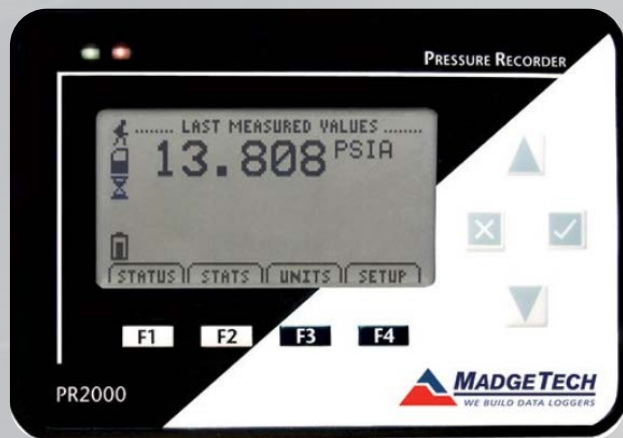
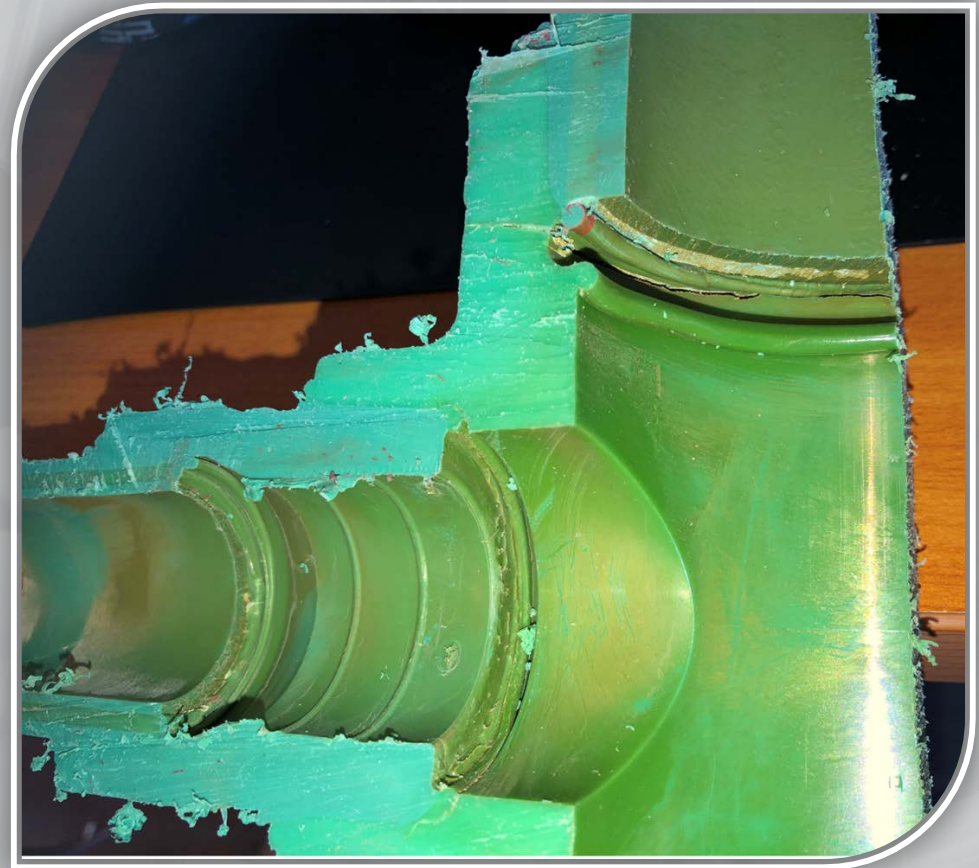
The background of the slide is a faded, grayscale image of a complex industrial piping system. It features numerous pipes of varying diameters, elbows, and valves, creating a dense, technical appearance. The lighting is soft, highlighting the metallic textures and the geometric forms of the pipes.

PIPING SYSTEMS DESTINED FOR FAILURE

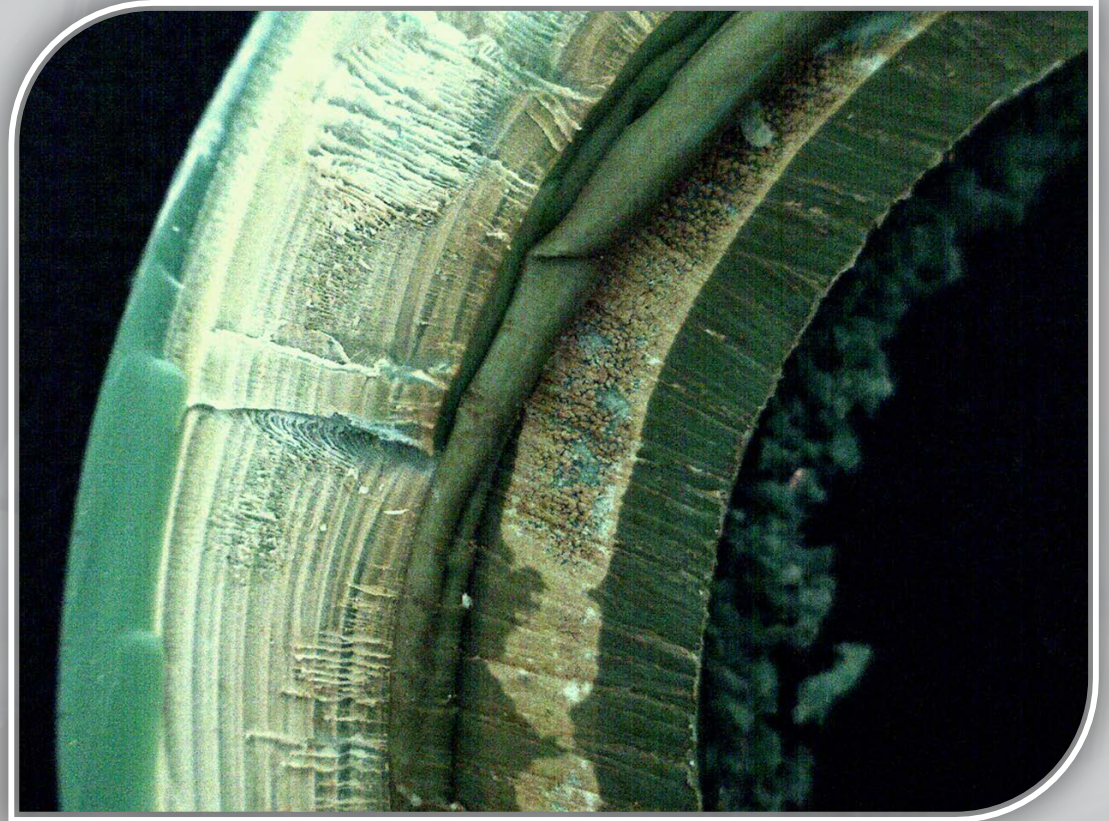
MEASUREMENT



PPR FAILURES



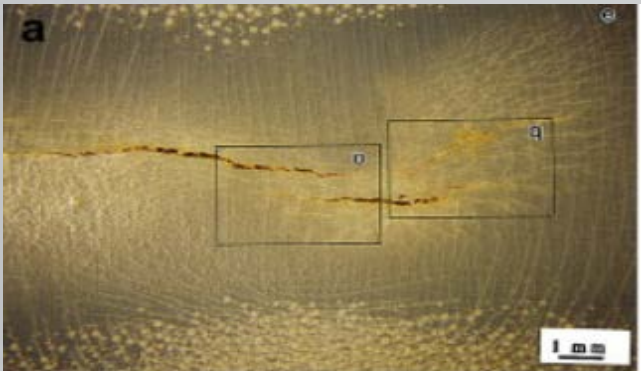
STRESS FATIGUE



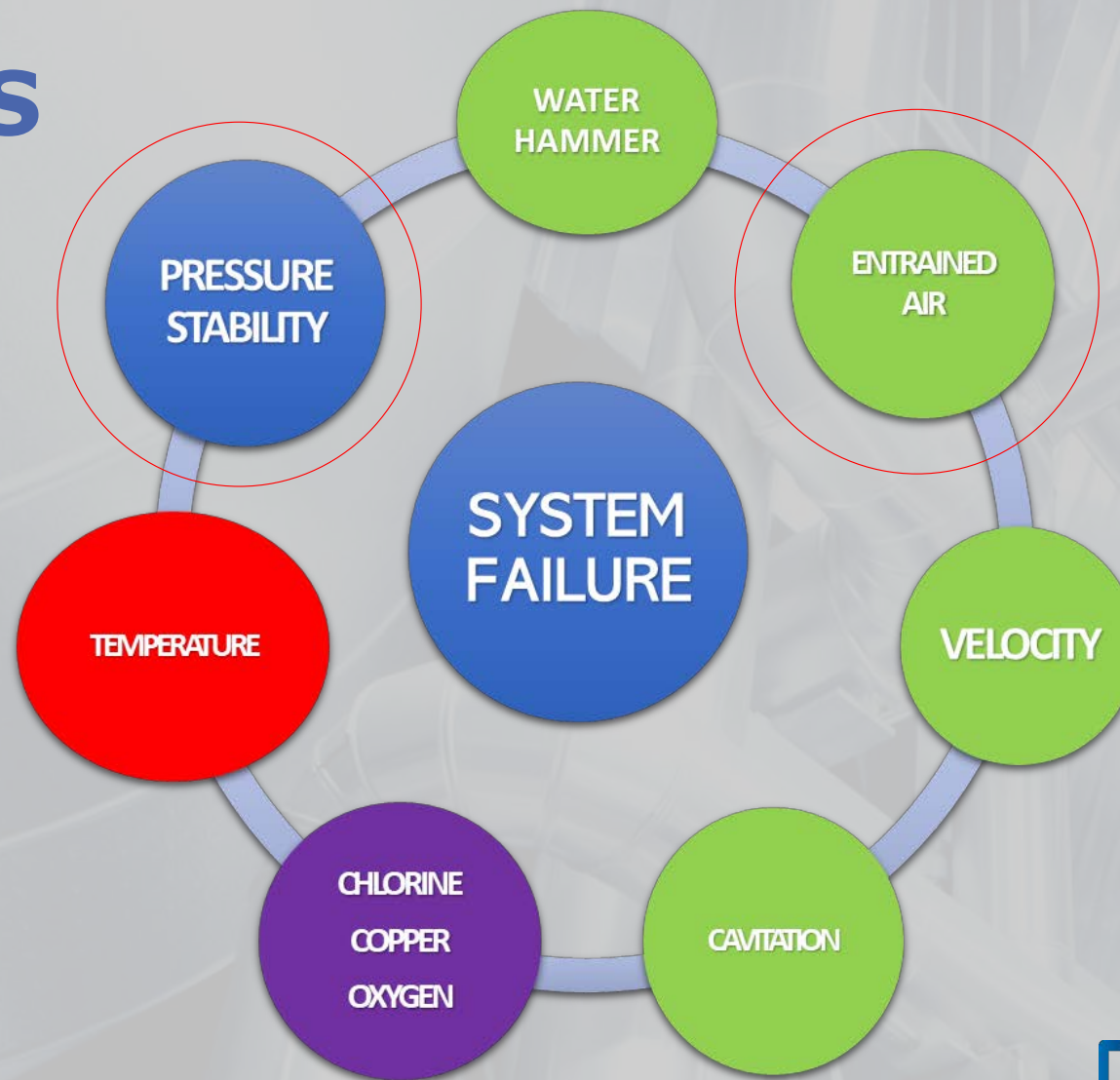
ENTRAINED AIR



INCREASE IN MATERIAL FAILURE



FACTORS



MEDIA REPORTS

CEED Seminar Proceedings 2017

Wong: Polyethylene Pipe Leak & Burst Cause

Investigation of Root Cause of Polyethylene Pipe Leaks & Bursts

Rui Xiang Wong

Dr Jeremy Leggoe

School of Mechanical and Chemical Engineering
The University of Western Australia

Dr Nazim Khan

School of Mathematics and Statistics
The University of Western Australia

Regina Wu

Water Corporation

Abstract

Polyethylene (PE) pipes have been reportedly failing through leaks and bursts at a higher rate in the North West Region (NWR) compared to other regions. These high failure rates mean frequent expeditions are required to fix the pipes, which raises issues in cost and resource allocation, as well as the safety of the personnel involved. This issue is of increasing concern as the usage of PE pipes is increasing. This project is investigating the root cause of the higher rate of burst or leaks of polyethylene pipe in the NWR, to recommend solutions that will mitigate the high rate of failures of the pipes.

MEDIA REPORTS

NATIONAL WA

Perth Children's Hospital will not open this year, WA Government concedes

By Hannah Barry

Updated 11 August 2017 – 3:07pm, first published at 2:47pm

f t e A A A

TODAY'S TOP STORIES

ANIMAL RIGHTS

'Humanely euthanised': Roos to be killed to make way for development south of Perth

POLICE

One dead, two injured after car hits rolled ute near Esperance

CRIME

Stolen four-wheel-drive found at centre of Jandabup fire

AIR TRAVEL

Qantas customers request exercise bikes, virtual reality for 20-hour flights

The Perth Children's Hospital will not open this year after an independent report revealed brass fittings were the "culprit" behind ongoing problems with lead contamination issues on Friday afternoon.

Health Minister Roger Cook said a month-long review by Western Australia's Chief Health Officer revealed the cause of the contamination, and found the source of the lead was due to the "dezincification of brass fittings".



The Perth Children's Hospital has been plagued with issues since its construction began. RADIO 6PR

As a result, Mr Cook confirmed the Perth Children's Hospital would not open "on time".

MEDIA REPORTS

WA Health Department brushes off latest construction woe at \$1.2b Perth Children's Hospital

By [Jacob Kagi](#)

Posted 16 Jun 2016, 12:25pm

West Australian Health Department officials have brushed off the latest construction problem at the Perth Children's Hospital, saying a burst water pipe has caused only minor damage.

Health Department officials told a parliamentary hearing the flooding in the basement of the \$1.2 billion hospital would not delay its opening, or come at any cost to the state.

[Yesterday's flooding was the latest in a string of construction issues](#) to plague the hospital, which had been due to open late last year but has been significantly delayed.

The 298 bed facility is now due to be handed over to the Health Department in August and be fully operational by November.

"From experience of all these large commissioning projects there are going to be these occurrences during the building of such a complex facility," Health Department Director-General David Russell-Weisz told Parliament.



PHOTO: The new hospital is due to be fully operational by November 20. (ABC News: Andrew O'Connor)

RELATED STORY: [Burst water pipe floods Perth Children's Hospital basement](#)

MEDIA REPORTS



Results in: Dr John Watling stands by one of the fountains. Picture: Picture: Ross Swanborough

Optus Stadium

Tests confirm lead in fountains outside Optus Stadium

John Flint | PerthNow
April 29, 2018 12:00AM

MEDIA REPORTS

Leaky pipes threaten Wellington hospital operating theatres

Tom Hunt • 17:38, Oct 28 2018



MONIQUE FORD/STUFF

Leaky pipes were discovered in Wellington Hospital eight years after it was opened.

Leaky pipes at Wellington Hospital could take out a theatre or other crucial area as the "extreme risk" issue rolls towards its fourth year.

Capital & Coast district Health Board has been struggling with leaking copper pipes for years but a just-released risk assessment shows that a long term solution appears to be a pipedream – even as it pursues legal

MEDIA REPORTS

NATIONAL WA

Burst water pipe floods Perth's Fiona Stanley Hospital

Updated 9 July 2015 — 6:02pm, first published at 3:00pm



TODAY'S TOP STORIES

ANIMAL RIGHTS

'Humanely euthanised': Roos to be killed to make way for development south of Perth

POLICE

One dead, two injured after car hits rolled ute near Esperance

CRIME

Stolen four-wheel-drive found at centre of Jandabup fire

AIR TRAVEL

Qantas customers request exercise bikes, virtual reality for 20-hour flights

Flooding at Perth's new Fiona Stanley Hospital for the second time in less than three months prompted ambulances to be diverted and operating theatres closed on Thursday.

By 4.30pm, repairs had been effected and most services resumed.



The Fiona Stanley Hospital is attracting migrants from both interstate and overseas, agents say.

A spokeswoman said that Friday's elective surgery would proceed as scheduled.

A main pipe that supplied ward towers burst in April, affecting access to hot water and the air conditioning system.

MEDIA REPORTS

Burst water pipe causes damage to nine floors of Verve Residences building in Newcastle West

Max McKinney

Editors Pick - List

f SHARE

TWEET



 Verve Residences

Pictures: Marina Neil

DAMAGE from a water leak on the ninth floor of a new Newcastle West apartment building will prevent people from moving in to the lower floors next week as planned.

MEDIA REPORTS



Firefighters respond to flooding at a high-rise unit on Therry St in Melbourne's CBD. Picture: Supplied, MFB

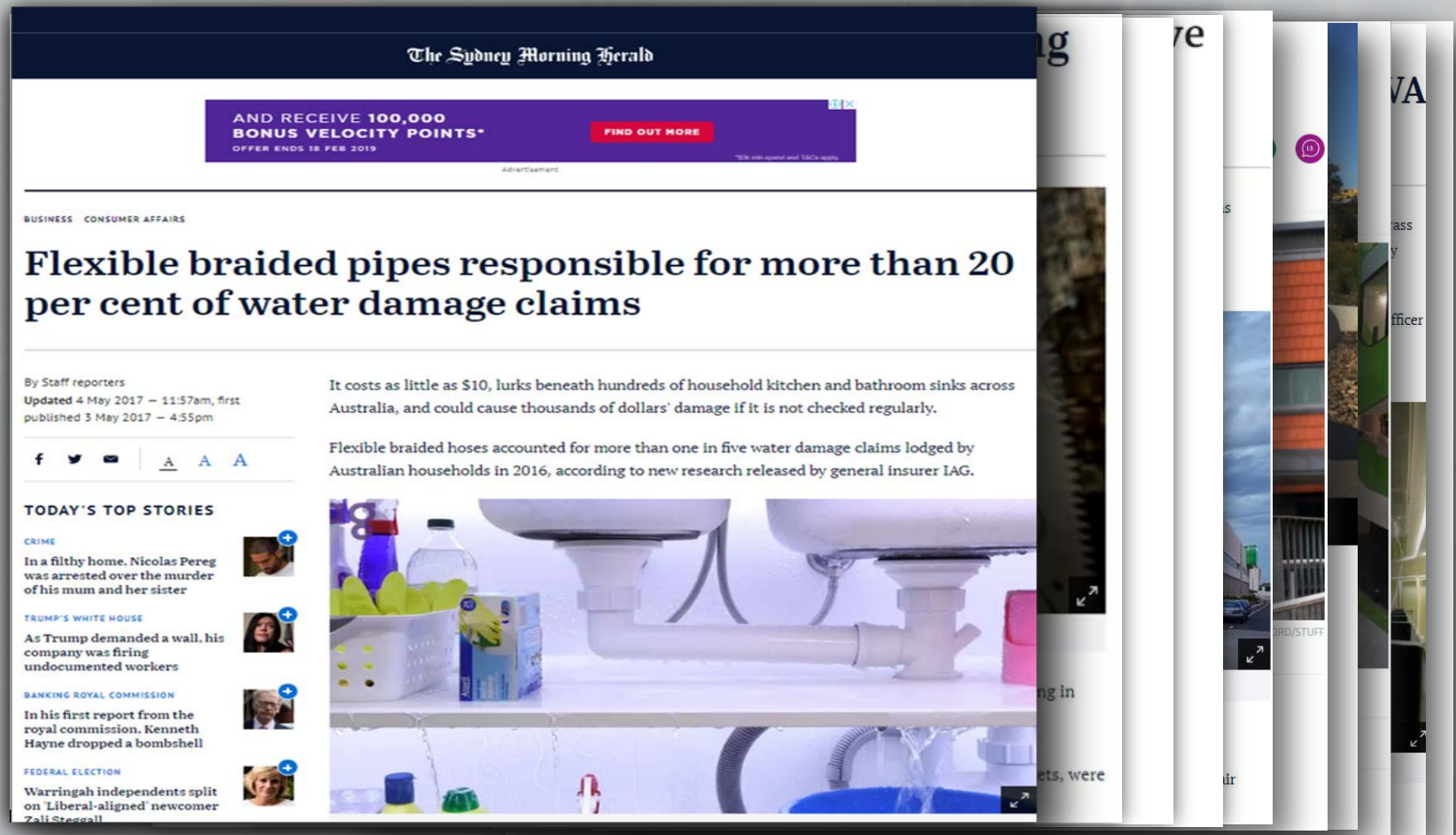
VIC News

Residents evacuated after burst water system floods CBD high-rise

Ben Cardwell | Herald Sun
August 17, 2019 7:03PM

Residents of a 48-storey high-rise in Melbourne's CBD have been forced to evacuate after a hot water system burst, spilling water on to the floors below.

MEDIA REPORTS



**WHY
NOW**



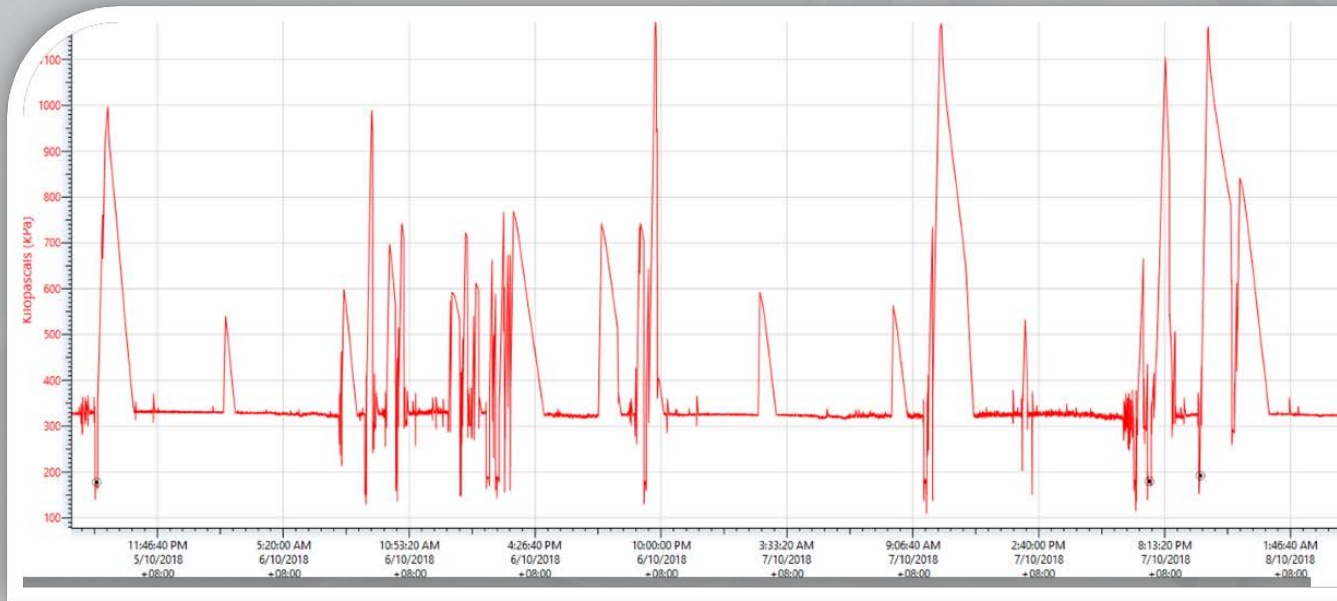
WHAT HAS CHANGED

EXPANSION CONTROL VALVE

1200 kPa



ECV

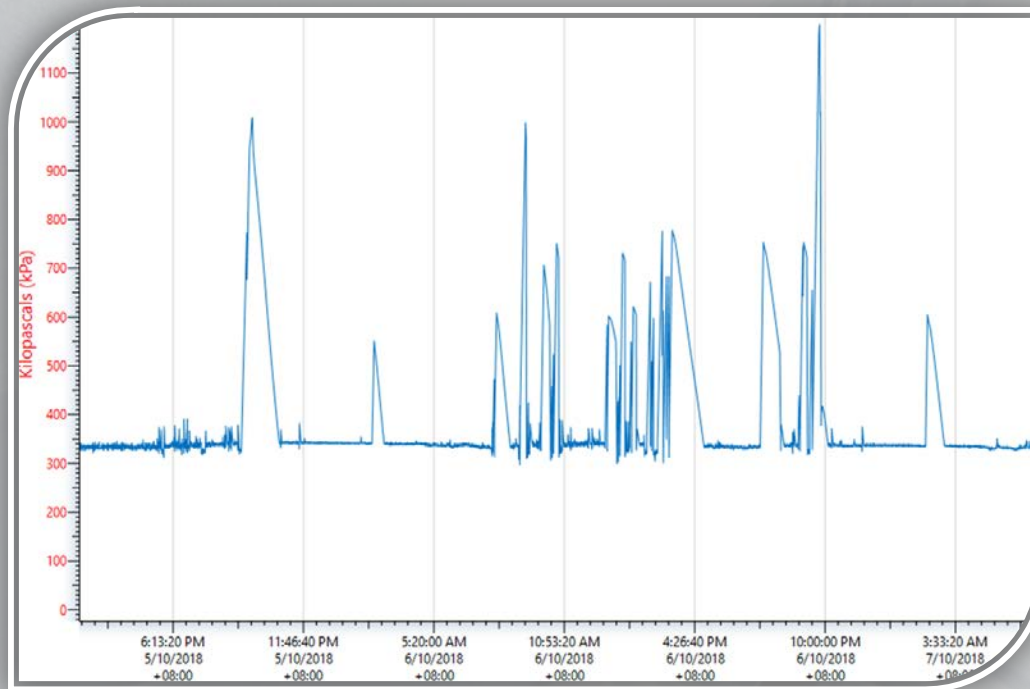


1200 kPa

TEMPERATURE MIXING VALVE



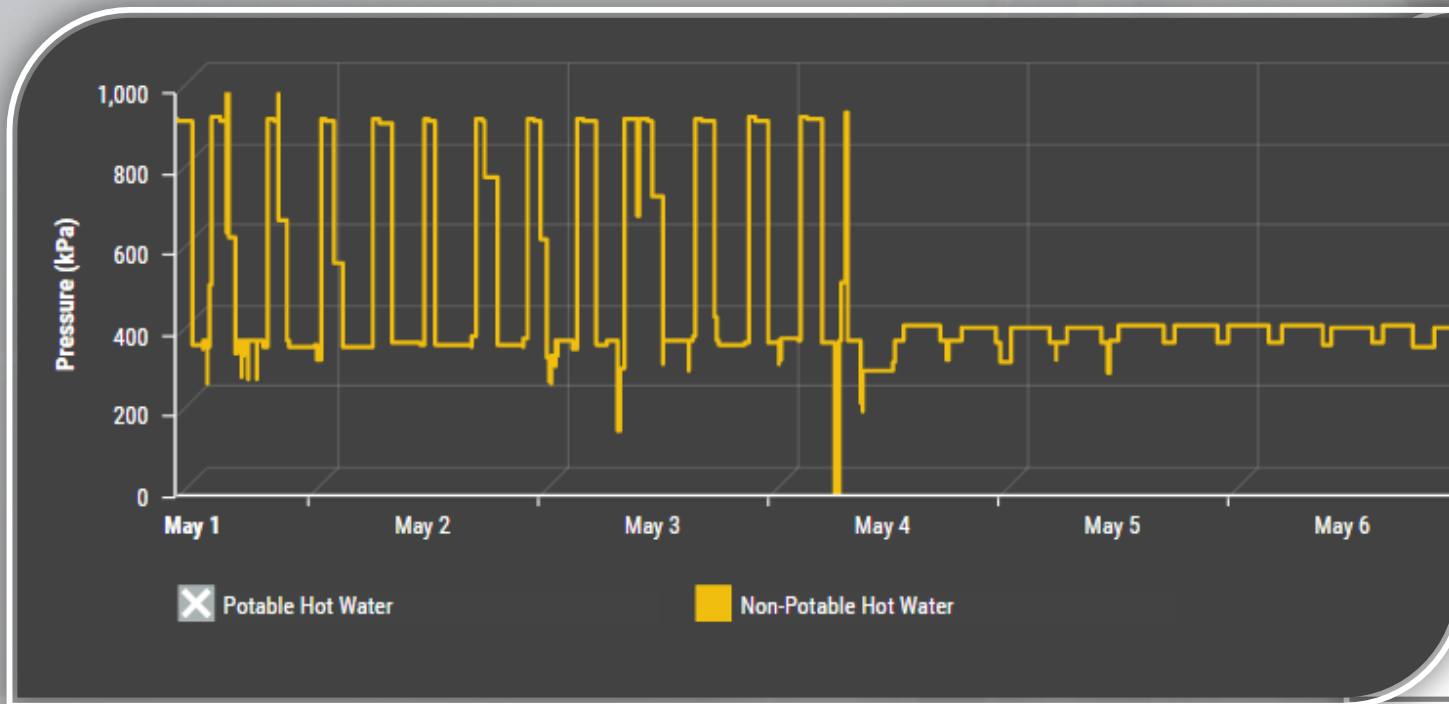
MIXING VALVE



AIR RELEASE VALVE



AIR RELIEF VALVE



INCREASED PRESSURE

AIR RELIEF VALVE

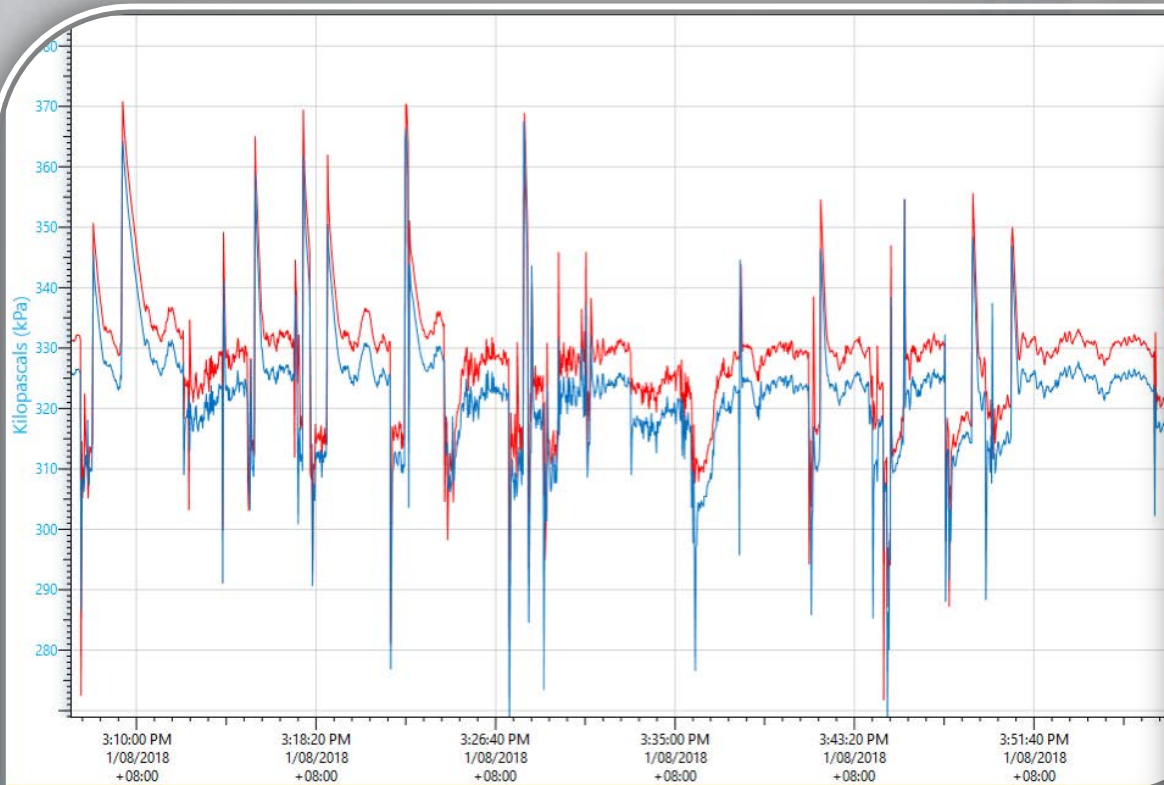


EXPANSION TANK

BACKFLOW

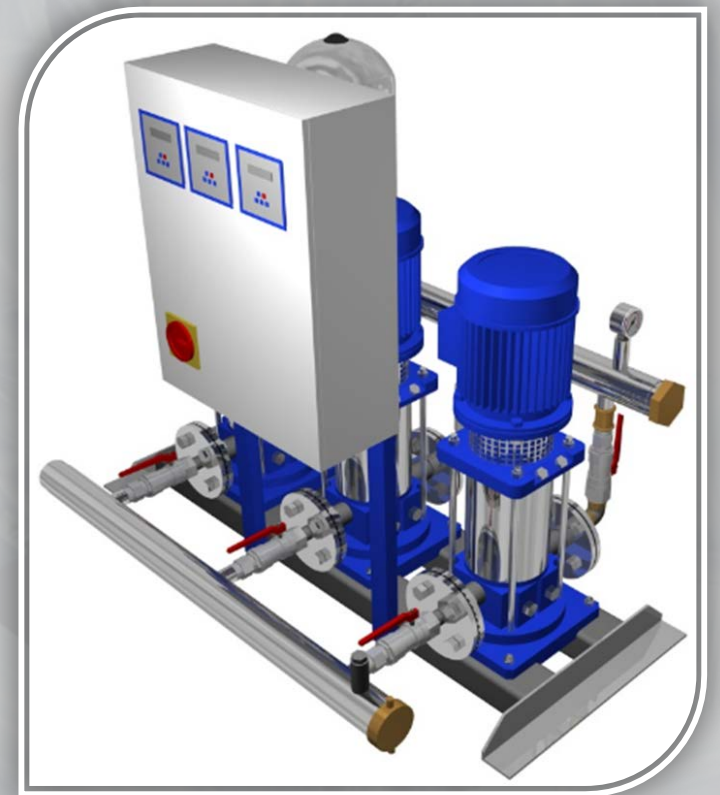


BACKFLOW

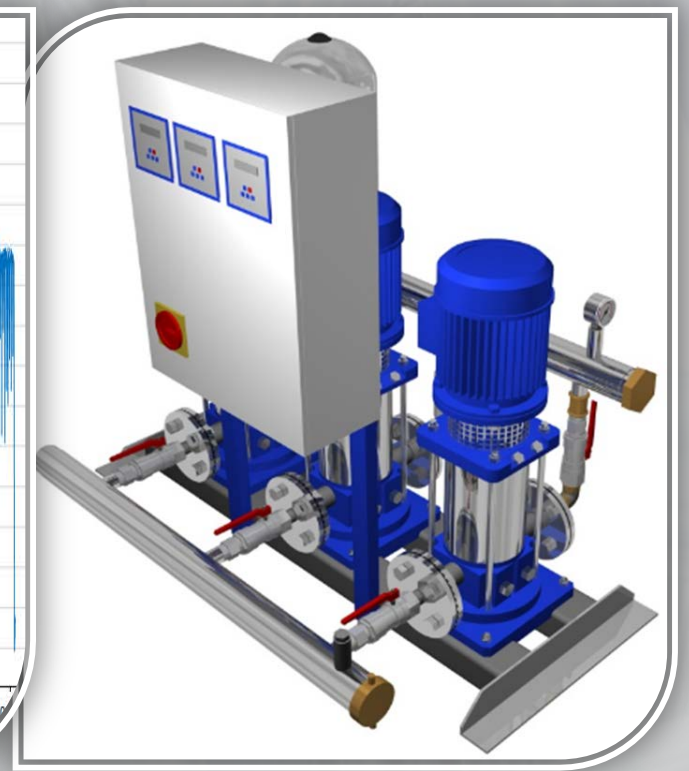
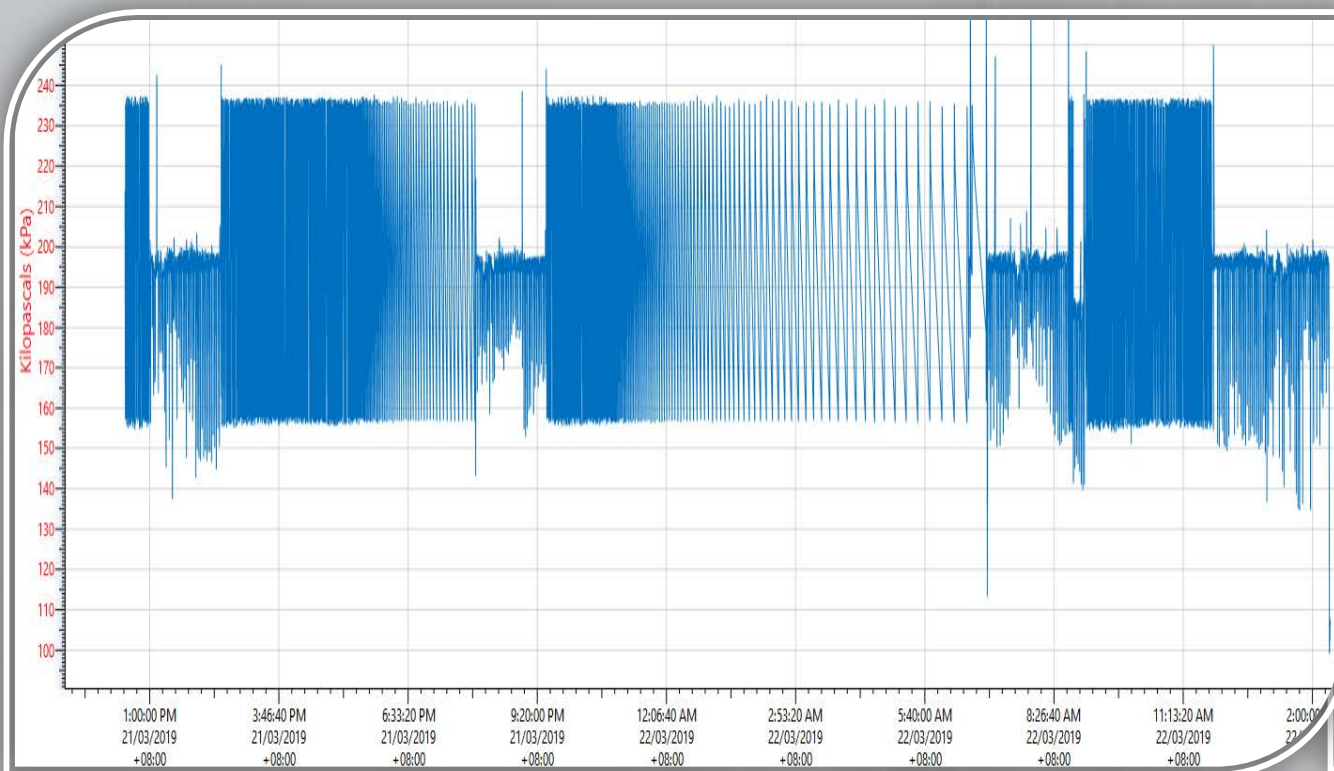


PRESSURE DROP

VSD PUMPS

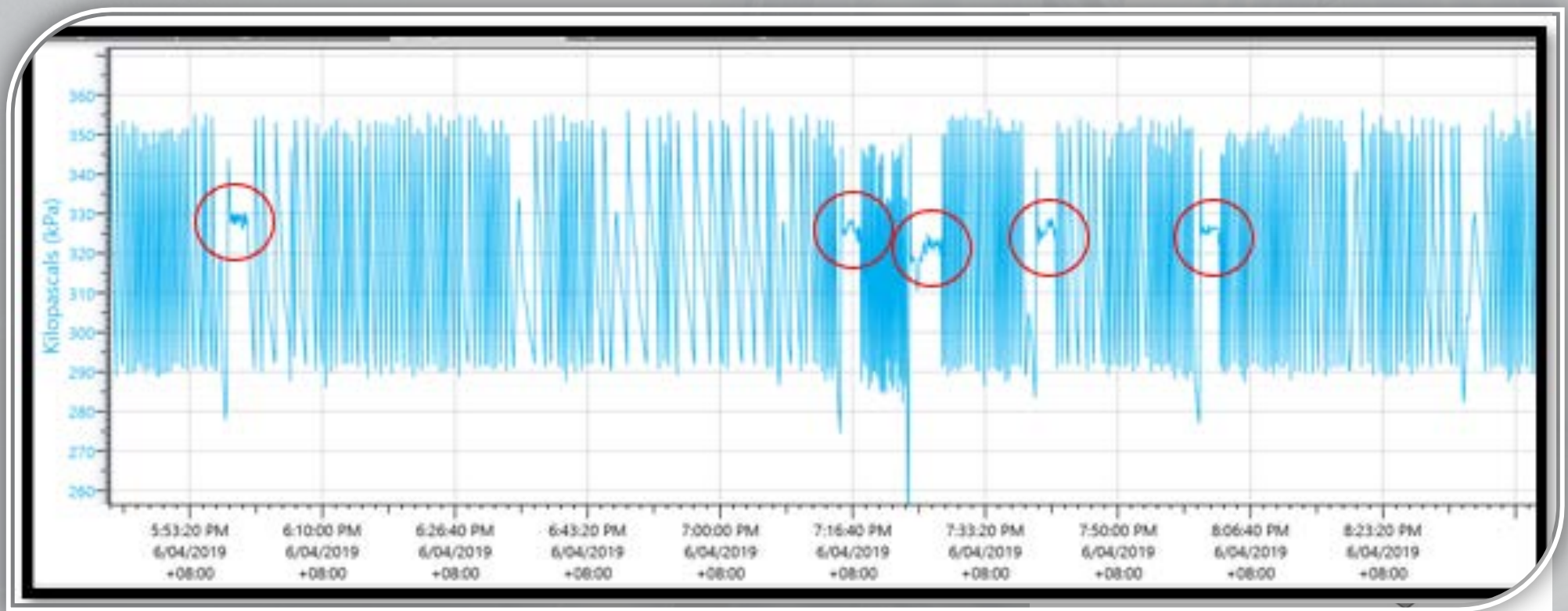


VSD PUMPS



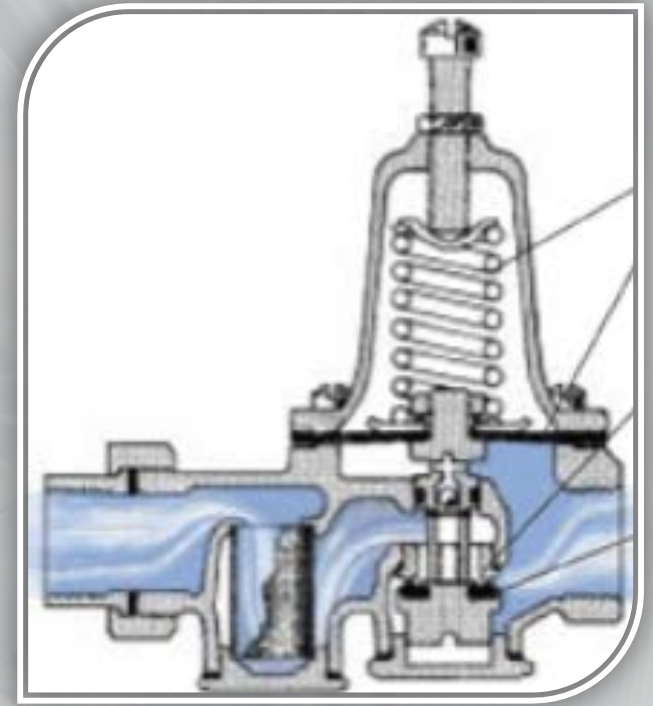
CYCLIC PRESSURES

VSD PUMPS

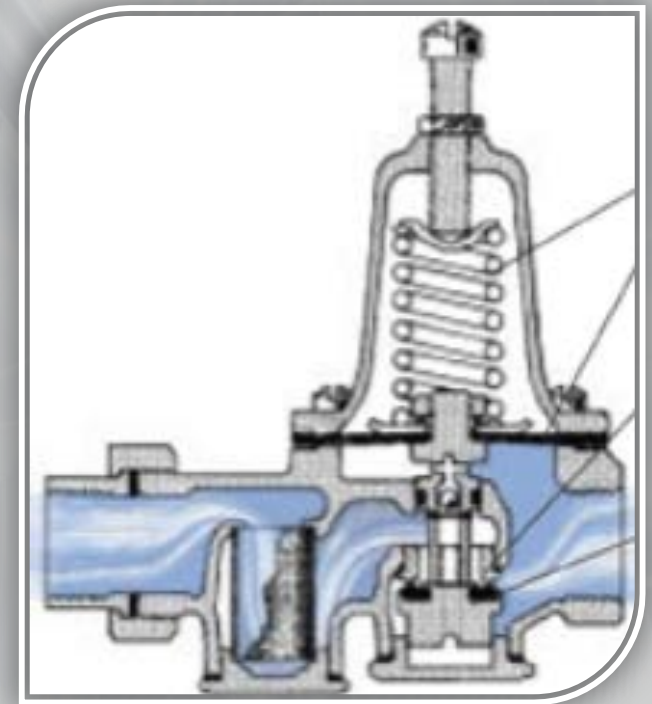
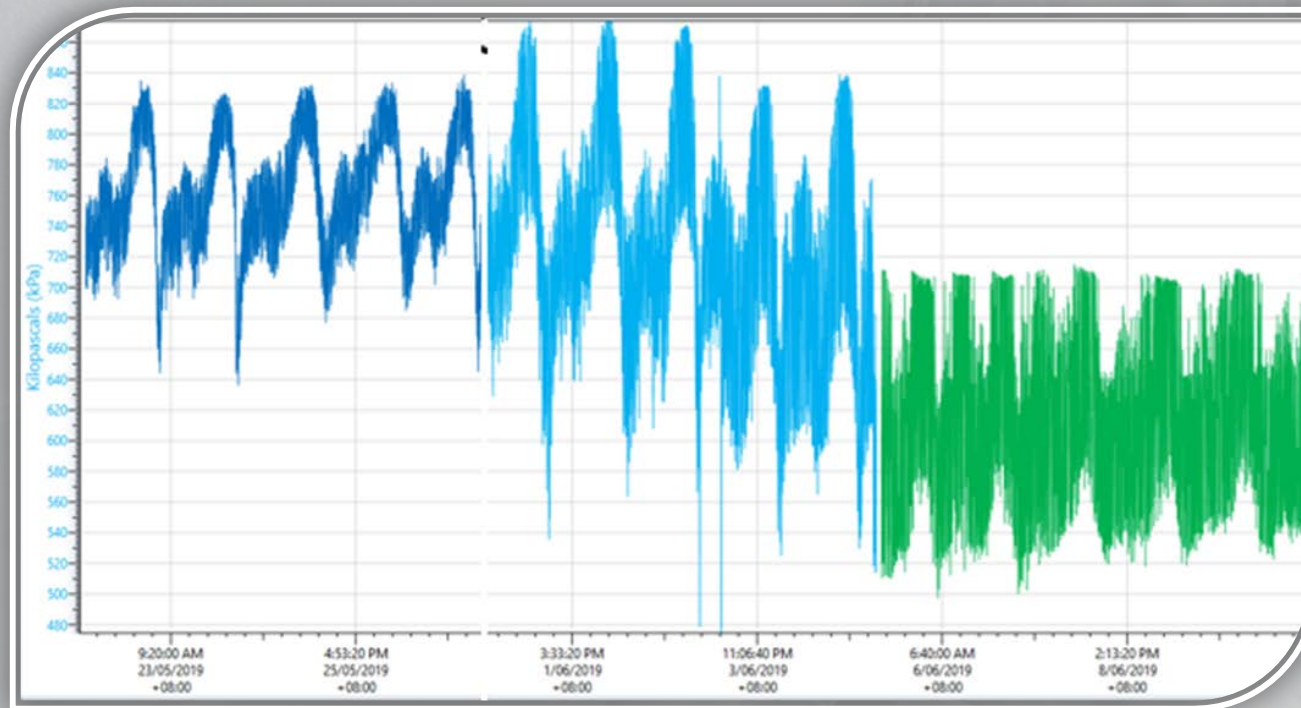


CYCLIC PRESSURES

PRESSURE REDUCING VALVE

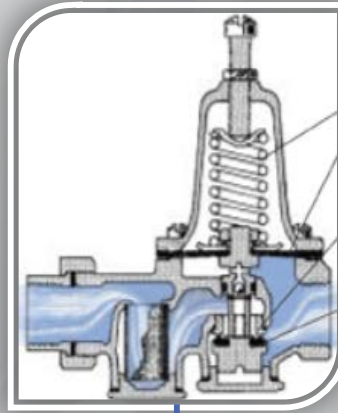


PRV



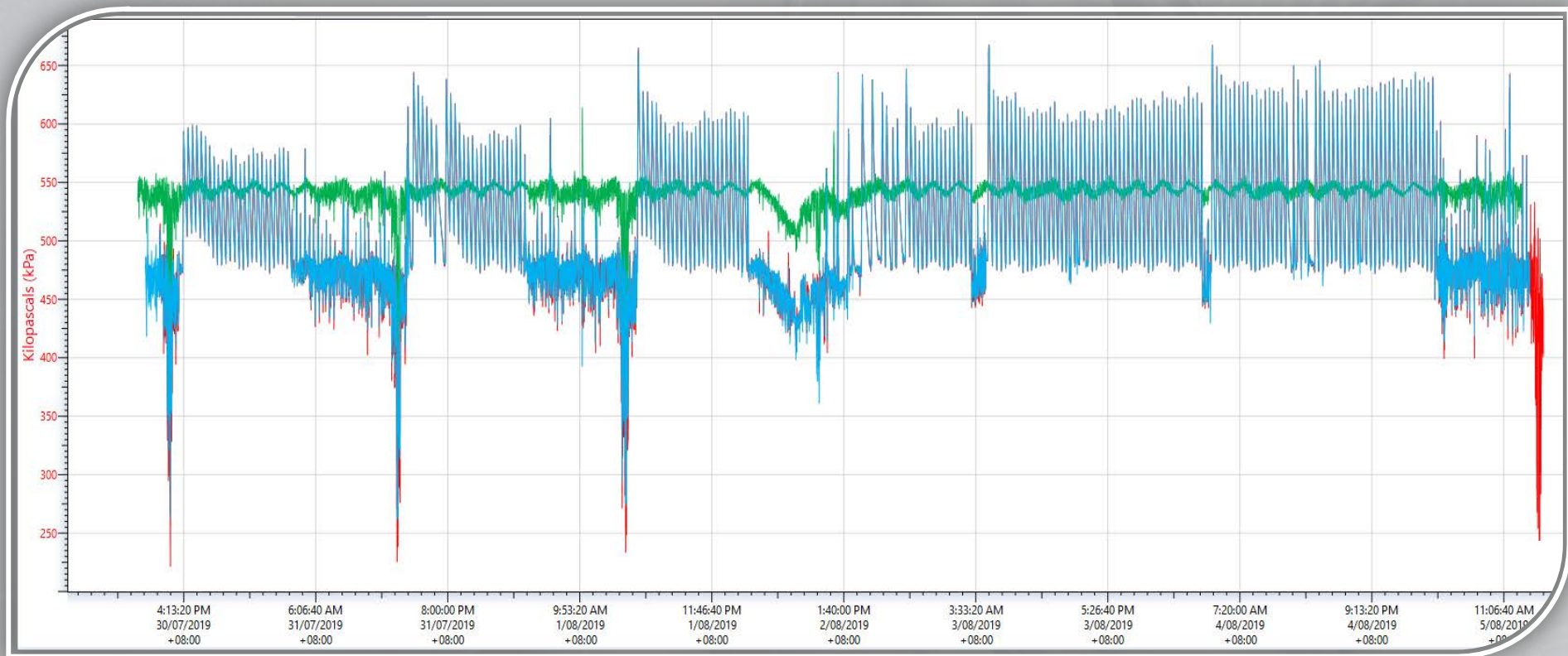
CYCLIC PRESSURES

COMBINE ALL DEVICES TOGETHER



WHAT HAPPENS?

DAMAGING SYSTEM DYNAMICS



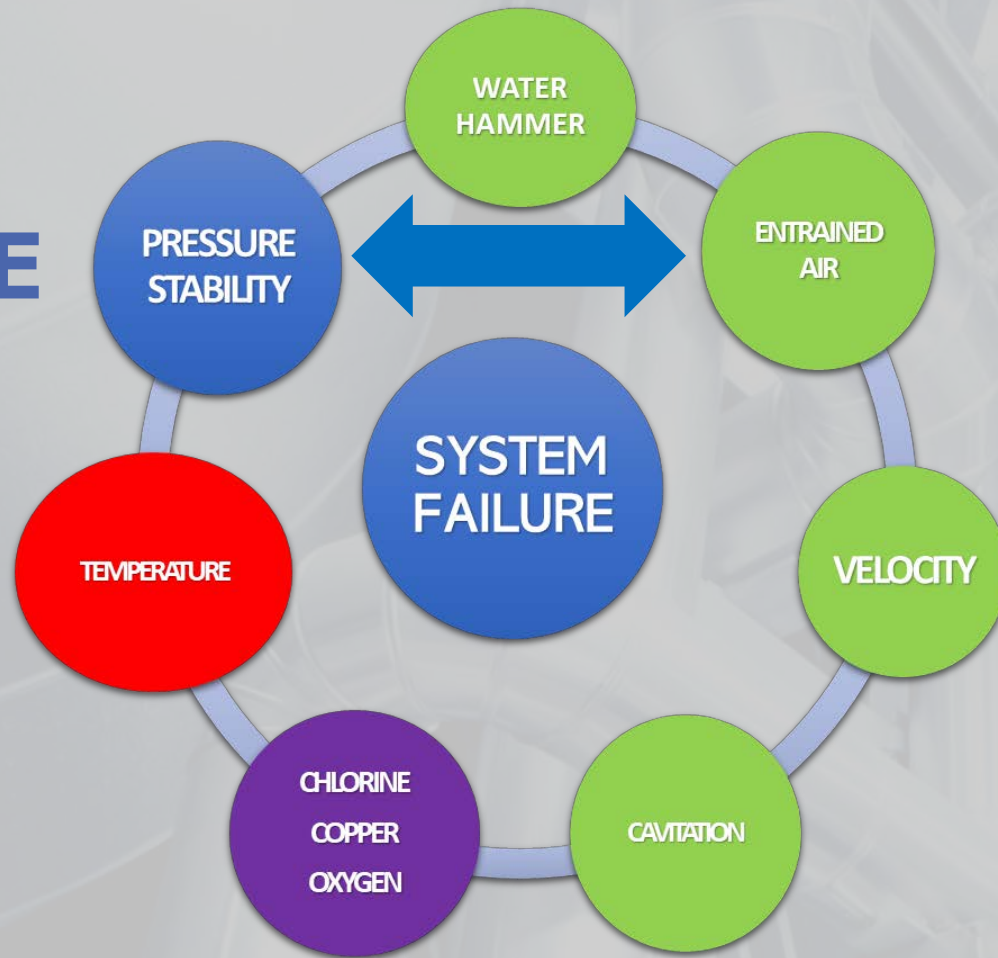
FIXED ONE PROBLEM



ONLY TO CREATE ANOTHER

COMBINATION

PRESSURE



AIR

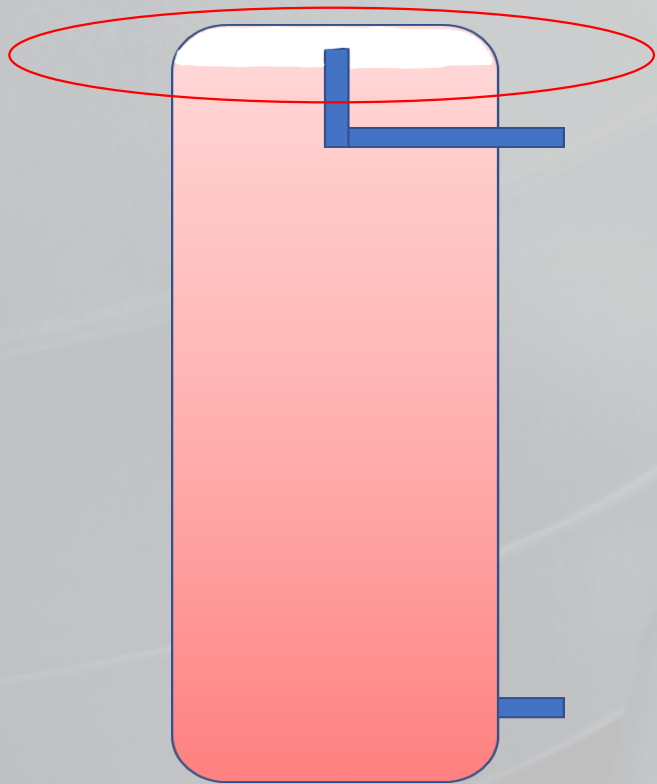
AIR



PRESSURE



AIR

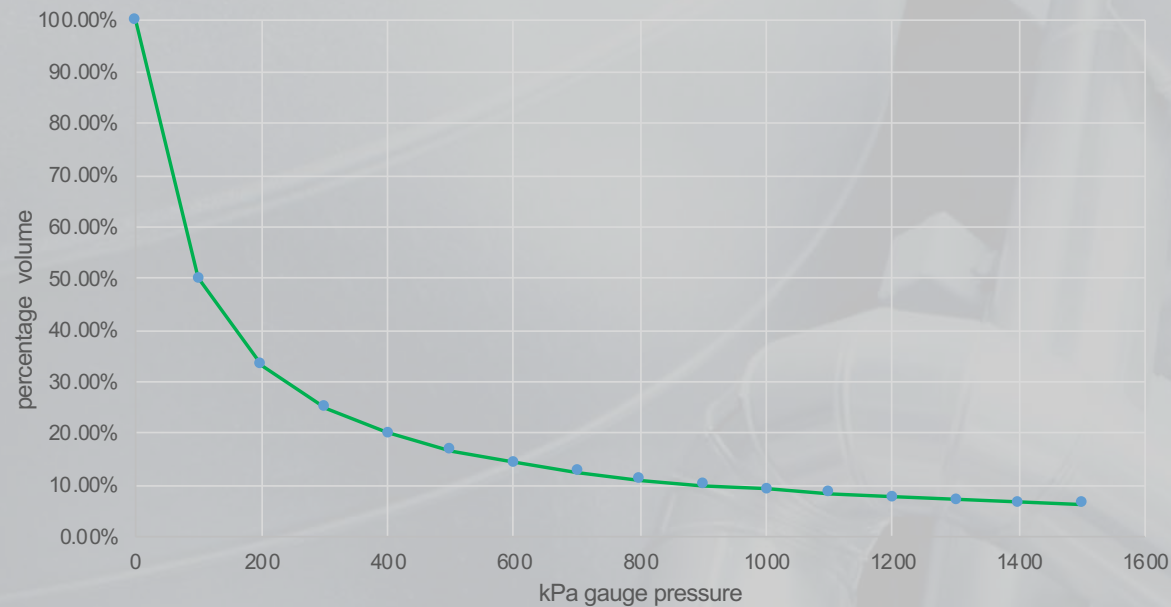


TEMPERATURE

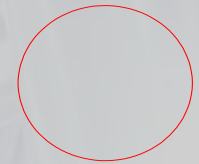


AIR EXPANSION AT PRESSURE

Air volume under pressure



1 Atm



2 Atm

$\frac{1}{2}$

3 Atm



$\frac{1}{3}$

4 Atm



$\frac{1}{4}$

5 Atm



$\frac{1}{5}$

6 Atm



$\frac{1}{6}$

7 Atm



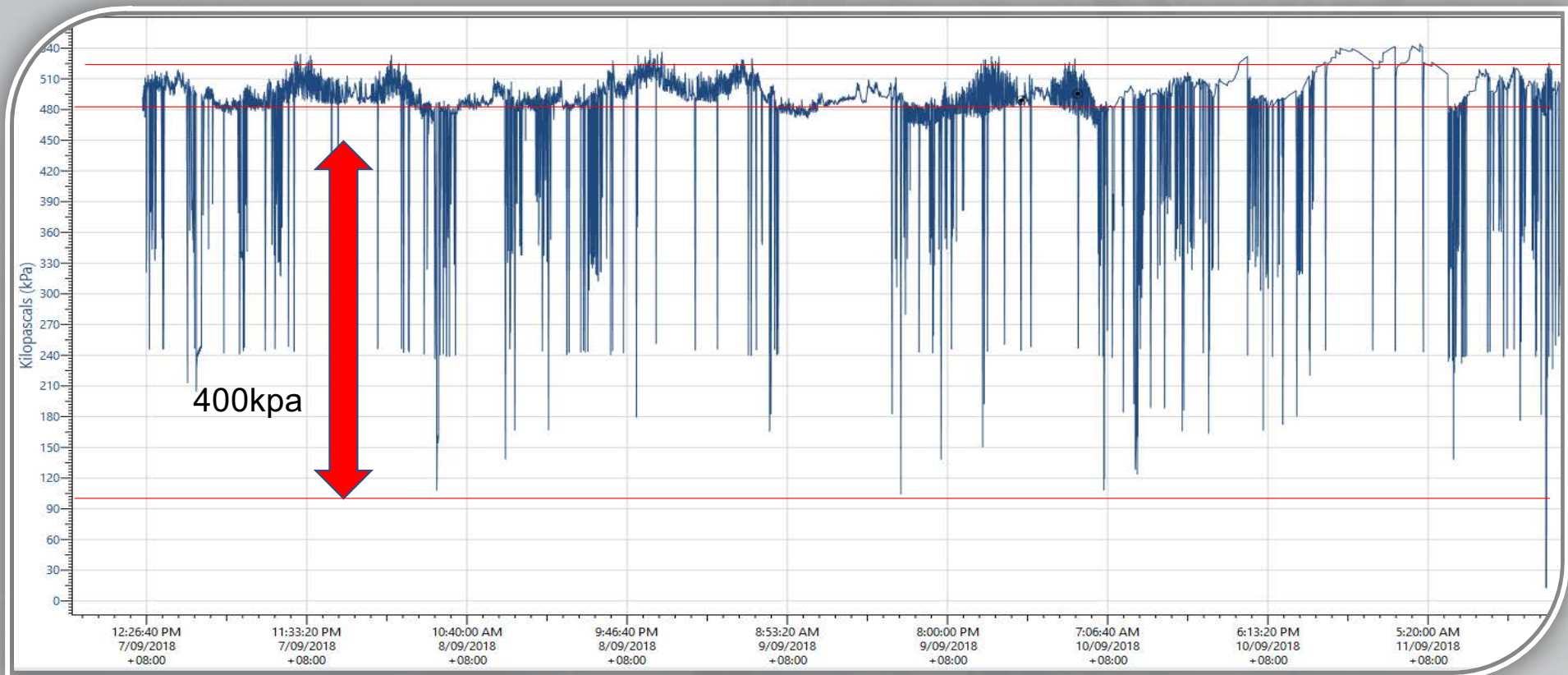
$\frac{1}{7}$

8 Atm

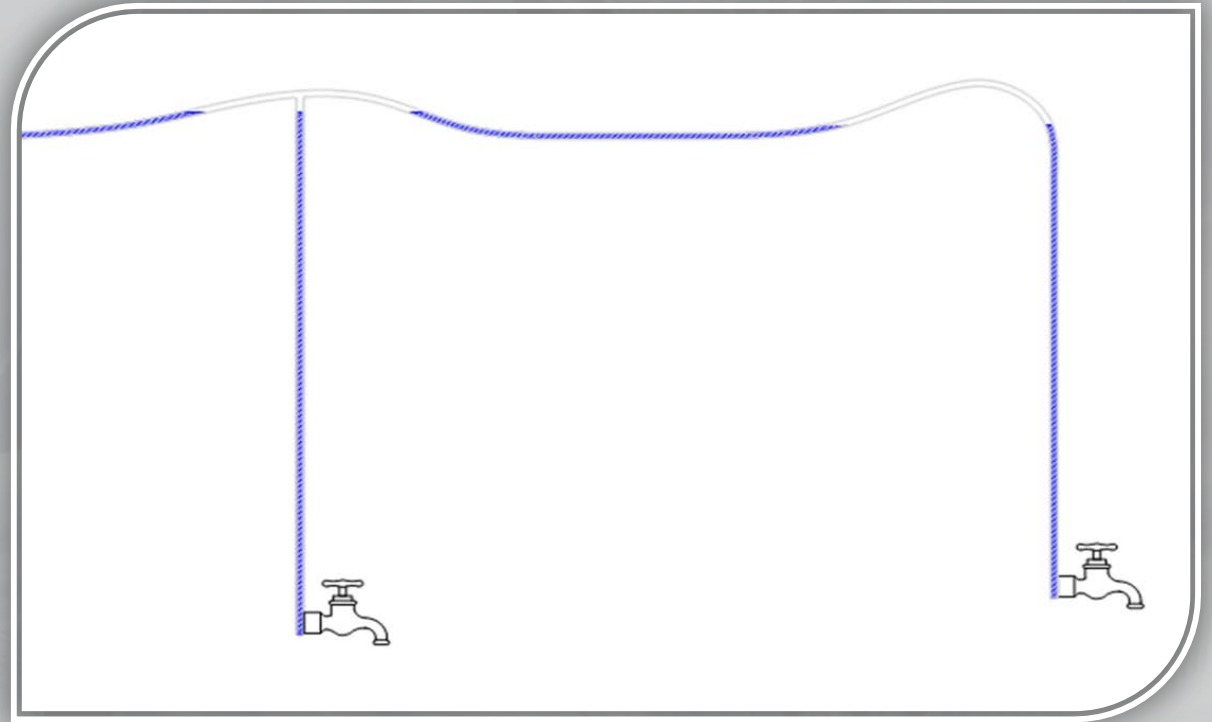
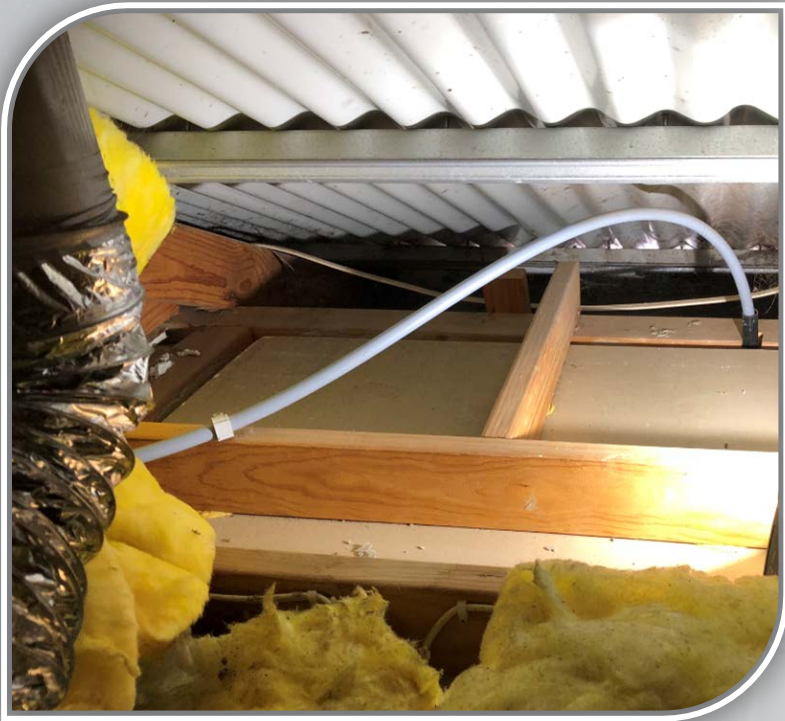


$\frac{1}{8}$

PRESSURE DROP



AIR IN PIPES + RAPID PRESSURE DROP



EQUALS CAVITATION



SUMMARY

PIPING FAILURES ARE A COMBINATION

- **COMPLEX FLUID DYNAMICS**
- **RANGE OF MODERN EQUIPMENT**
- **CHANGES IN SYSTEM DESIGN**
- **INCREASED INSTALLER ERROR**

**WE CAN'T SOLVE
PROBLEMS**

BY USING THE SAME KIND OF

THINKING

WE USED WHEN WE CREATED THEM

Thanks for listening

