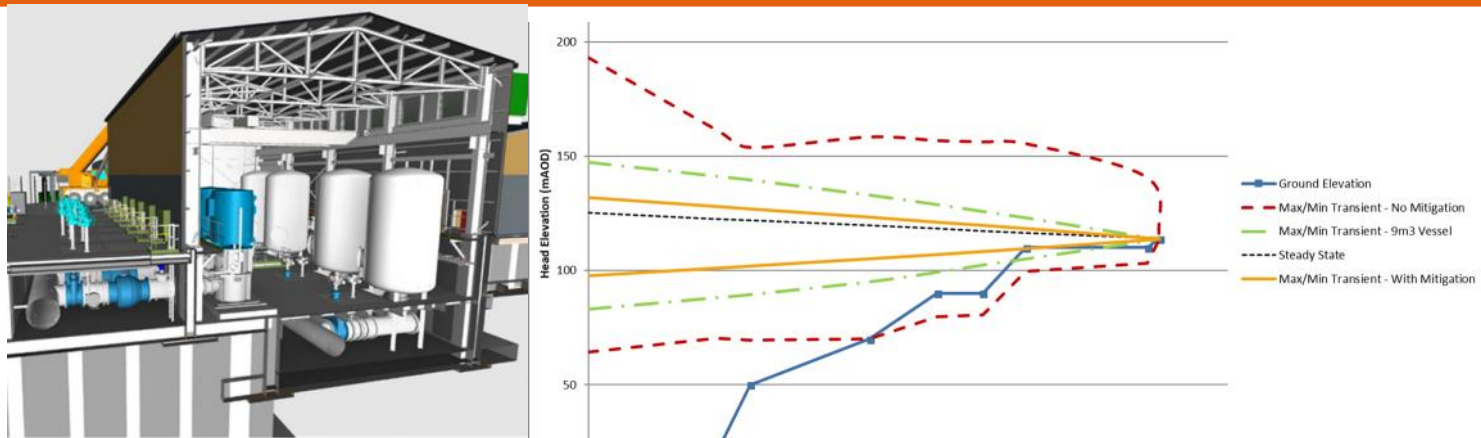


PRESSURE SURGES IN PIPELINE SYSTEMS

Niklas John CEng FIMechE



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

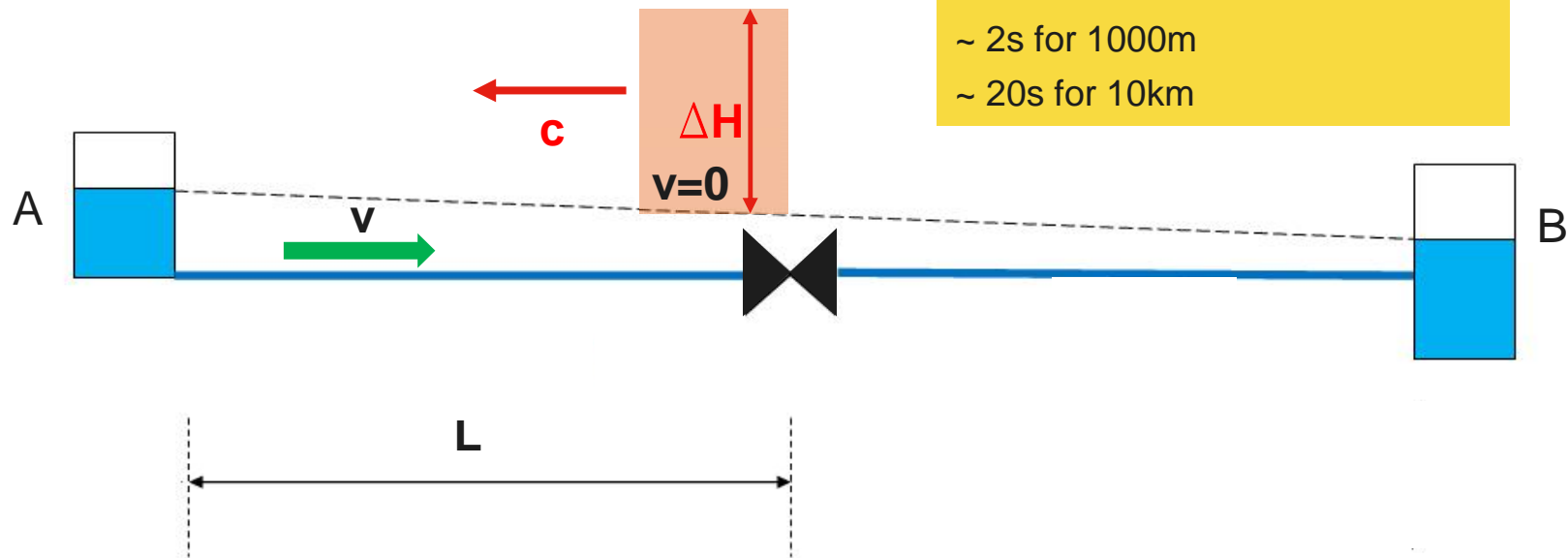
Pressure Surge

$$\Delta H = \frac{\Delta}{T} \quad \Delta H : \text{“Joukowski Head”}$$

$$= \frac{2v}{c} \quad T : \text{Pipeline Period}$$

c (Steel / DI) : 1100 m/s
c (PE): 400 m/s

T:
~0.02s for 10m steel pipe
~0.2s for 100m
~ 2s for 1000m
~ 20s for 10km

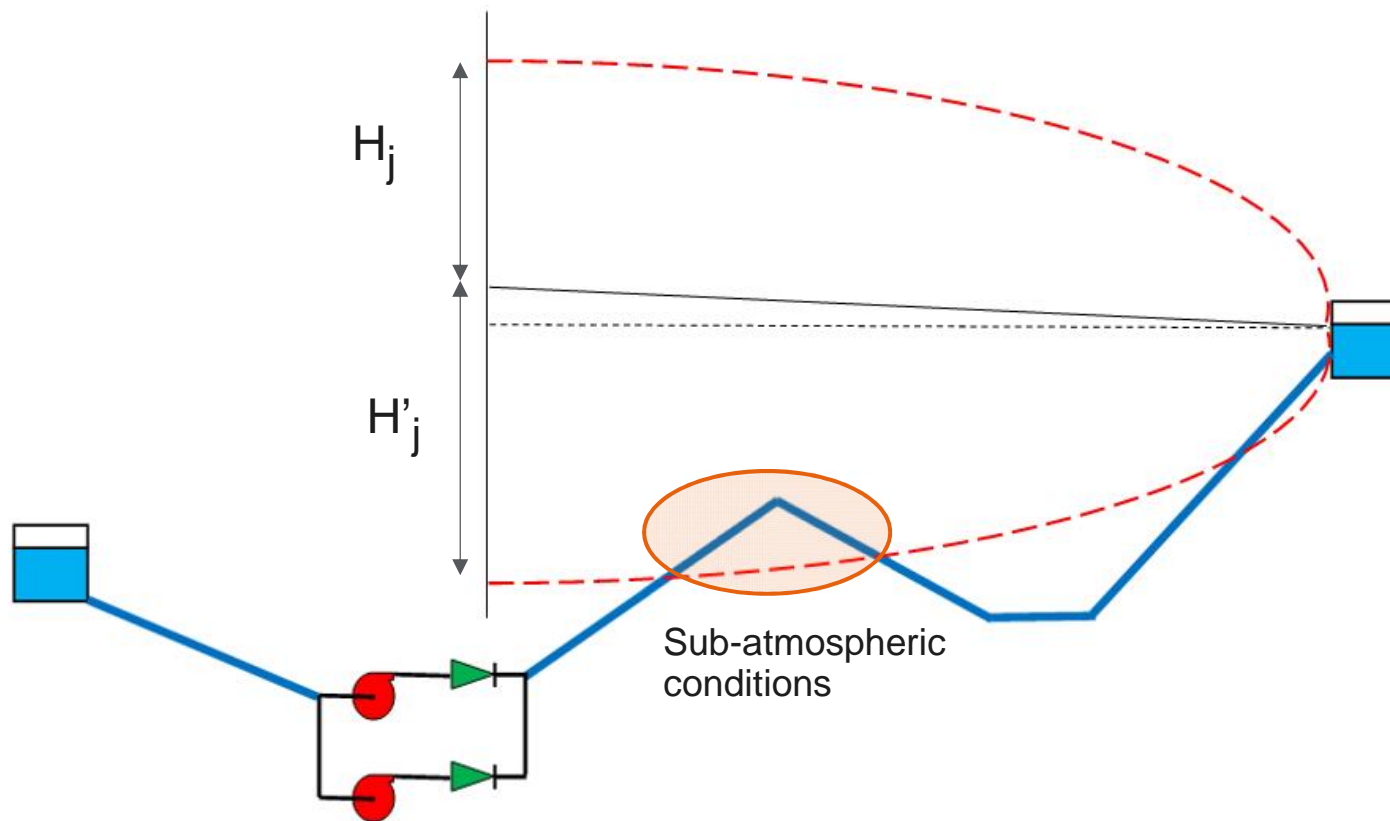


Pressure Surge – Mitigation



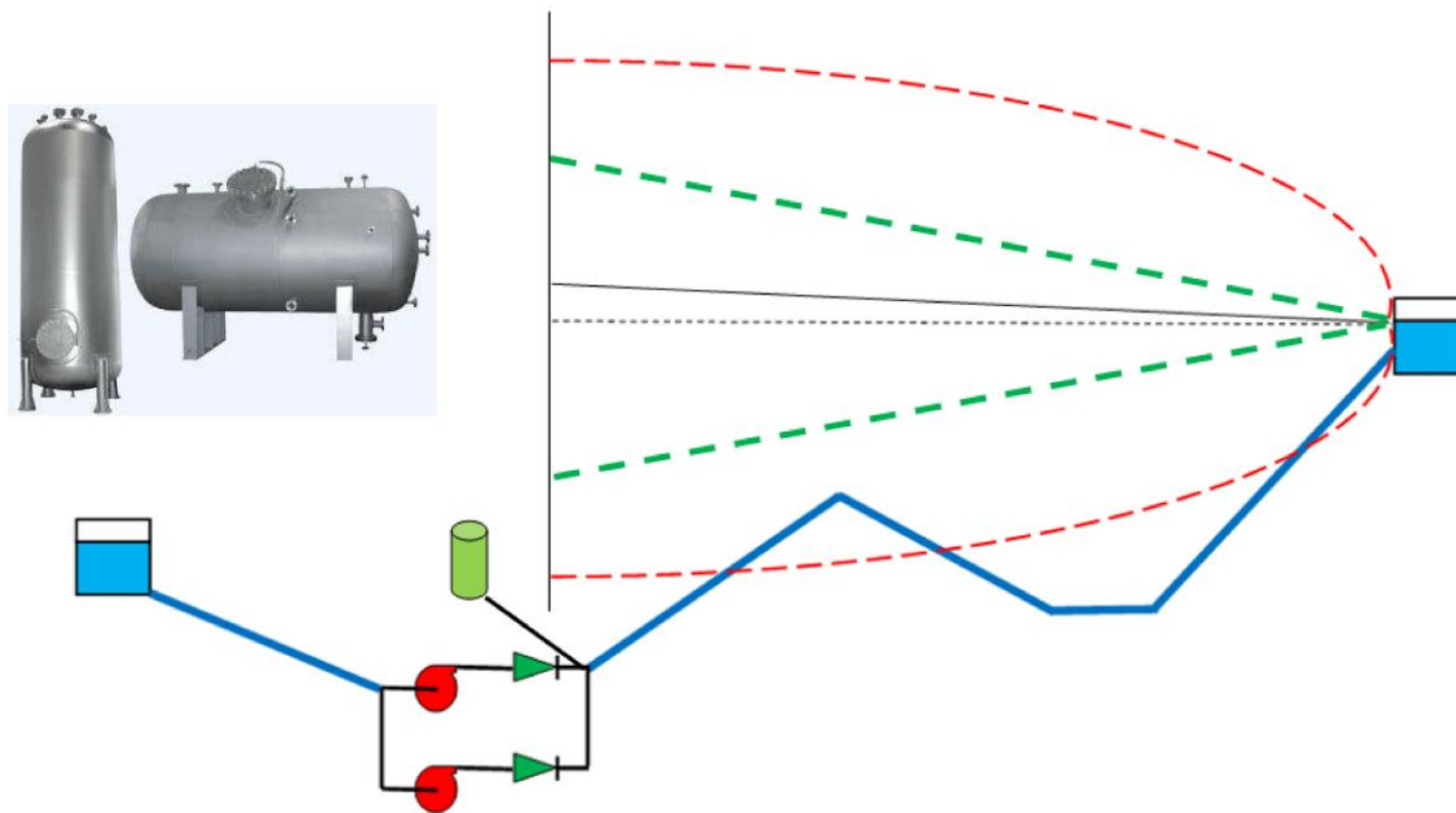
Pumped Pipeline System

Pump Trip – No Surge Protection

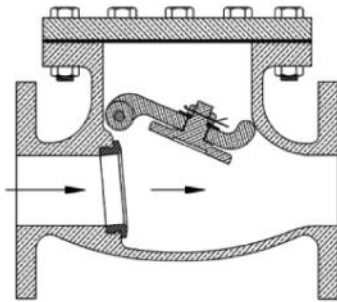


Pumped Pipeline System – Water Supply

Pump Trip – With Surge Vessel

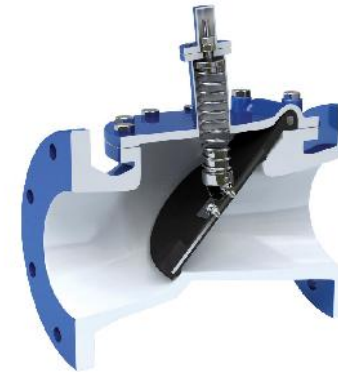
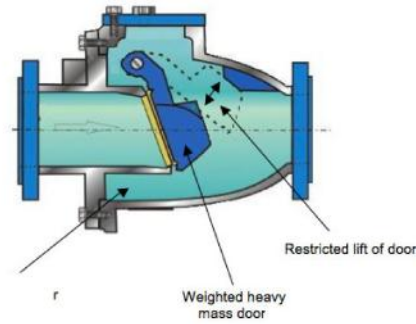


Pressure Surge – Check Valve Slam



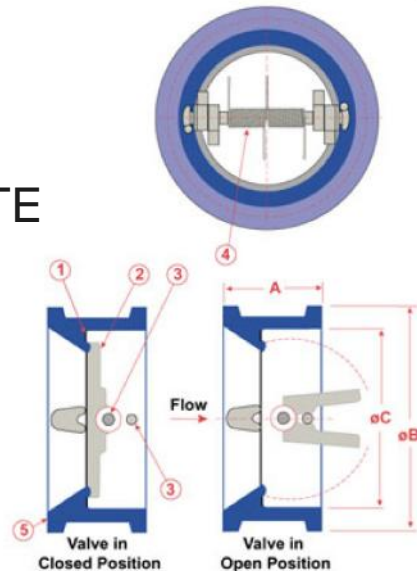
SWING CHECK

RECOIL SWING CHECK



RESILIENT HINGE /
RECOIL RESILIENT HINGE

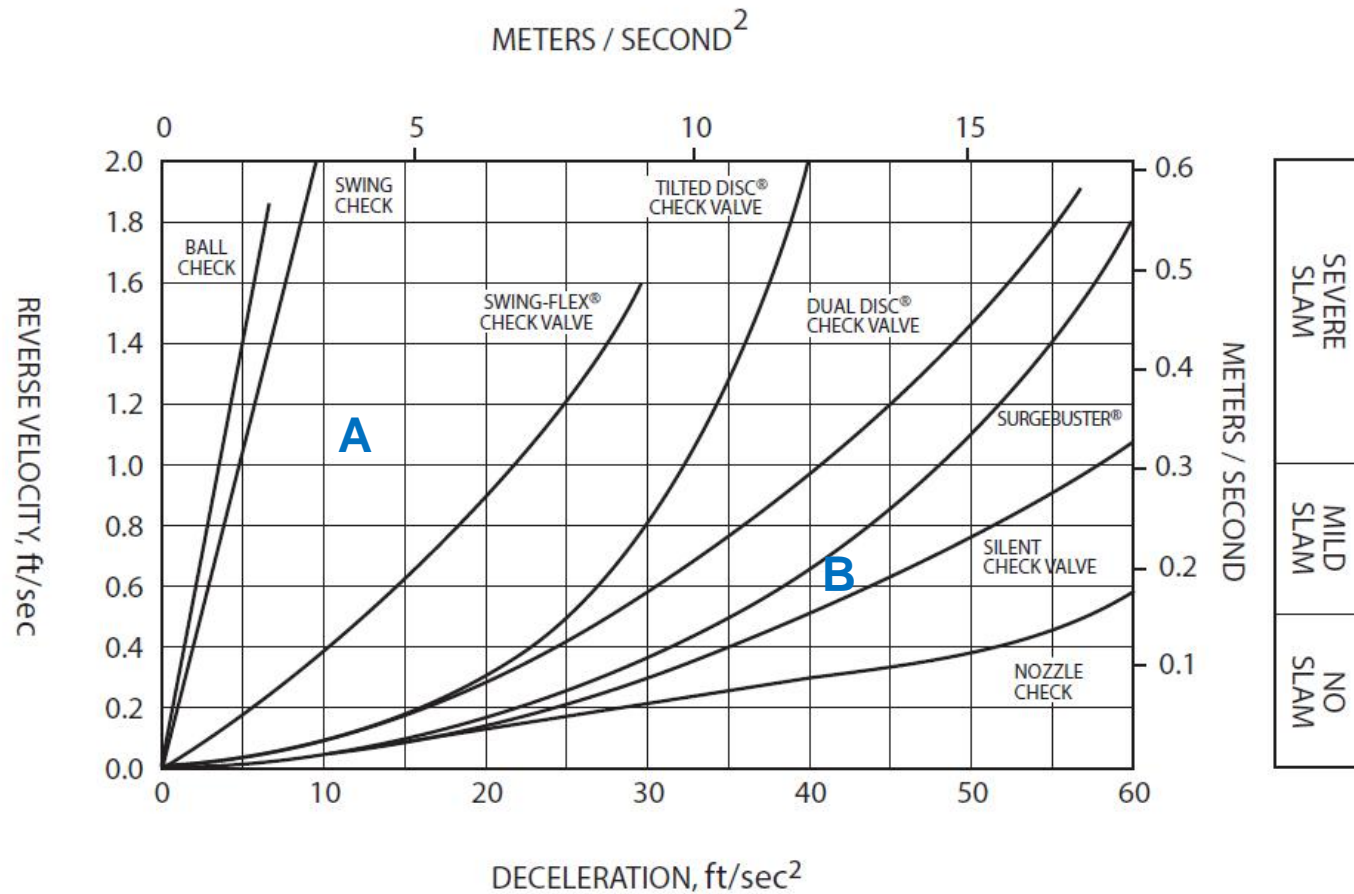
DUAL PLATE



NOZZLE CHECK

Pressure Surge - Pumping Systems

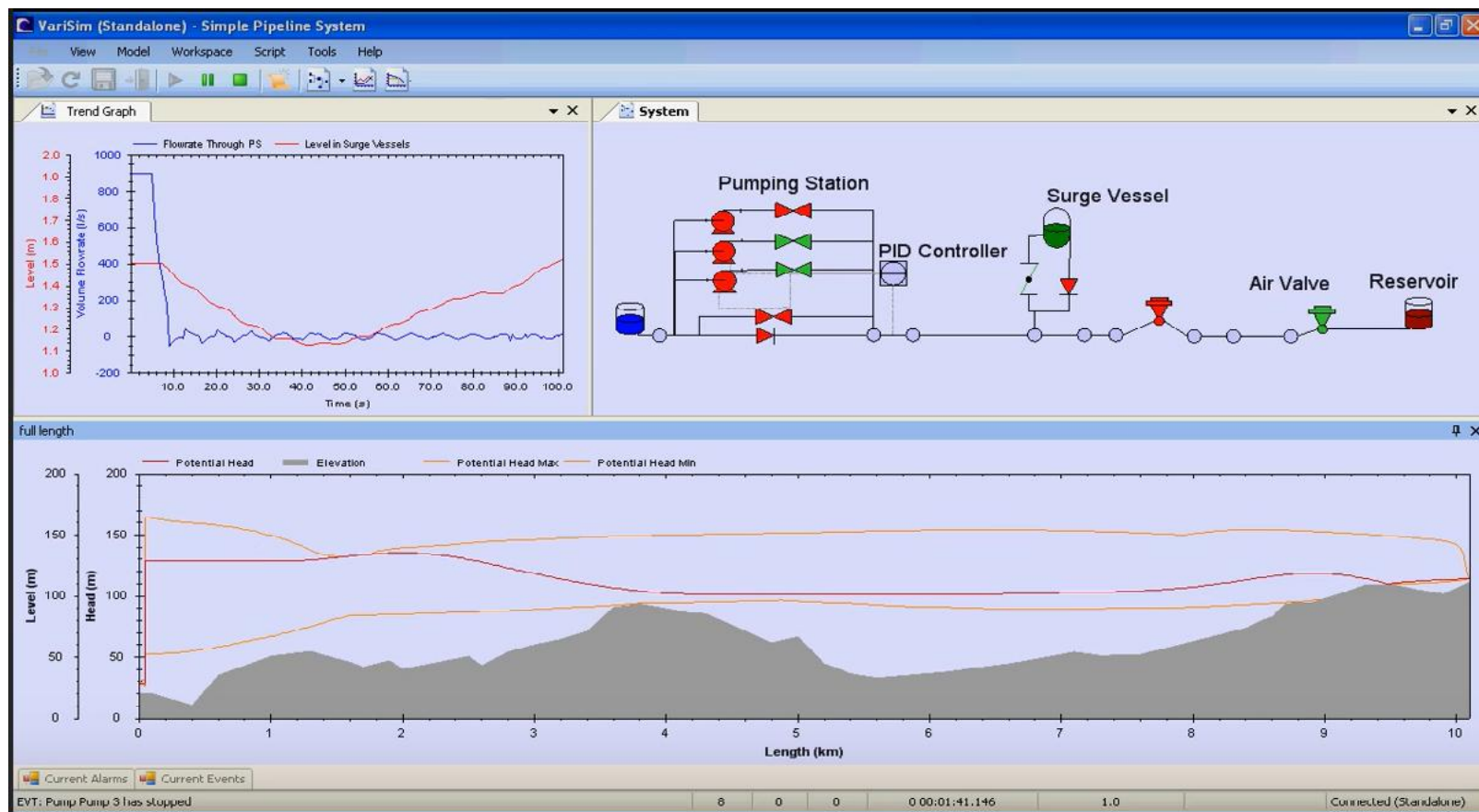
Check Valves – Dynamic Response Evaluation/Comparison



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:

