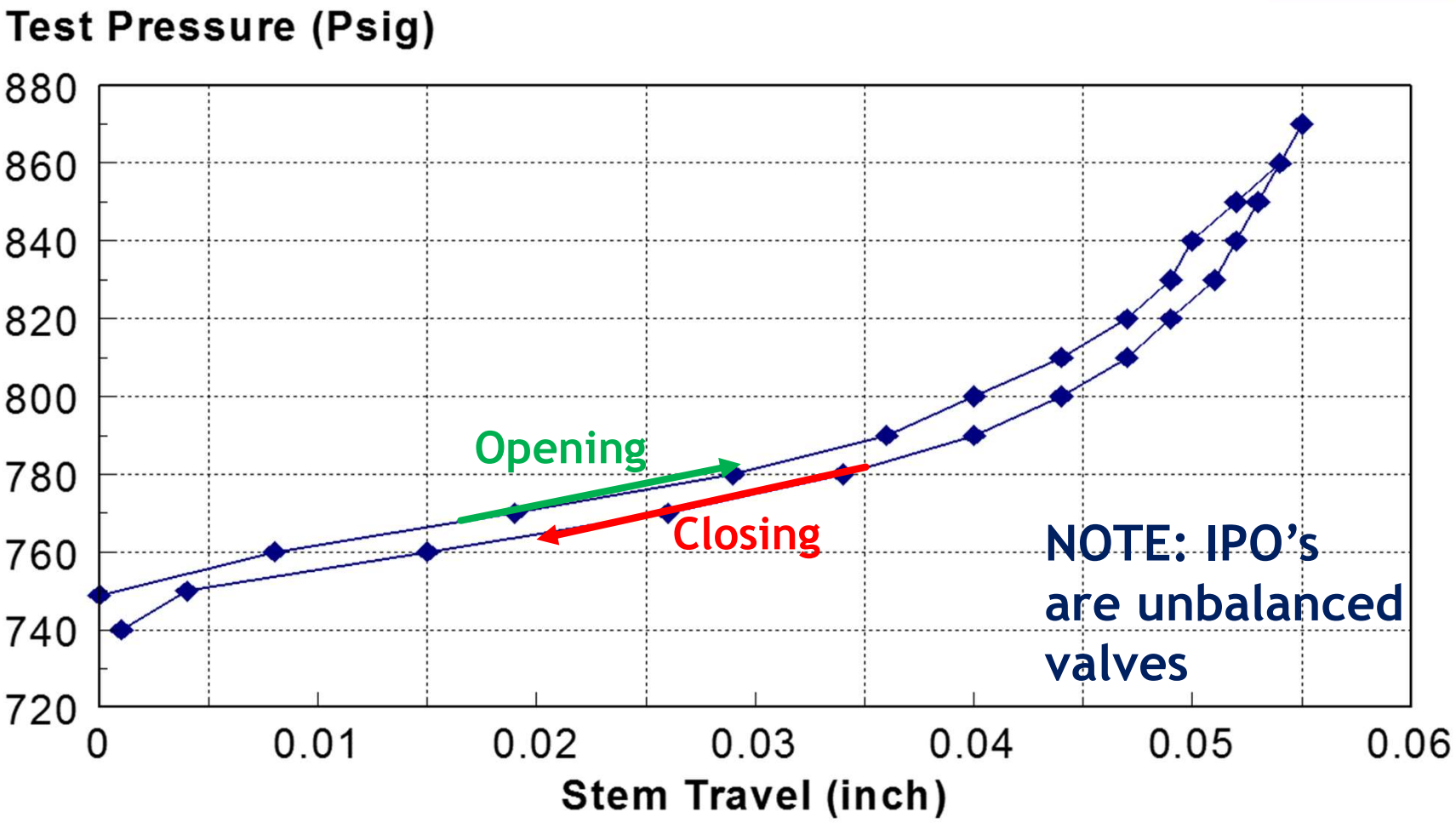
Key Operational Parameters

- Load Rate
- Stem Travel
- Flow Coefficient

Load Rate

- A measure of the valve stem's resistance to movement. (psi/inch)
- One of the MOST important GLV performance parameters.
- Nearly constant for a given valve model (i.e. BK).
- Slightly lower for used valves than new valves.

Typical Load Rate Test Data



Load Rates – Nitrogen vs Spring

- Load rates of nitrogen charged valves are a function of the set pressure.
- Load rates of spring loaded valves are nearly constant.
- Typically, spring loaded valves have much higher load rates than nitrogen charged valves therefore…

  For the same pressure conditions, nitrogen charged valves will come farther open than spring loaded valves.

Load Rates by Valve Type

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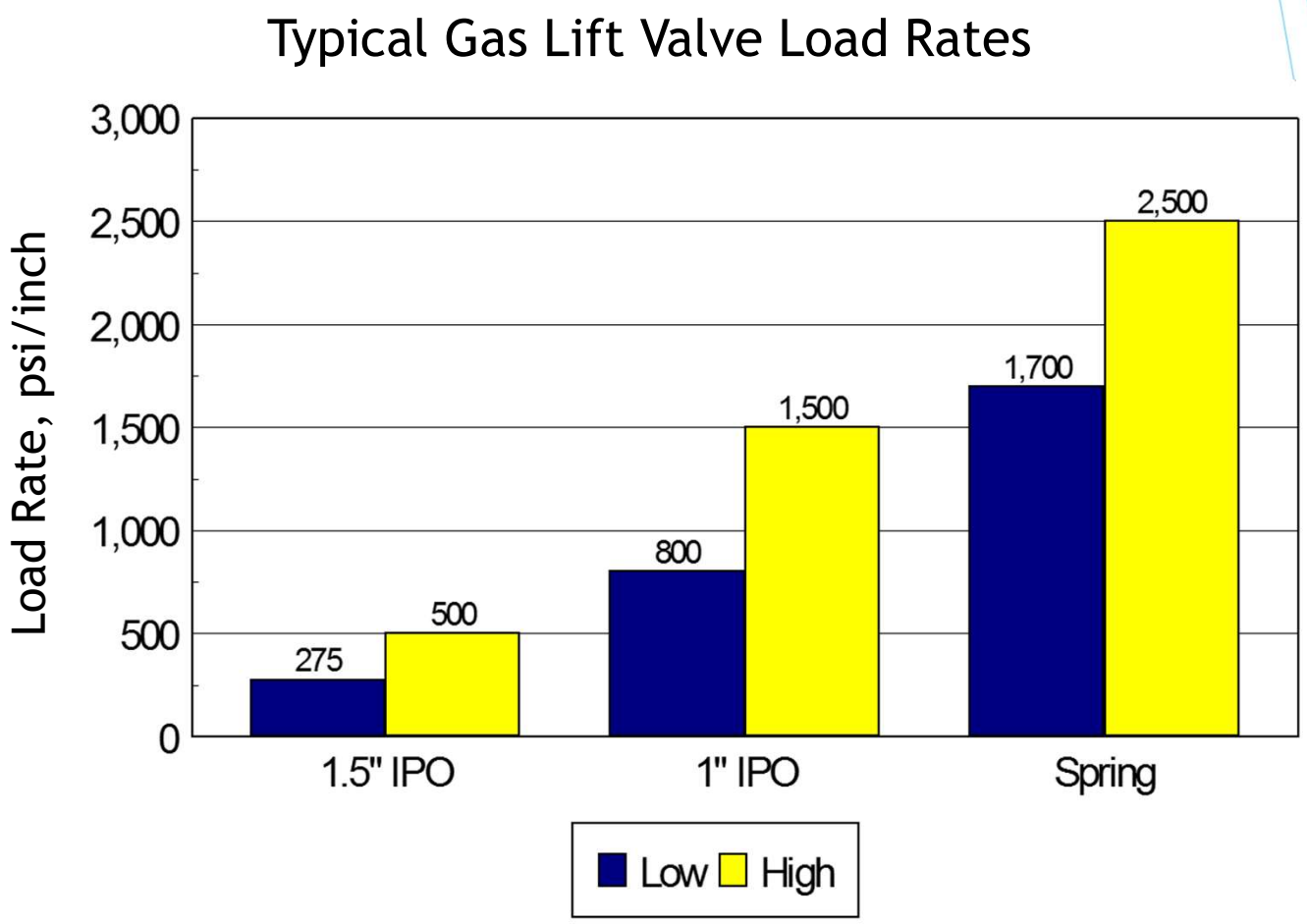
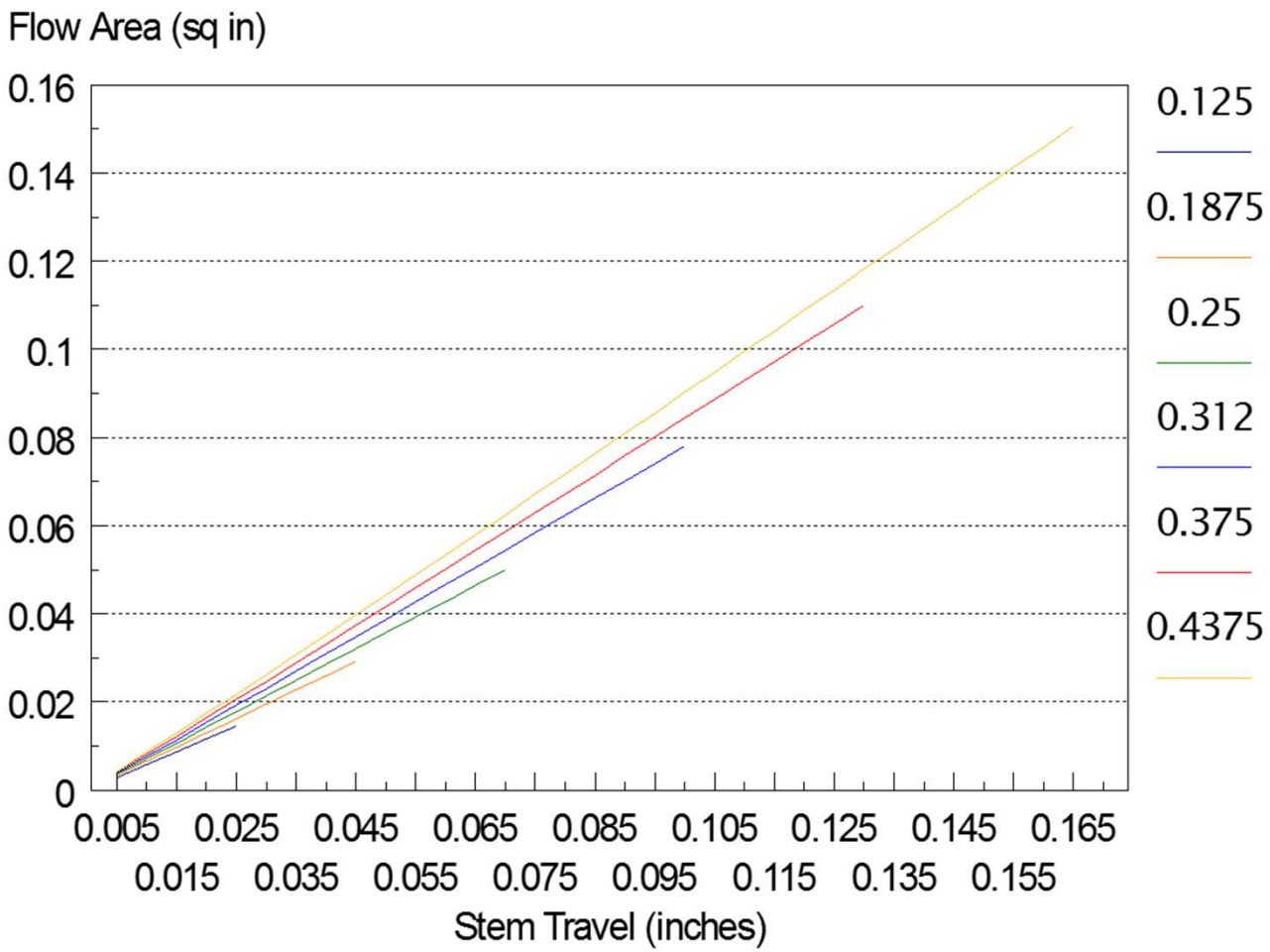


Effective Stem Travel

- Effective stem travel: The amount the stem can move away from the seat within the linear portion of the load rate curve.
- A function of set pressure for valves with internally charged bellows.
- The higher the set pressure, the lower the effective stem travel.
- For externally charged bellows, the effective stem travel is constant regardless of set pressure.

Stem Travel for Full Open Port



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Bellows Stacking

- Occurs when the outer convolutions come in contact with each other.
- Causes load rate to increase dramatically.
- Reduced stem travel and throughput.
- Once lost, effective stem travel can not be recovered.

Internally Charged Bellows

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Damaged Bellows After Aging

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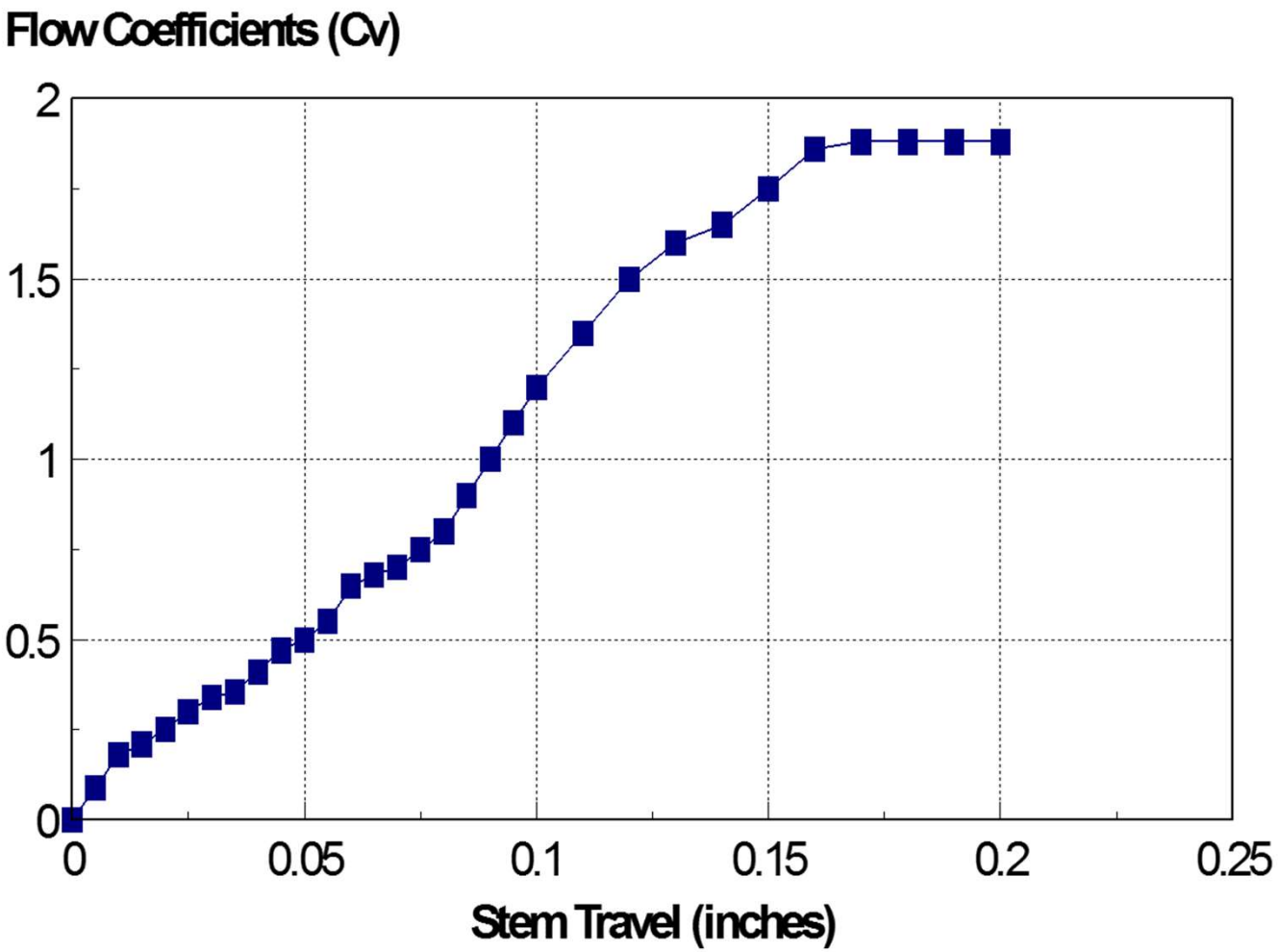
Flow Coefficients

- Measure of the flow capacity
- A function of port size and stem travel.
- Constant regardless of whether valve is new or used.
- Flow coefficient test also determines when valve “chokes”.
- High set pressures may cause outer convolutions to balloon, limiting effective stem travel.

Typical Flow Coefficient Curve



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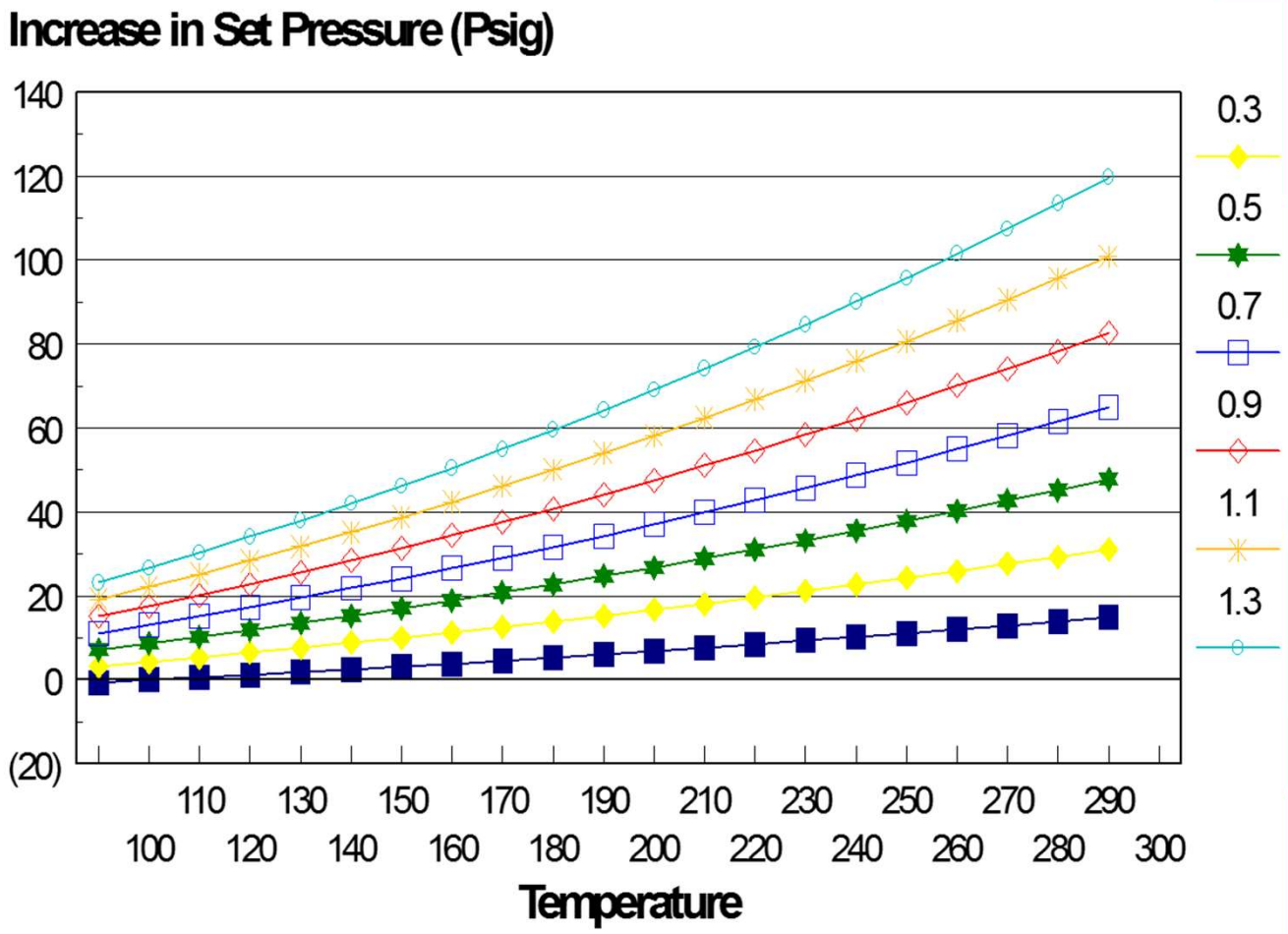
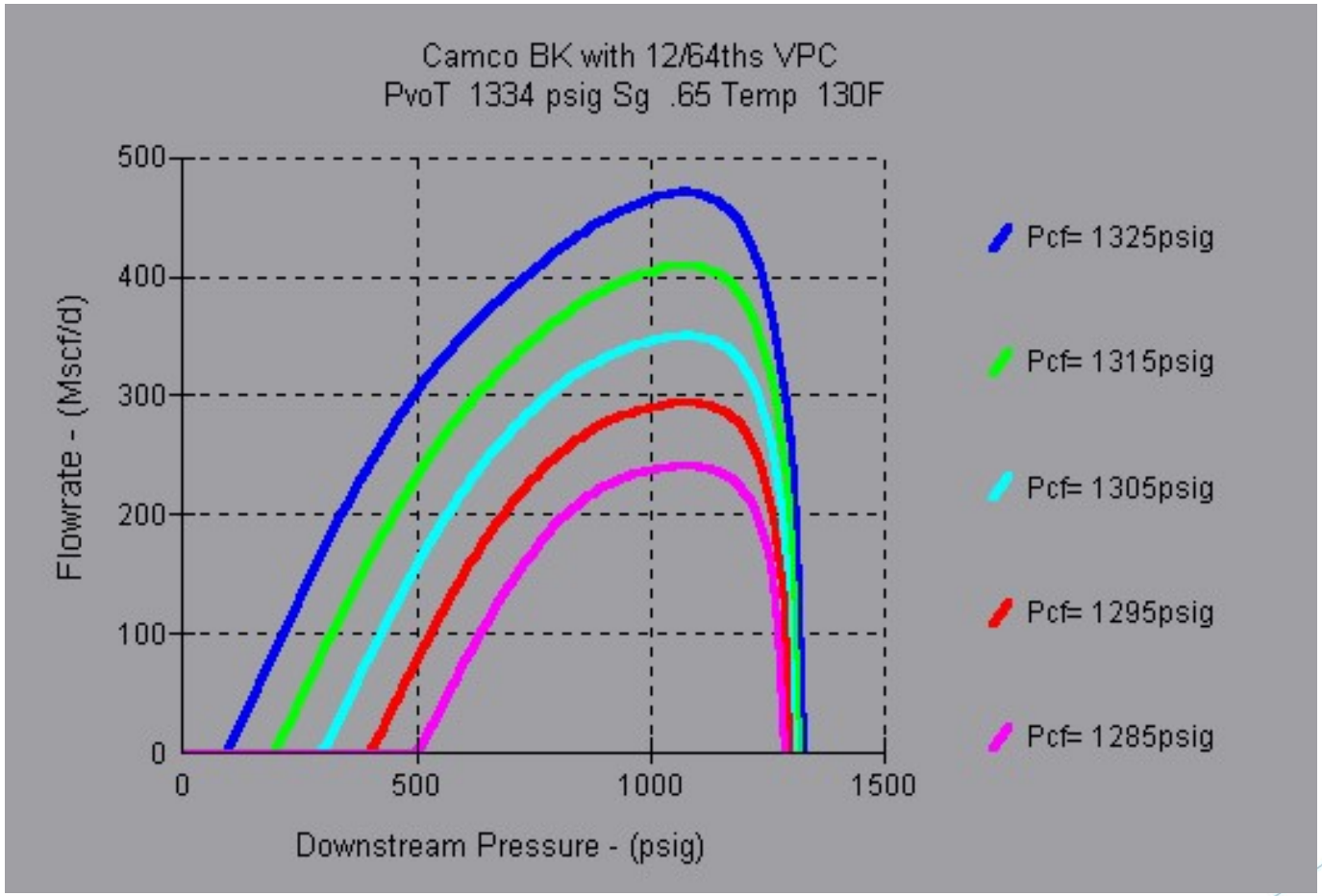
Vibration Dampening

- GLV's tend to "chatter" when throttling. The liquid fill in the dome is used to suppress the chatter.
- The liquid fill is usually Silicone fluid. Silicone fluid if very temperature sensitive and expands at five times the rate of water.
- Silicone fluid in dome WILL increase set pressure more than normal temperature correction.
- The more silicon fluid, the more the set pressure will increase.

Silicone Fluid vs. Set Pressure



Top Valve with Range of Injection Pressures



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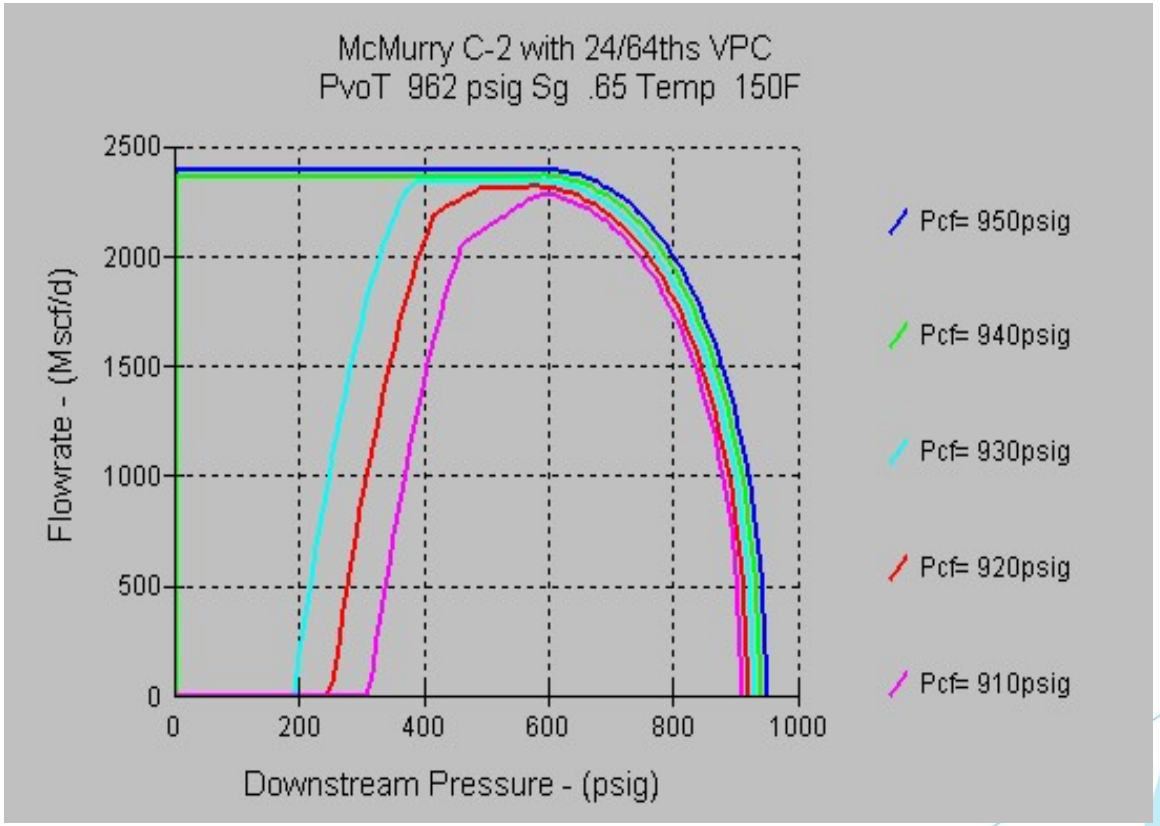
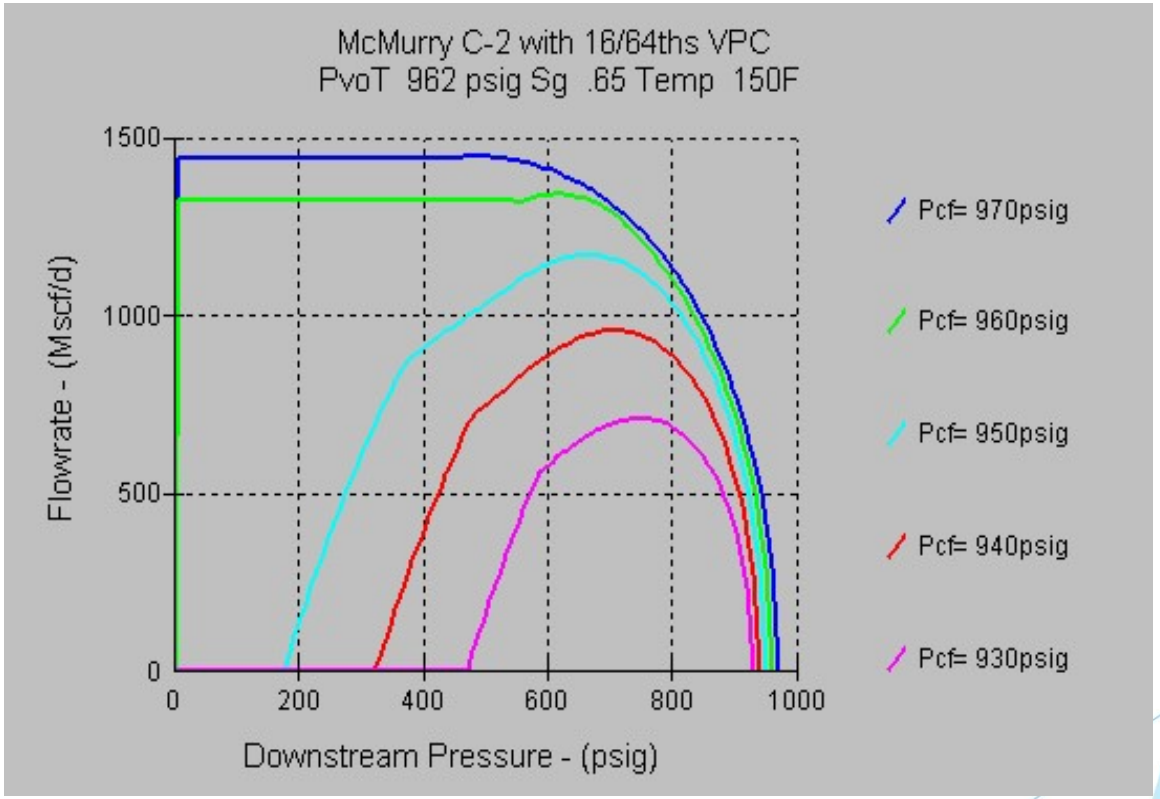
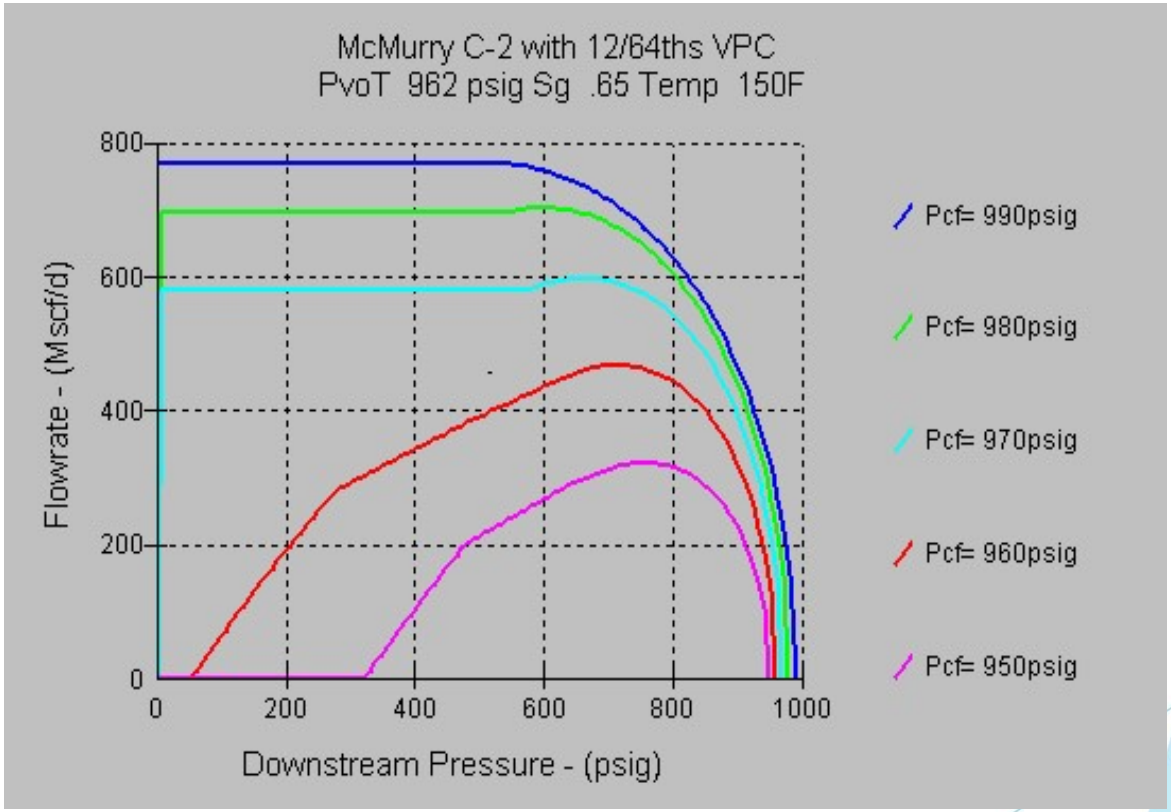
Sensitivity to upstream pressure: port = 24/64



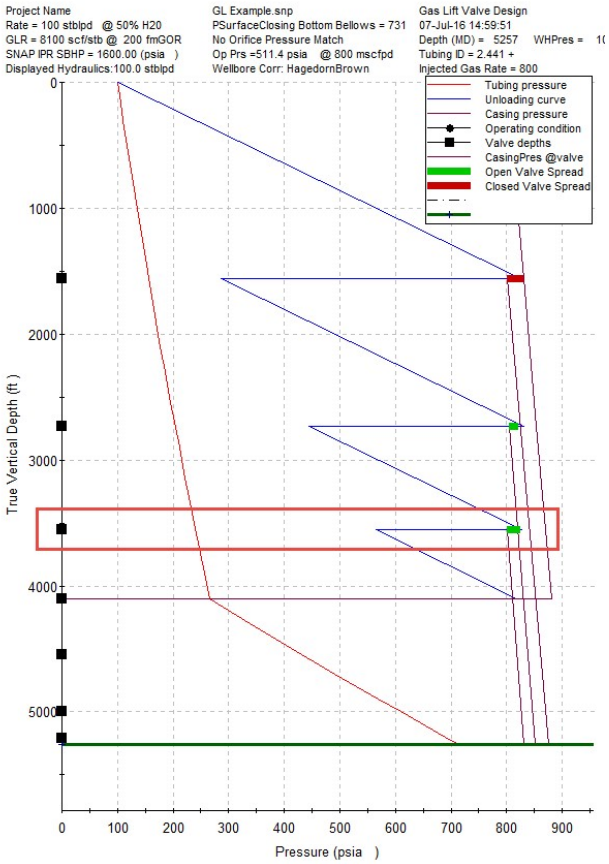
Sensitivity to upstream pressure: port = 16/64

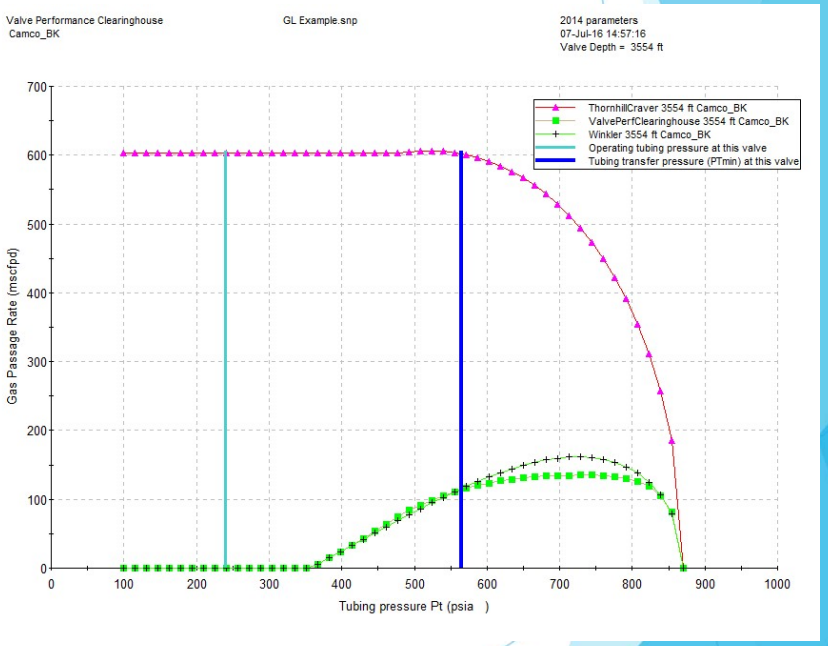


Sensitivity to upstream pressure: port = 12/64

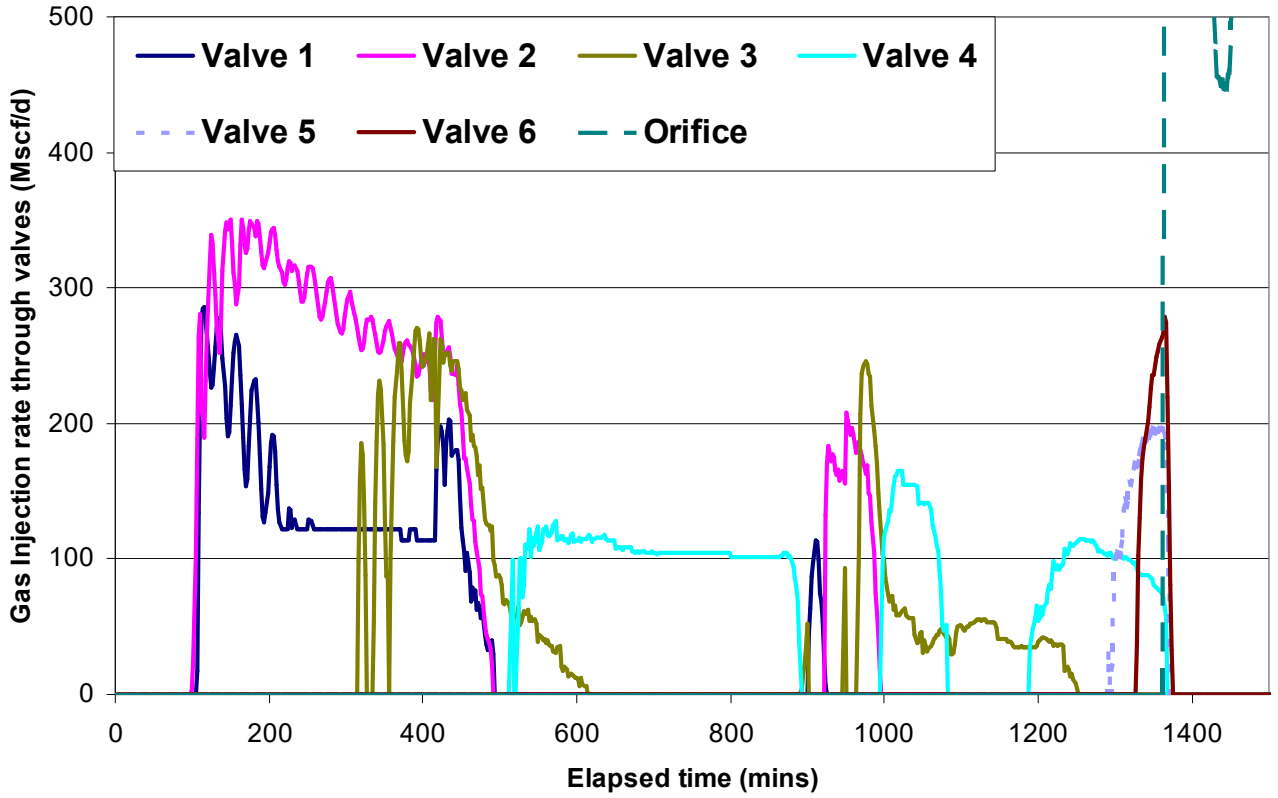


Is this valve open?

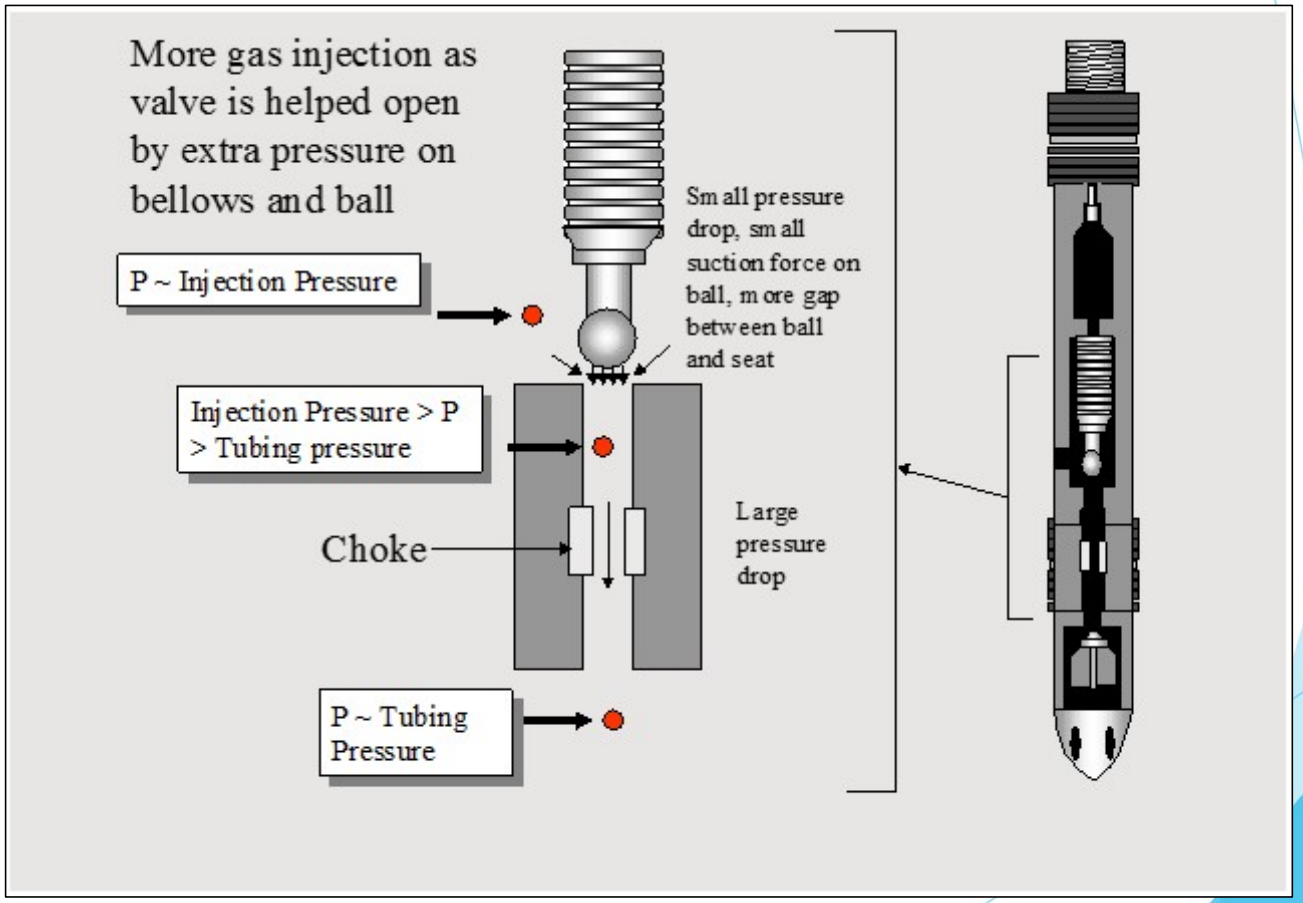




Unloading Valve Performance



Choked IPO Valves



Choked IPO Valves

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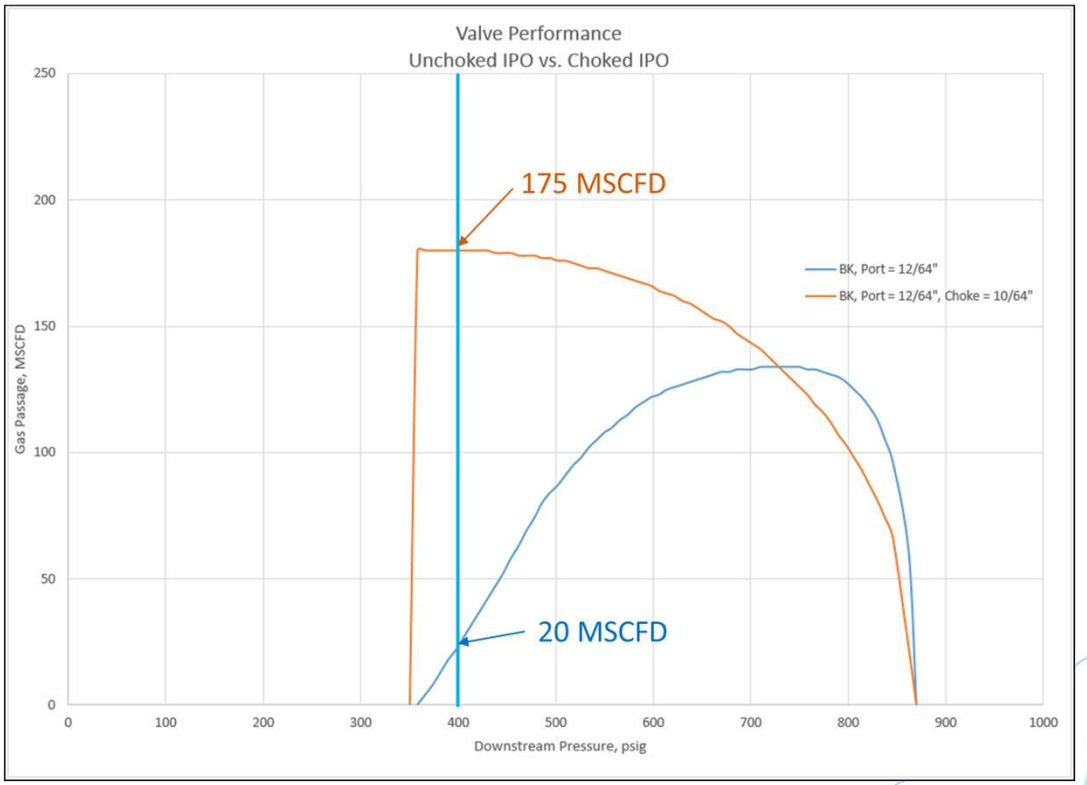

The upward movement of the valve stem with increasing tubing pressure is referred to as:

A. Throttling
B. Chattering
C. Stacking
D. Unloading

For a given port size, an IPO valve will have greater throughput than an orifice.

A. True

B. False

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Which correlation provides the most accurate gas passage predictions for an IPO valve?

A. Thornhill-Craver
B. Bertovic
C. TUALP
D. Winkler-Eads
E. API Simplified
F. VPC

Which valve will have the higher load rate?

A. BK with P_{tro} = 1000 psig

B. BK with P_{tro} = 1200 psig

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For a given port size and set pressure, which will have the greatest effective stem travel?

A. Camco BKF-12
B. Camco BK
C. Camco R-20

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A new valve will have a higher flow coefficient than a used valve.

A. True

B. False

Which of these will improve an IPO valve's gas passage?

A. Smaller bellows area
B. Smaller port size
C. More liquid fill in dome
D. Downstream choke
E. Bellows stacking

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Break

- Stretch and move!
- Please return in 15 minutes.

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