PRESSURE SURGES IN PIPELINE SYSTEMS

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Pressure Surge - Potential Consequences
Pressure Surge - Causes

Flow controlling elements
• Valve Closure (Control/Isolation/Relief)
• Pump starting and stopping
• Turbine starting and stopping
• Reciprocal Pumps

Other causes
• Pipe Priming
• Phase Change
Pressure Surge

\[ \Delta H = \Delta \]  \( \Delta H : "J"\ oukowski\ Head" \\

\[ = \frac{2}{T} \]

\( T : \) Pipeline Period

\[ \Delta H \]  \( v=0 \)

\[ c \]  \( \text{(Steel / DI): 1100 m/s} \]

\[ c \]  \( \text{(PE): 400 m/s} \]

\[ T: \]  

\( \sim 0.02s \) for 10m steel pipe  
\( \sim 0.2s \) for 100m  
\( \sim 2s \) for 1000m  
\( \sim 20s \) for 10km

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Pressure Surge - Mitigation
Pumped Pipeline System

Pump Trip – No Surge Protection

Sub-atmospheric conditions
Pumped Pipeline System - Water Supply

Pump Trip – With Surge Vessel
Pressure Surge - Check Valve Slam

- SWING CHECK
- RECOIL SWING CHECK
- RESILIENT HINGE / RECOIL RESILIENT HINGE
- DUAL PLATE
- NOZZLE CHECK
Pressure Surge - Pumping Systems
Check Valves – Dynamic Response Evaluation/Comparison

www.valmatic.com
Pressure Surge - Surge Analysis
Specialist Computer Modelling
Pressure Surge - Surge Analysis

Surge Analysis Engagement Tips

1. Reputation and Experience

2. Project Stage

3. Fixed Price - so fix scope.
   - Pipeline topography and route
   - Design flow rates
   - Surge criteria / system constraints
   - Presentation of results
Pressure Surge - Surge Analysis

Surge Analysis Engagement Tips

4. Risk assessment review at enquiry stage

5. Fixed vs. variable wavespeed modelling

6. Understand assumptions made and their sensitivity impact

7. Hold conversations and ask questions!
Pressure Surge

RECOMMENDED READING:

Fluid Transients in Pipeline Systems
Second Edition
A R D Thorley