BUILDING WATER SERVICES

A Seminar to look beyond minimum standards

Perth, Western Australia – 28 February 2018

1 of 3 - Copy of Slides provided by First Speaker:

Guest Speaker: Philip Woolhouse **MIPA – Principal Consultant at Phil Woolhouse Hydraulics**

Philip Woolhouse has more than 30 years' experience in the plumbing sector and is the principal consultant at Phil Woolhouse Hydraulics. Based in Perth, Philip is widely recognised in the Australian industry and overseas as a specialist in the resolution of complex installed hot and cold water system issues and is regularly sought out to determine the root cause and make recommendations to rectify such issues.

There is no Audio available and the following slides are provided for information only and as a memory jogger for those who attended. Further Seminars will be held during 2018 in different parts of Australia.

RECOGNISING A PROBLEM

MEASUREMENT IS THE KEY TO IMPROVEMENT

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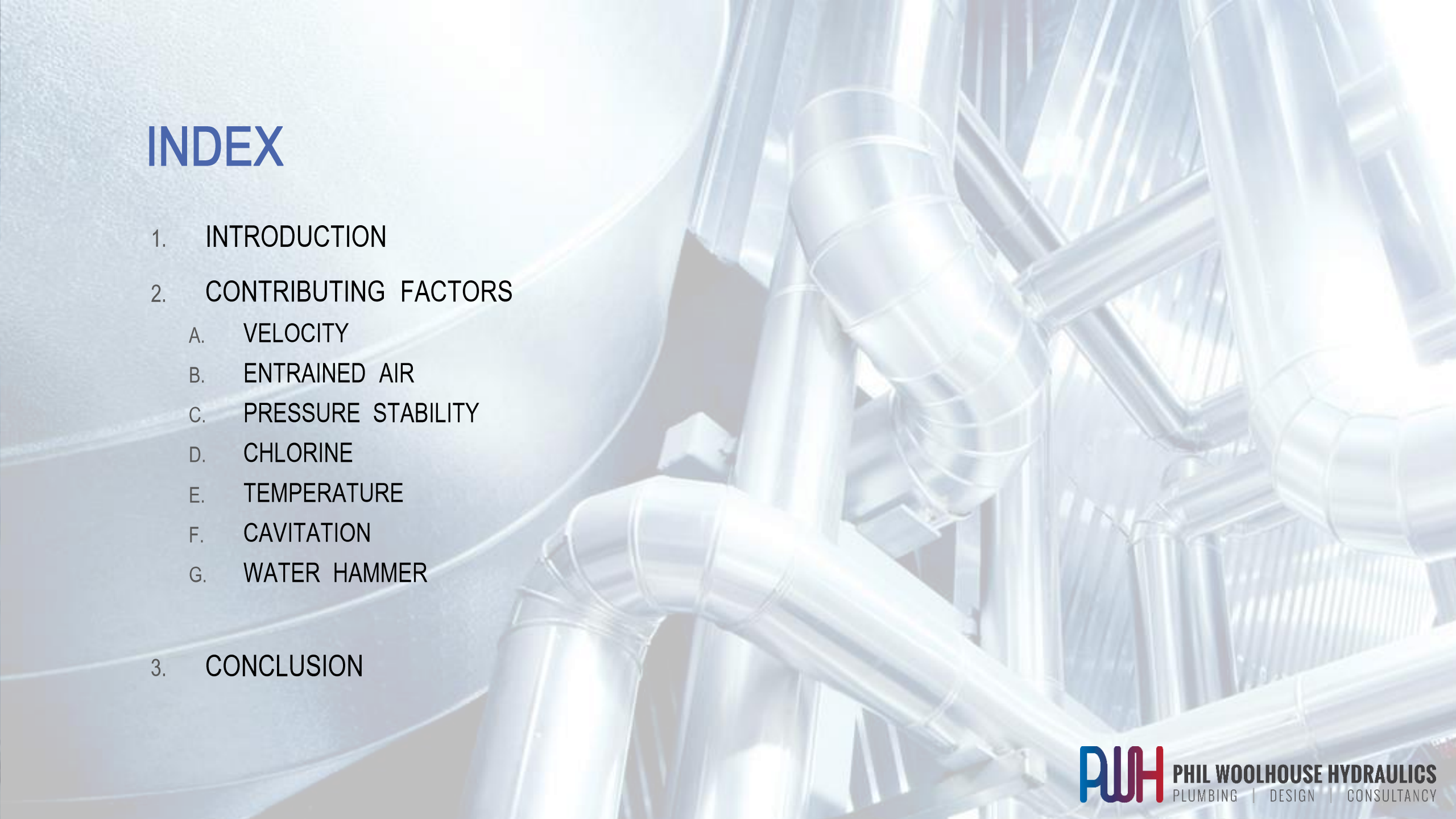

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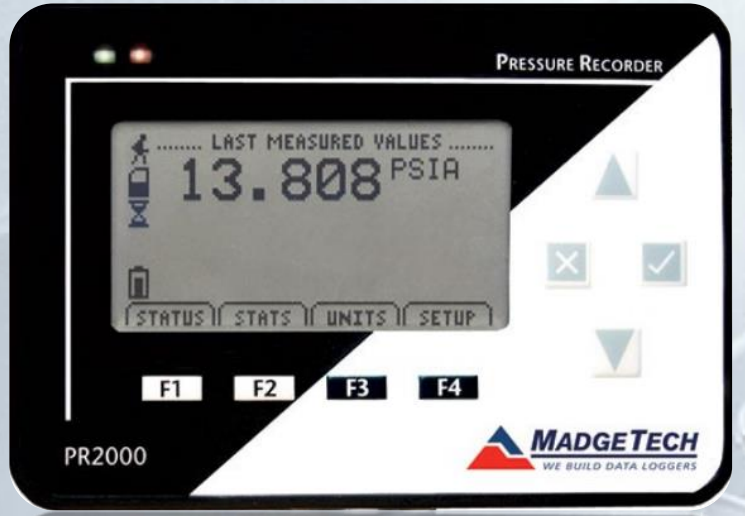
INTRODUCTION



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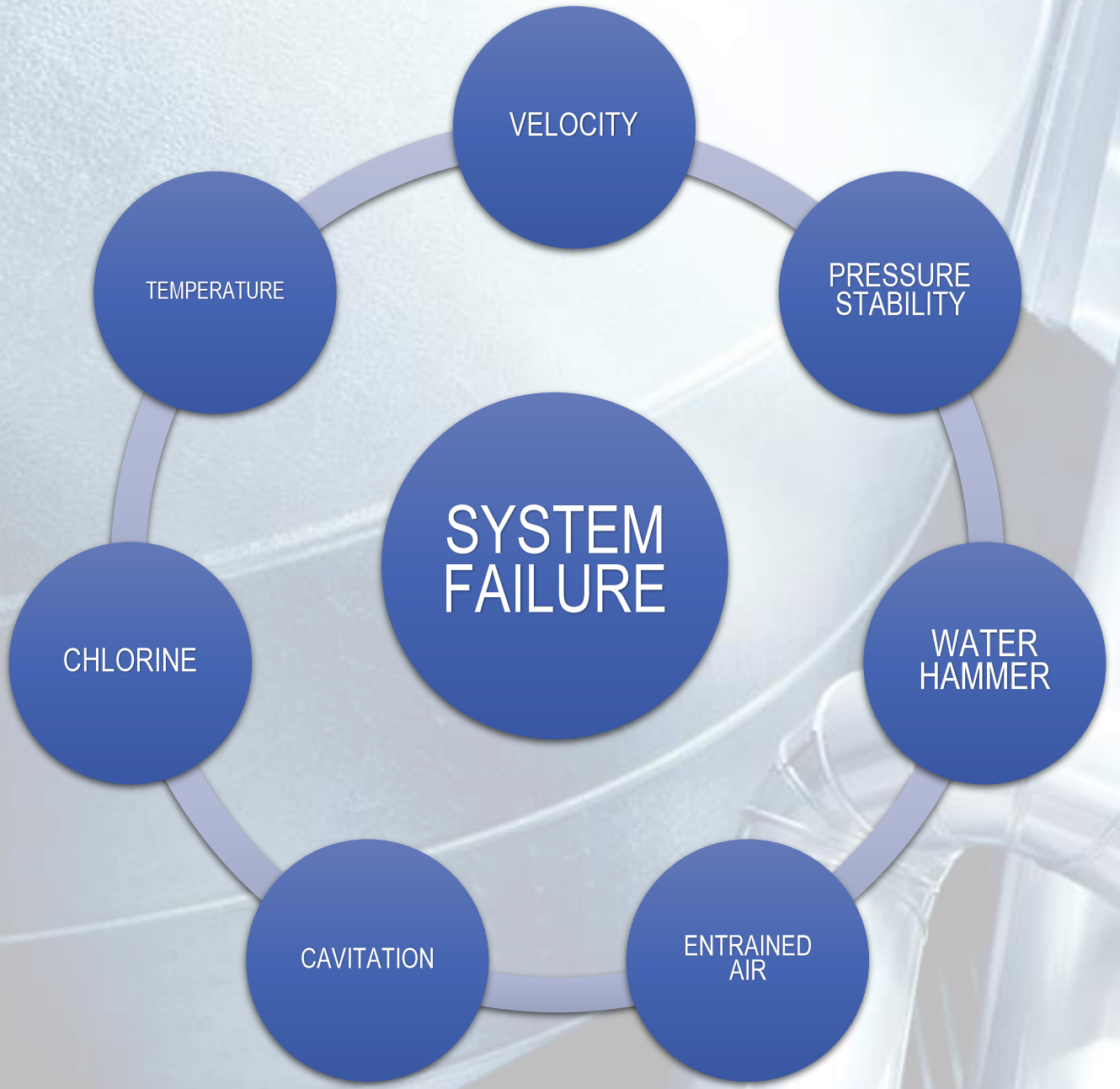
CONTRIBUTING FACTORS



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VELOCITY

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PROBABLE SIMULTANEOUS DEMAND (PSD) IN AS3500

NO. OF UNITS OR DWELLINGS	AS3500	HIGHEST RECORDED ONSITE MEASUREMENT
100	7.55 L/s	2.0 L/s

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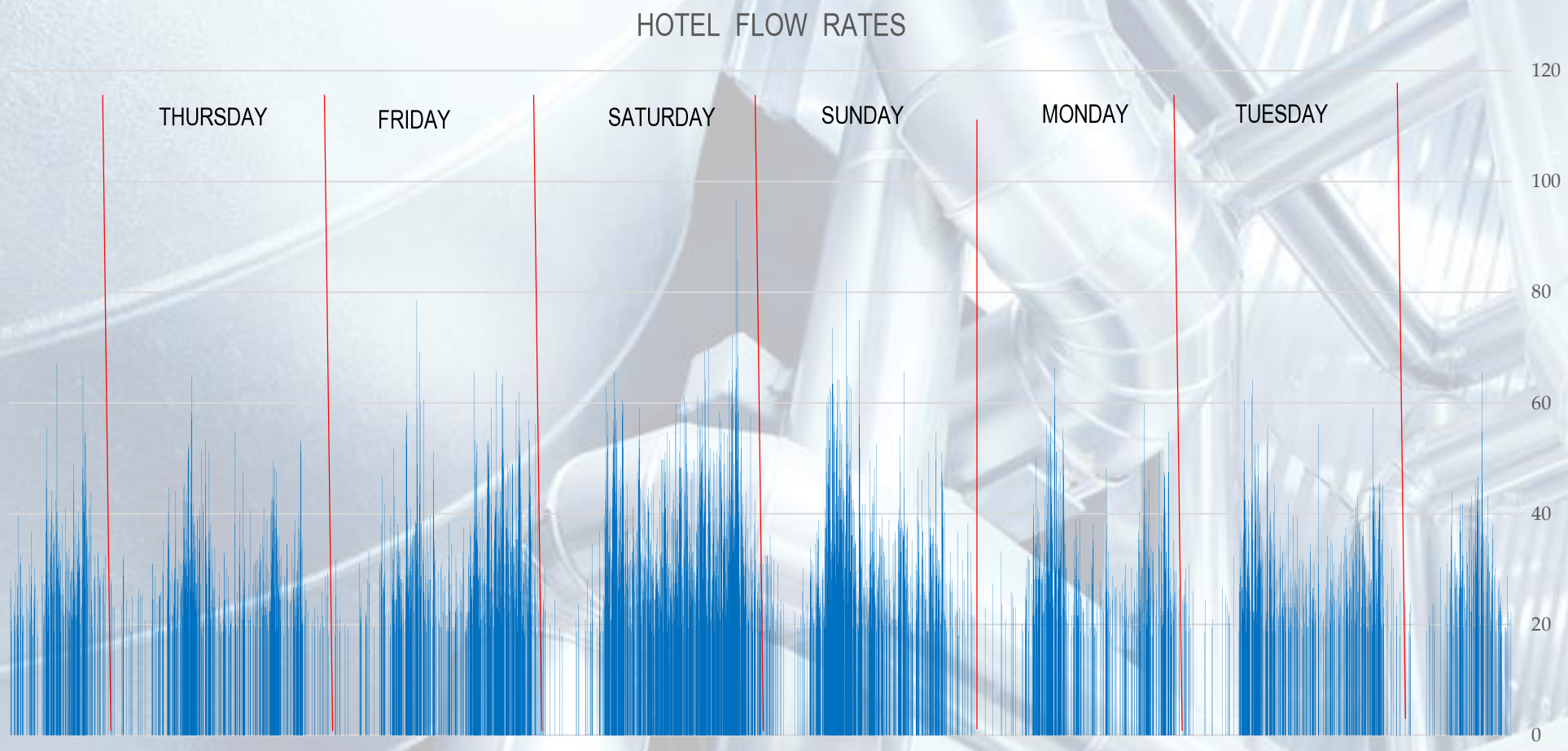
WEEKLY FLOW PROFILE



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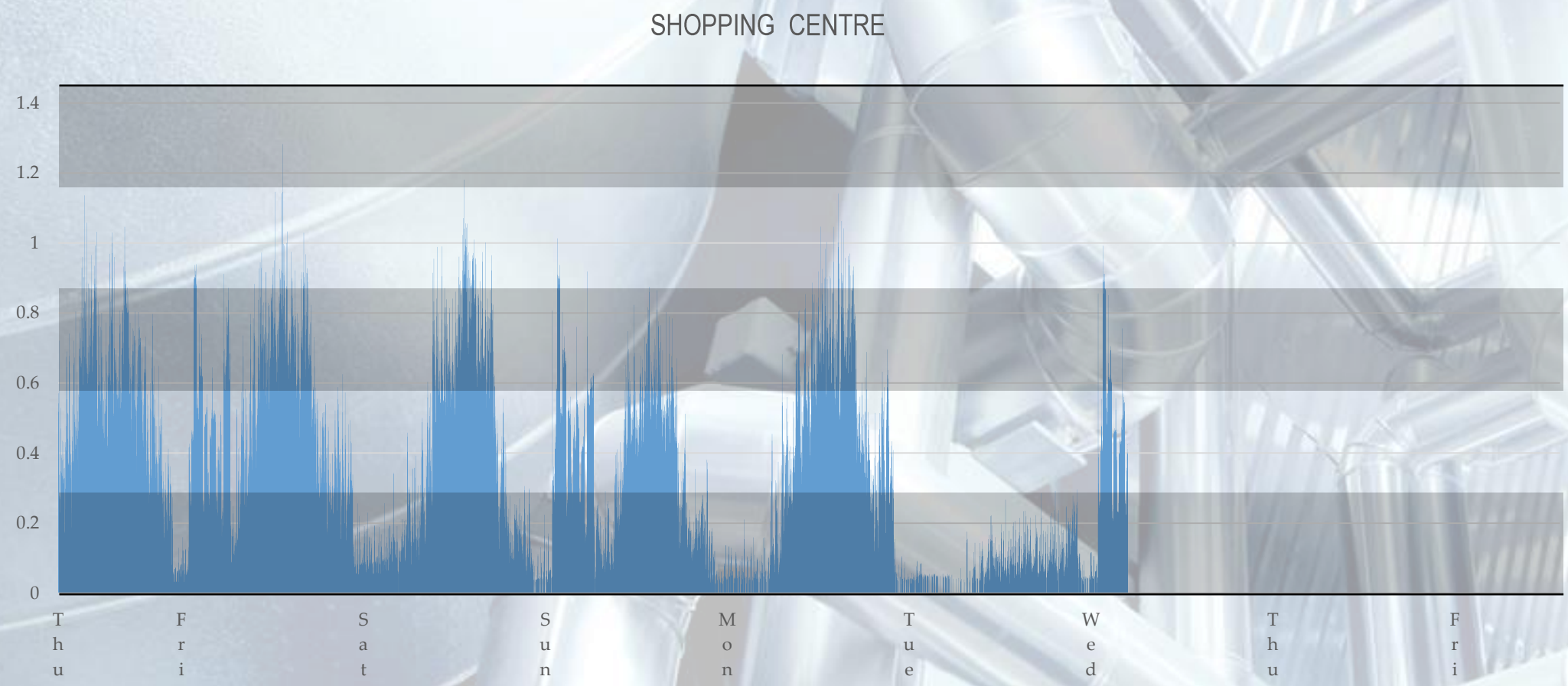
ZONES OF FLOW PROFILE



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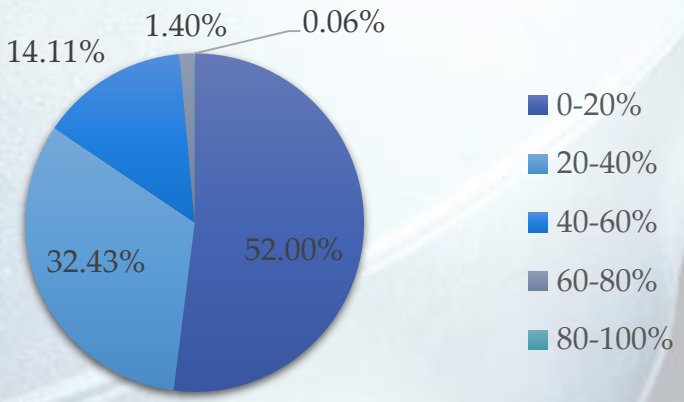
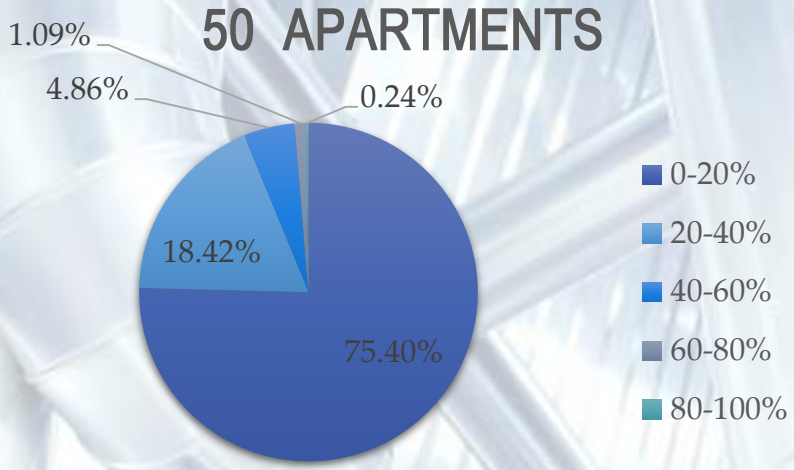
PERCENTAGE OF FLOW WITHIN ZONES

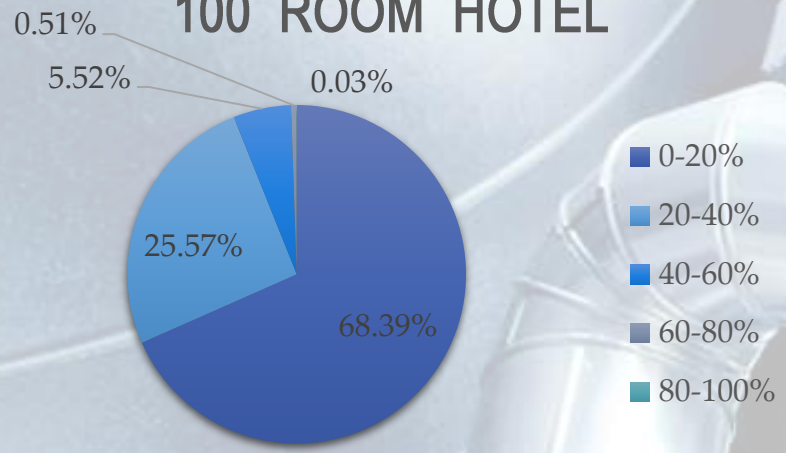
SHOPPING CENTRE



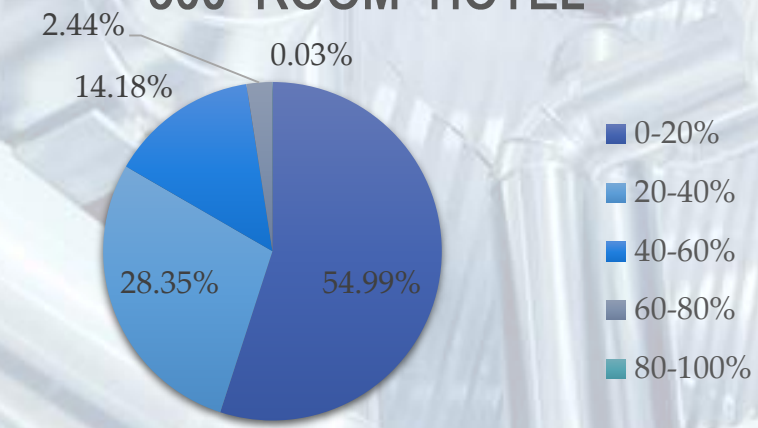
50 APARTMENTS



100 ROOM HOTEL



500 ROOM HOTEL



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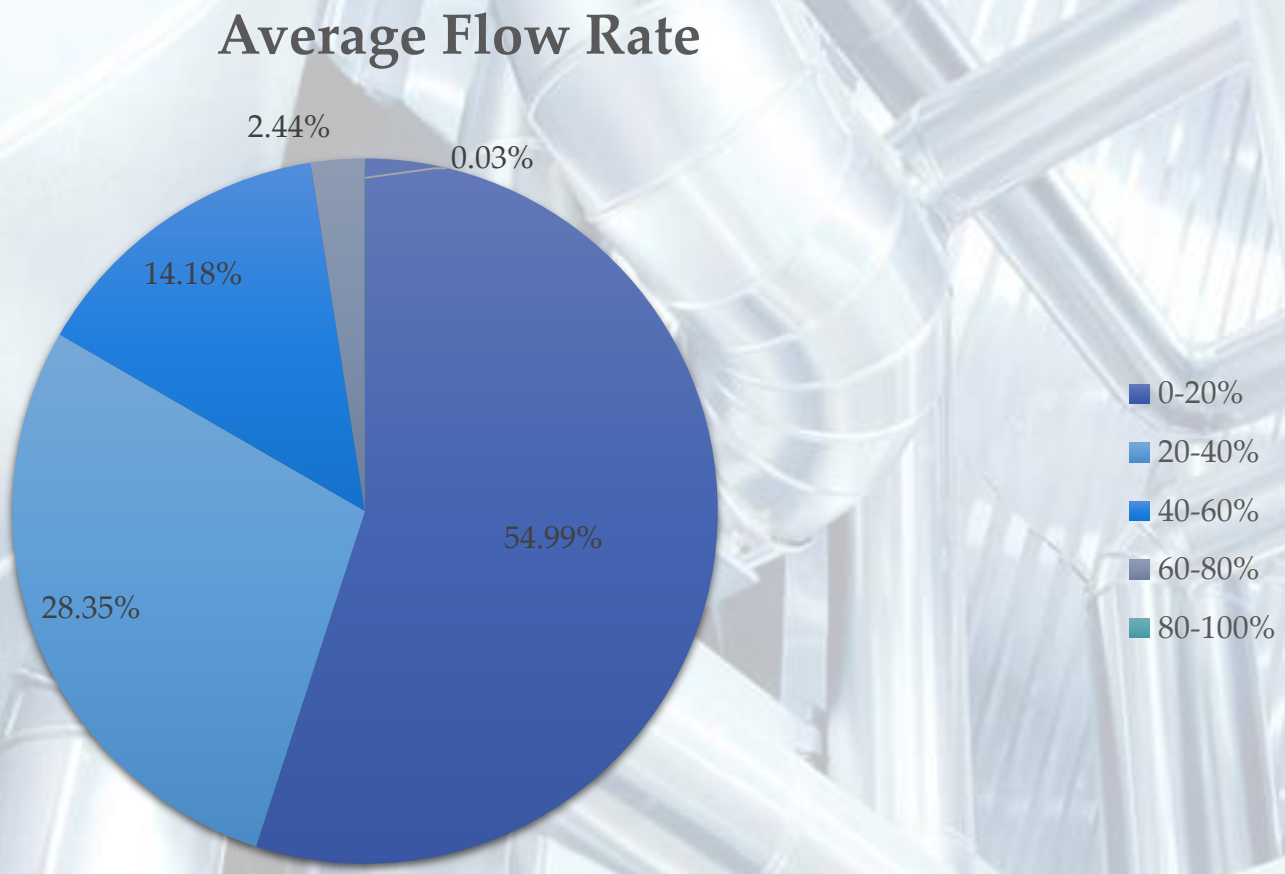
COMBINED ZONED FLOW PROFILE



97% of the time Flows are less than 60% of the weekly peak

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SUMMARY OF VELOCITIES

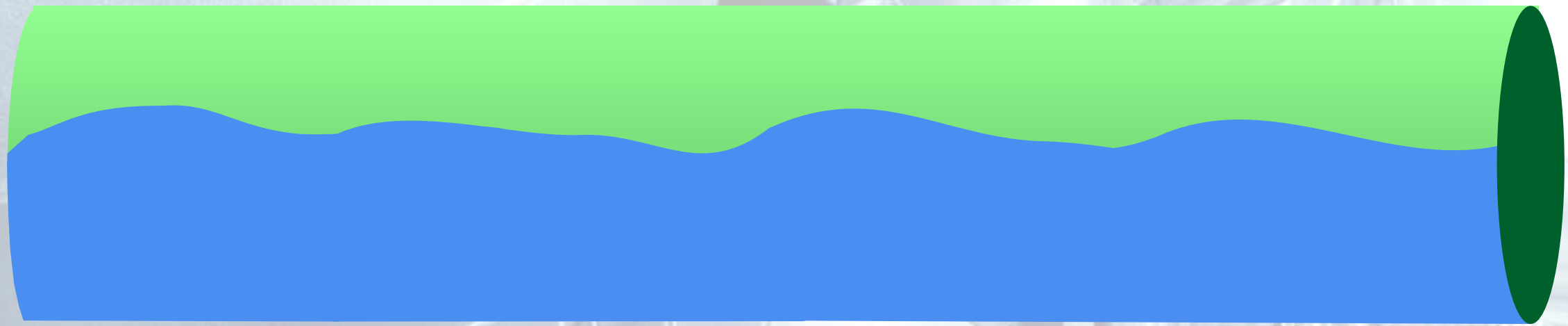
IN GENERAL IF USING PSD VALUES IN AS3500 OR THE BSB THE VELOCITIES ARE LIKELY TO BE TOO LOW NOT TOO HIGH (LESS THAN 0.2M/S)

THE MAJORITY OF HIGH VELOCITIES ARE DUE TO OVERSIZED RETURN OR PRIMARY CIRCULATING PUMPS

VELOCITIES WERE TOO HIGH IN AS3500 (NOW ADDRESSED 2019)

THE VELOCITY IN PIPES NEEDS TO BE ENOUGH TO MOVE ENTRAINED AIR

ENTRAINED AIR



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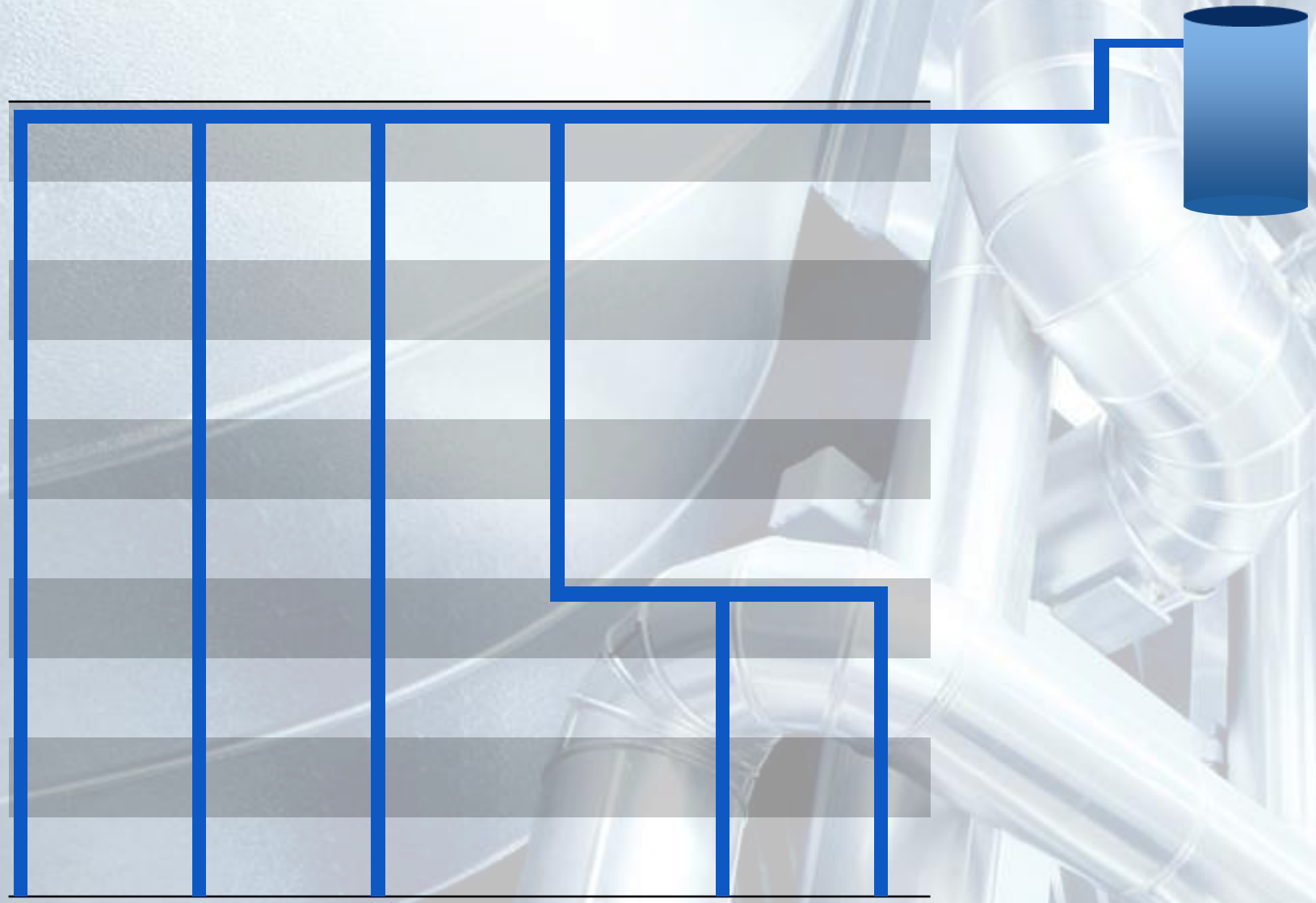
LOCATION OF DAMAGE DUE TO AIR



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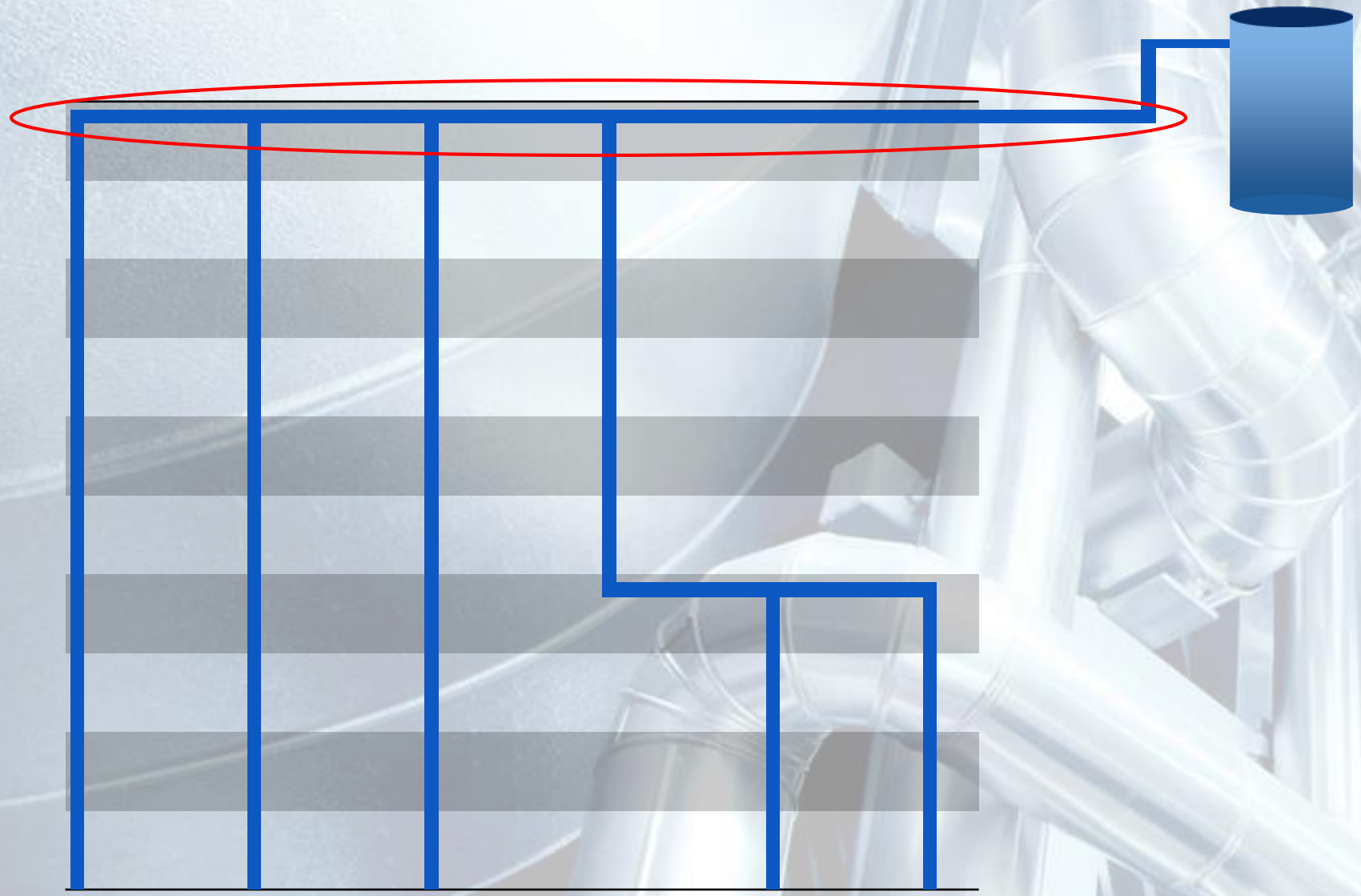

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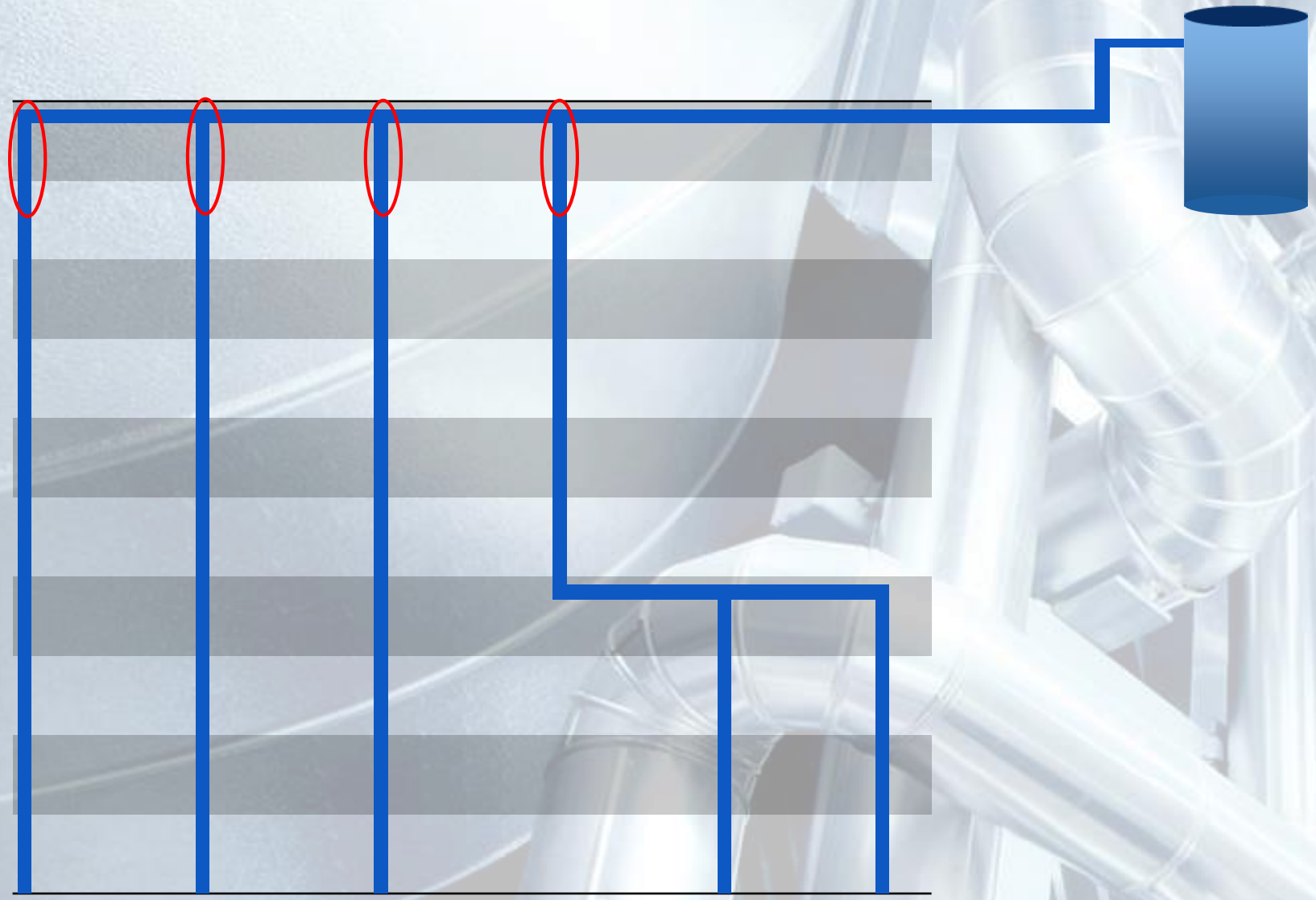

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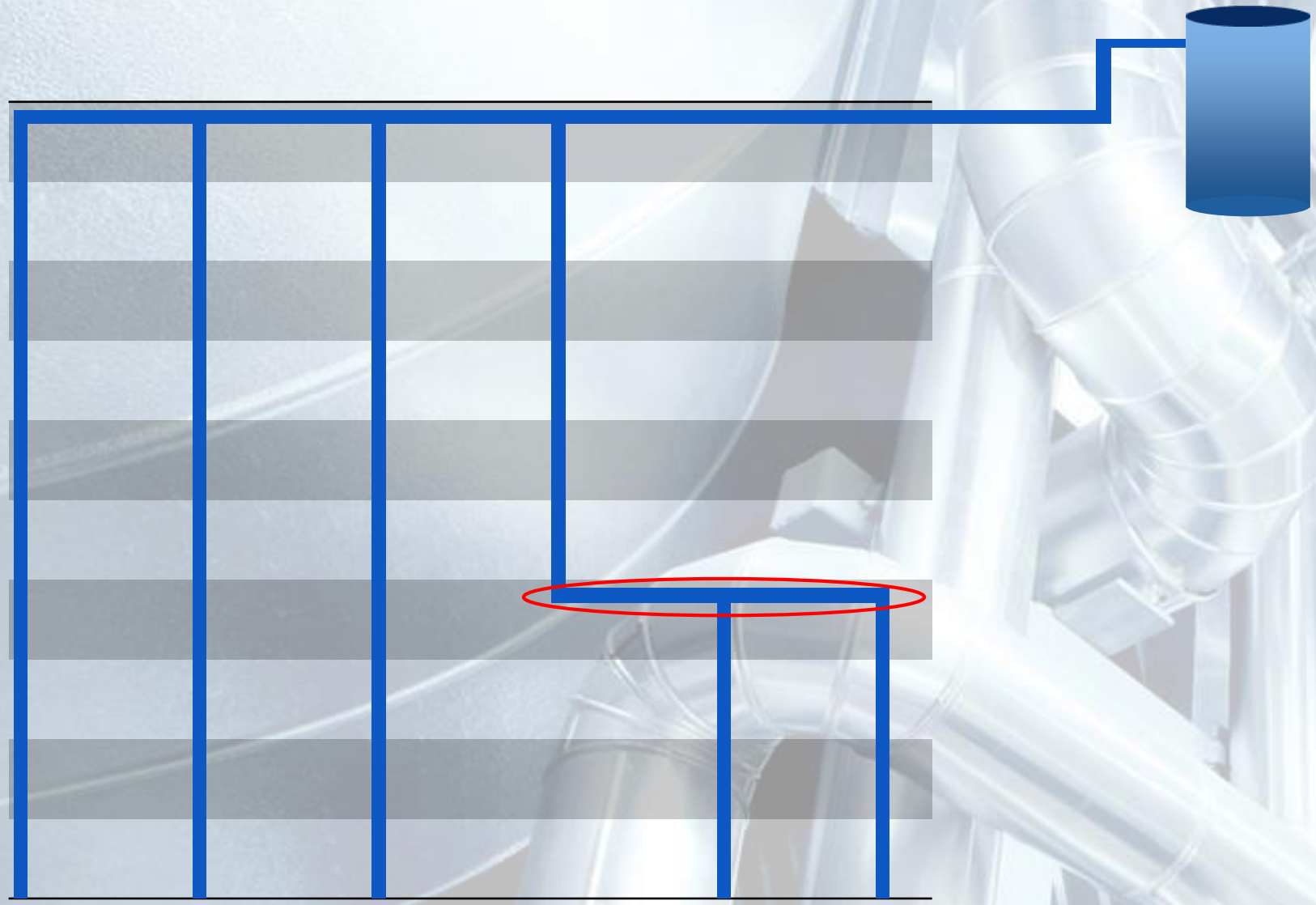

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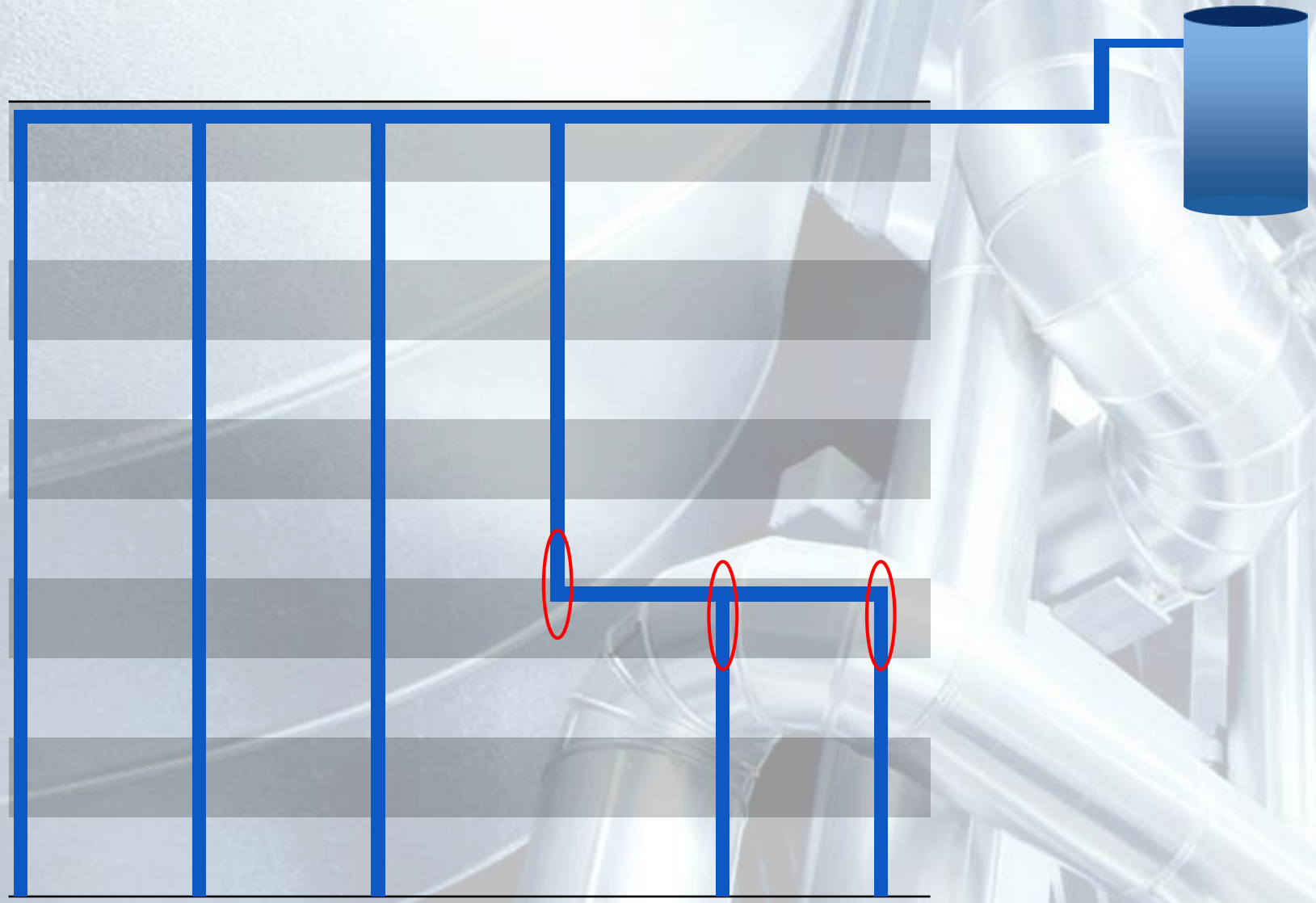

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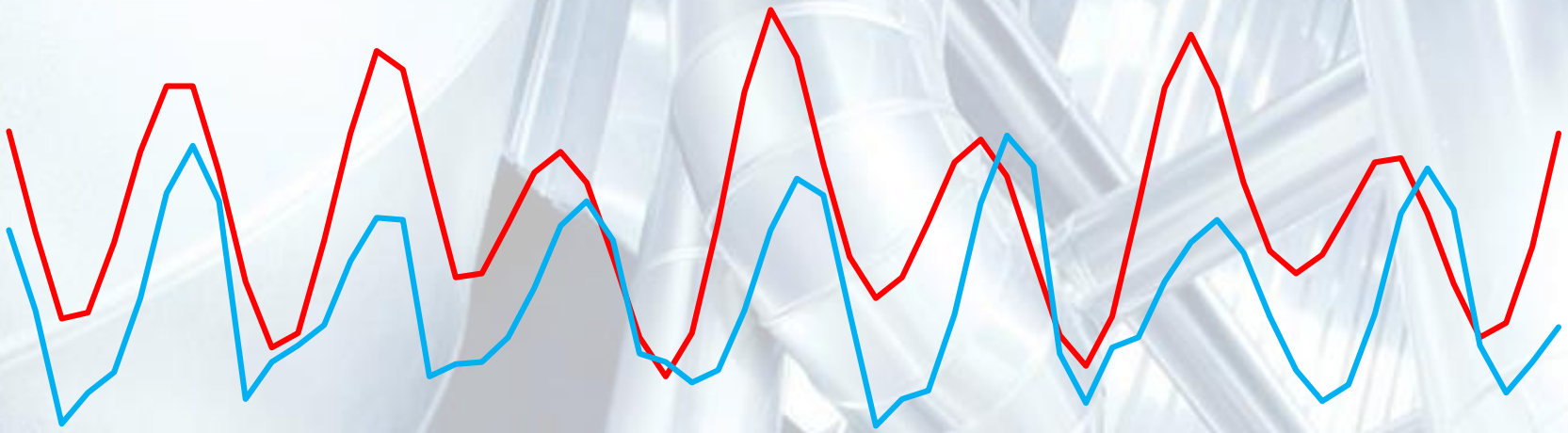
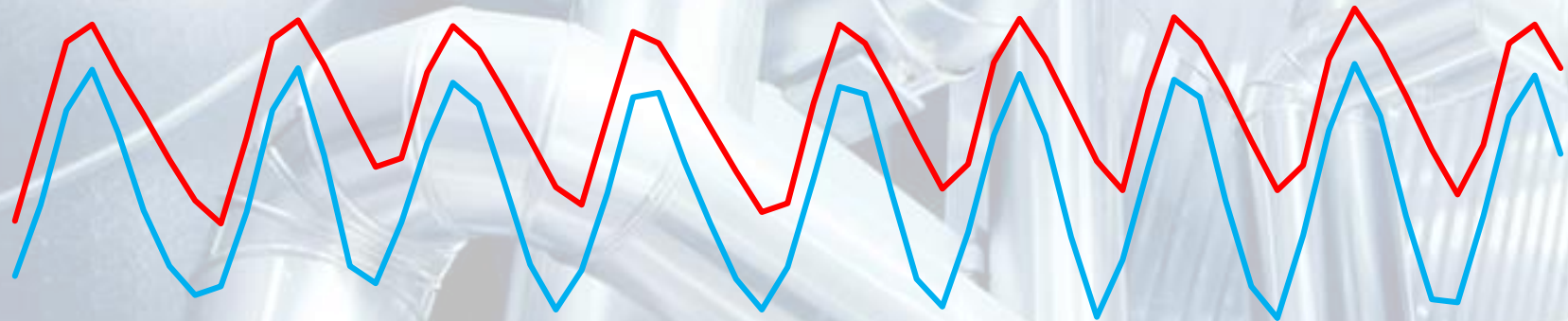
PRESSURE PROFILING LOOKING FOR AIR

WITH AIR



AIR REMOVED



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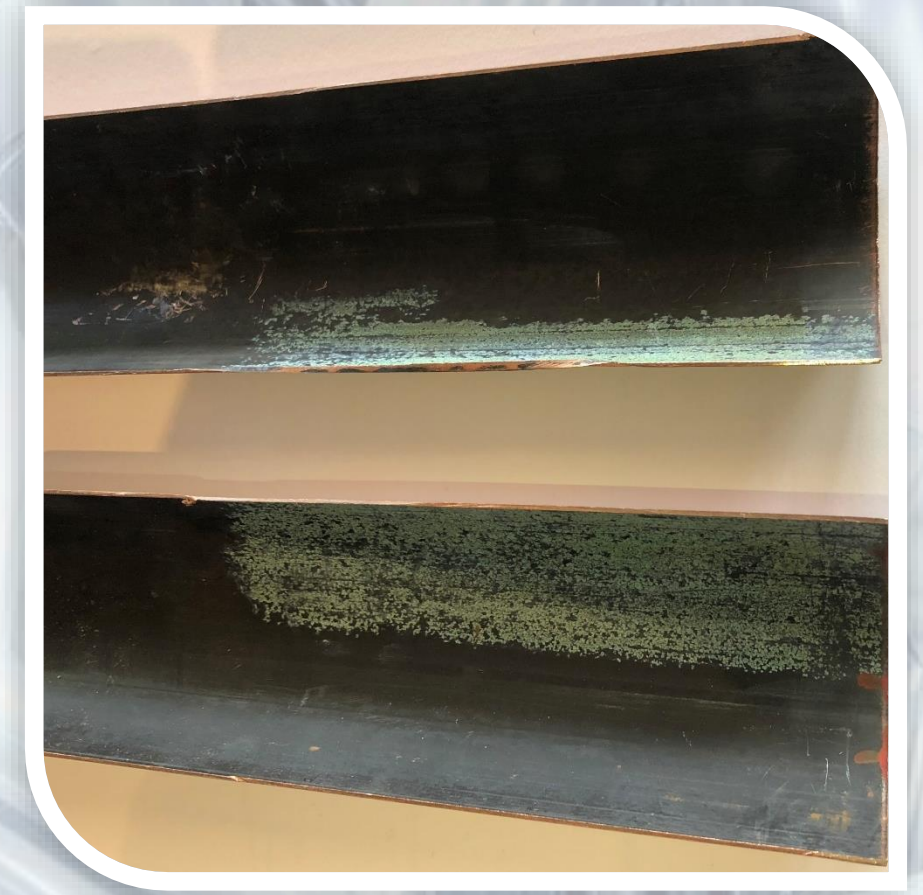
ENTRAINED AIR



EVIDENCE OF PIPES HALF FULL OF AIR THAT HAVE LED TO FAILURE

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ENTRAINED AIR SUMMARY

- AIR IN PIPES CHANGES THE PRESSURE DYNAMICS OF THE ENTIRE SYSTEM
- THE MIXTURE OF AIR, DISINFECTANTS AND TEMPERATURE INCREASES CORROSION TO ALL MATERIALS EXPONENTIALLY
- MOST MODERN DAY PIPING SYSTEMS ARE NOT DESIGNED OR INSTALLED TO AID IN AIR RELEASE

PRESSURE

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PRESSURE STABILITY

PRESSURE REQUIREMENTS IN AS3500	
AS 3500.1	
3.3.2 MINIMUM	50KPA DYNAMIC PRESSURE AT THE MOST DISADVANTAGED FIXTURE
3.3.4 MAXIMUM	STATIC PRESSURE NOT TO EXCEED 500KPA AT ANY OUTLET

PRESSURES WITHIN THE STANDARD DO NOT ADDRESS CYCLIC ACTIVITY

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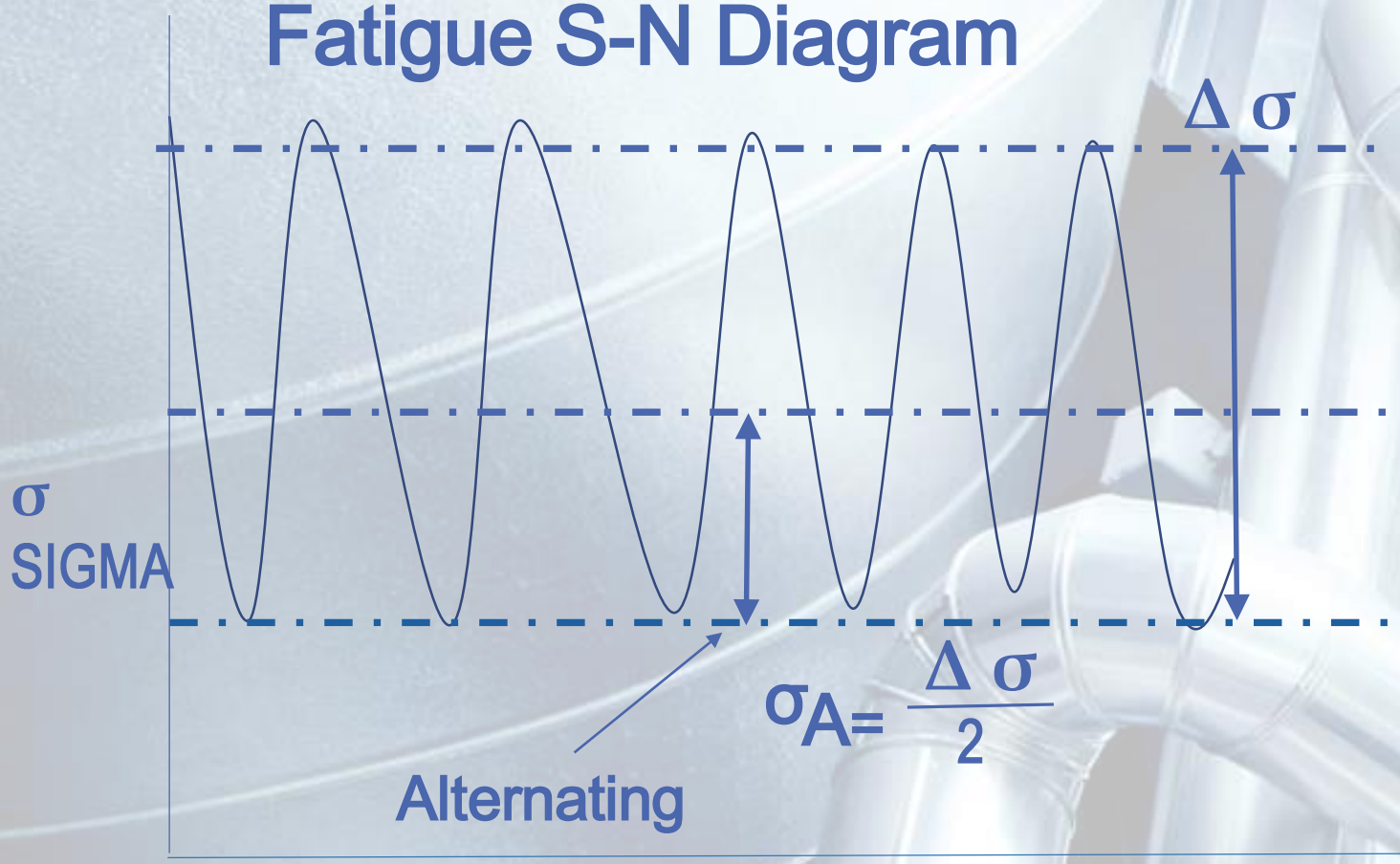
Pressure Stability

Fatigue S-N Diagram



Force over a function of time

A MATERIALS LIFE CAN BE CALCULATED BASED ON THE RATE OF CYCLIC ACTIVITY

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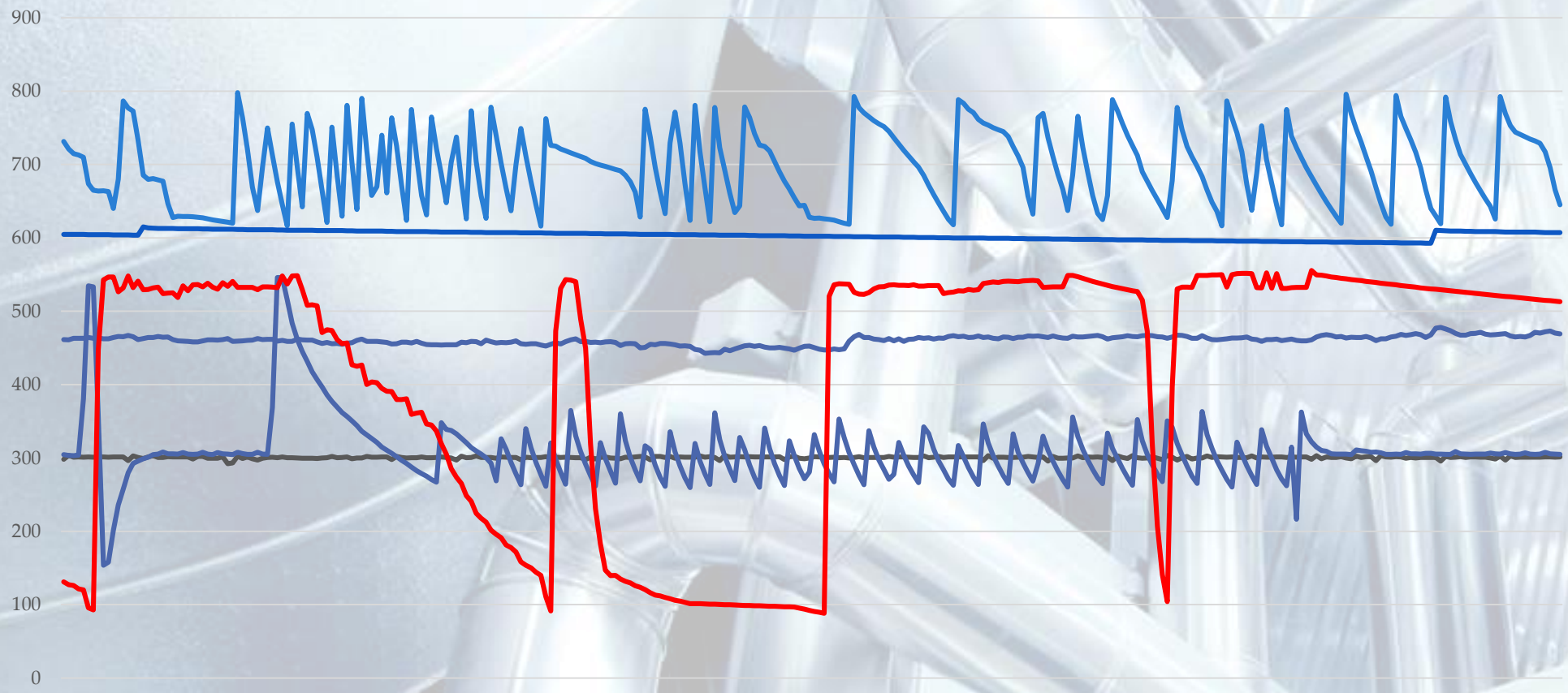
CYCLIC PRESSURES



SOME EXAMPLES OF PRESSURE WITHIN A SYSTEM THAT HAVE LED TO FAILURE

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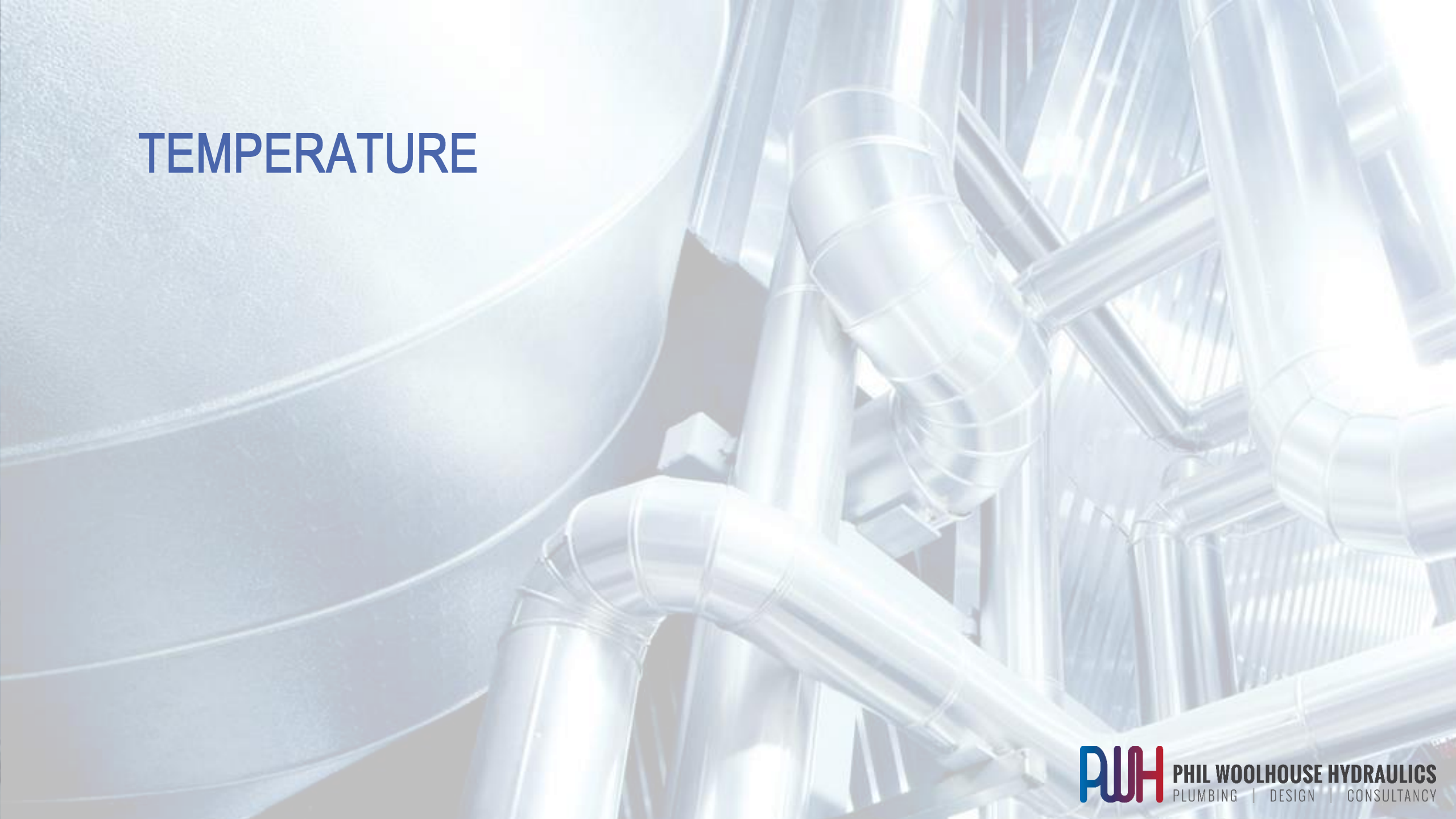
SUMMARY PRESSURE STABILITY

- MOST CYCLIC PRESSURES ARE CAUSED BY OVERSIZED BOOSTER PUMPS
- CYCLIC PRESSURES CAN ALSO BE CAUSED BY AIR BEYOND THE PRESSURE REDUCTION VALVES
- PRESSURE CYCLING NOT ONLY DAMAGES PIPES BUT HOT WATER TANKS AND VALVES

TEMPERATURE



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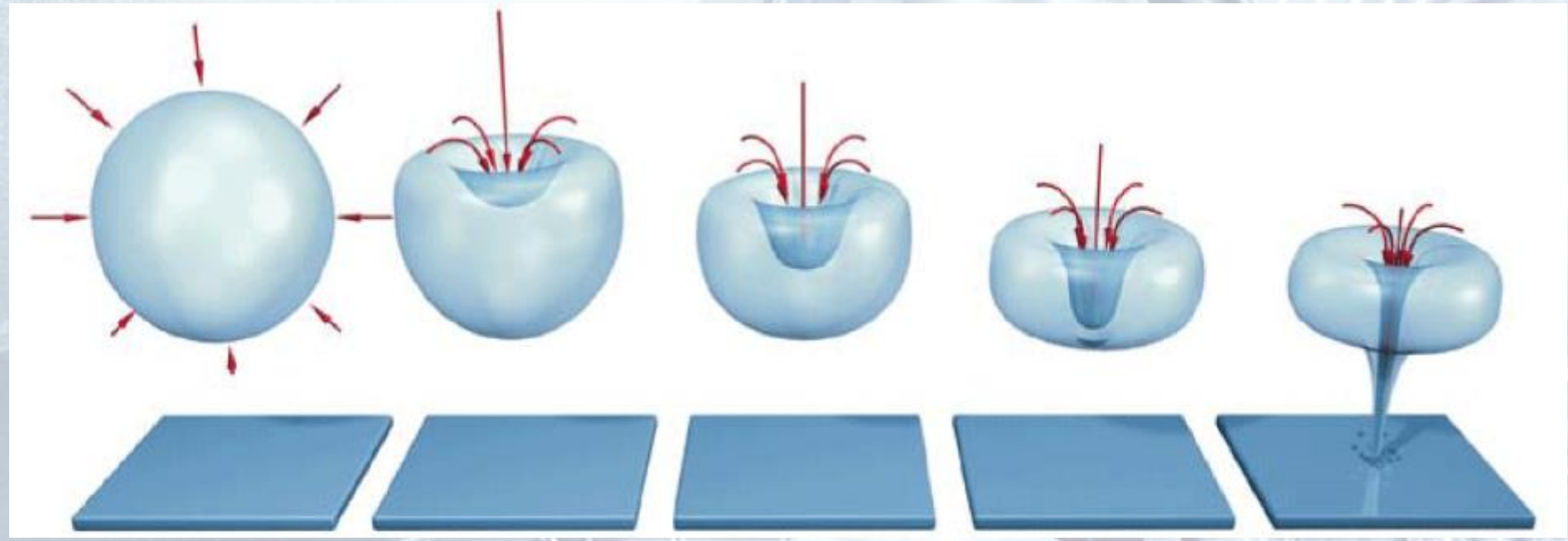
TEMPERATURE

- THE HIGHER THE WATER TEMPERATURE, THE MORE AIR RELEASED FROM THE WATER
- DISINFECTANTS BECOME UNSTABLE IN HIGH TEMPERATURE WATER AND CAN GAS OUT OF SOLUTION
- HIGHER WATER TEMPERATURES INCREASES THE RATE OF CORROSION

CAVITATION



PRESSURE BURSTS CAN BE IN EXCESS OF
58,000PSI OR 400,000KPA
CAN REACH TEMPERATURES OF OVER 1000°k

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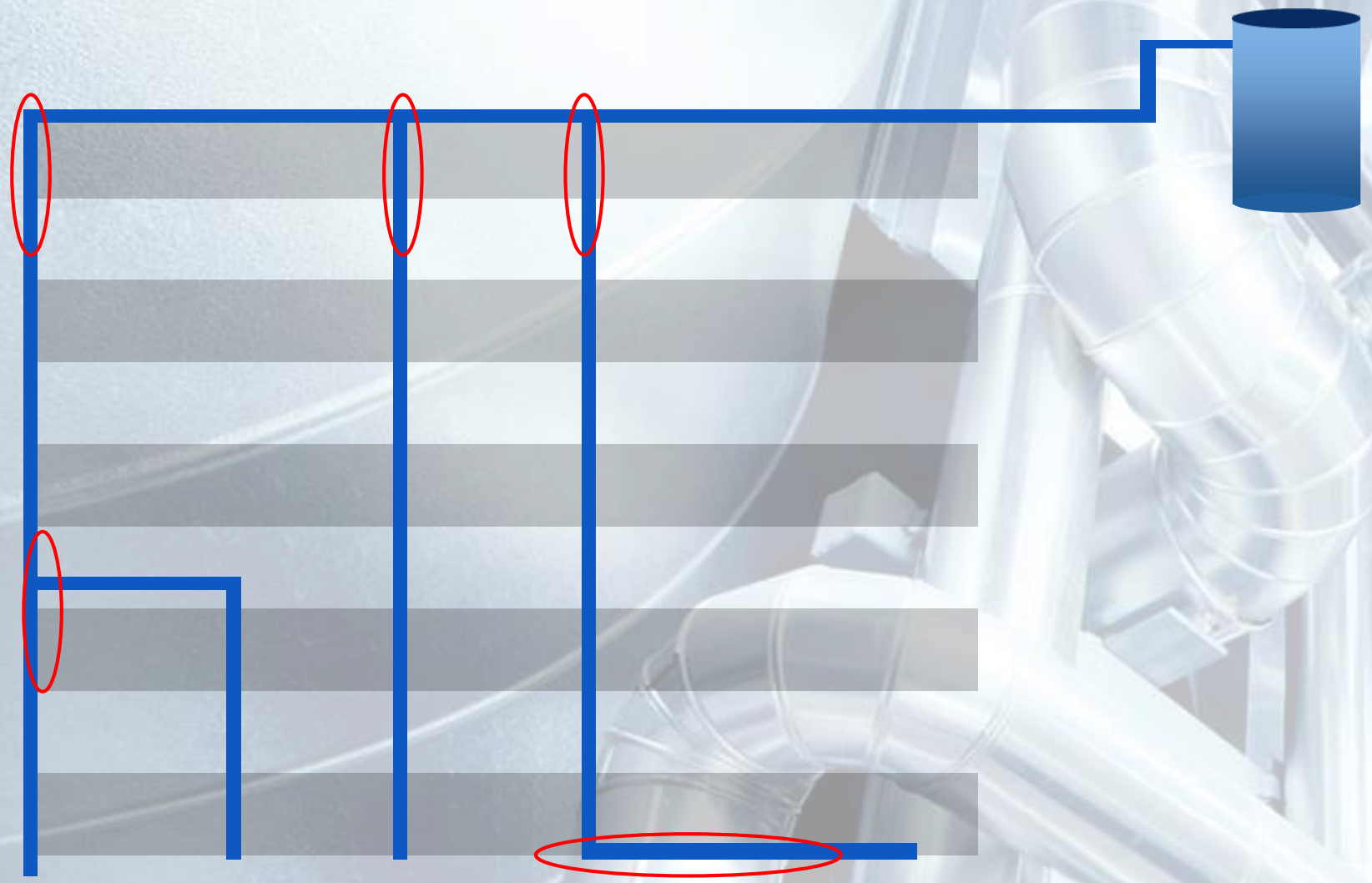
CAVITATION DAMAGE



AIR IN THE SYSTEM LEADS TO CAVITATION

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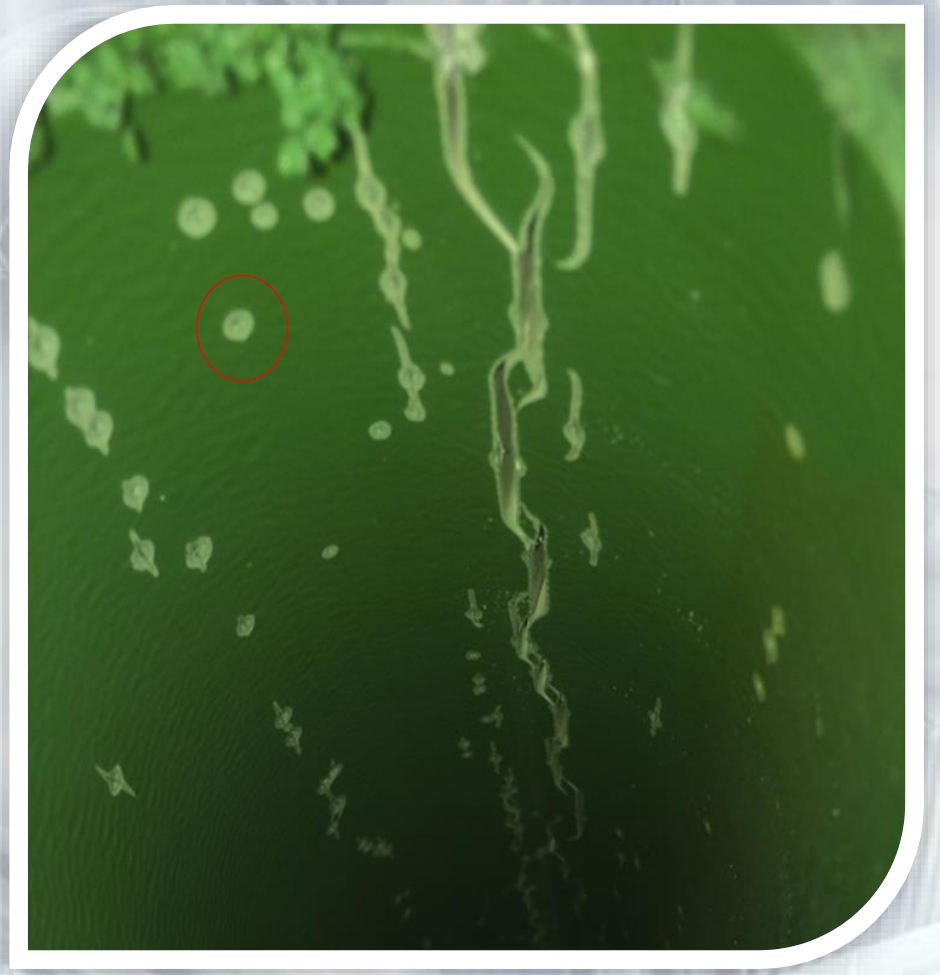
CAVITATION DAMAGE



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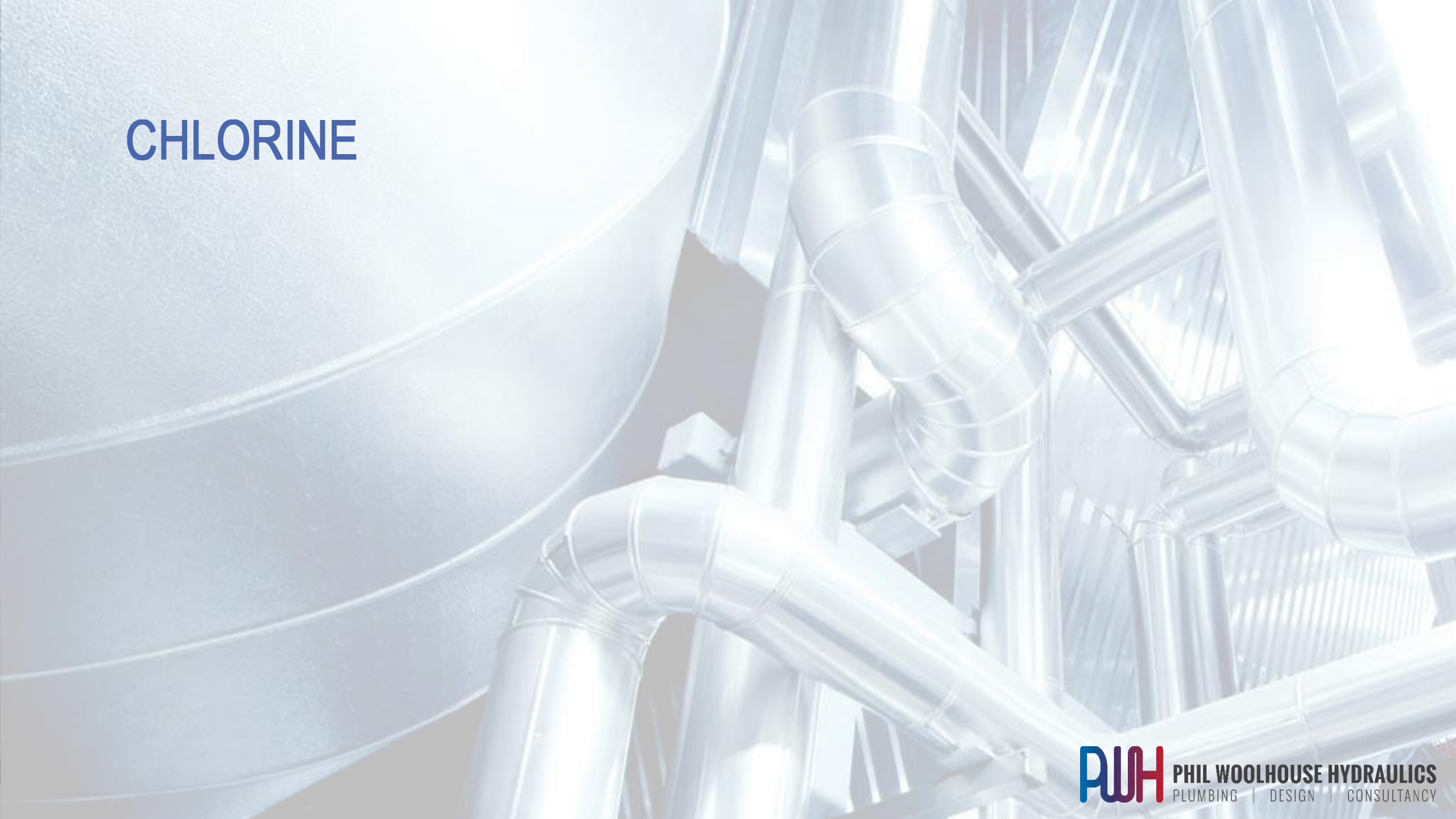
CHLORINE



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CHLORINE

FREE CHLORINE LEVELS VARY THROUGHOUT THE DAY

LEVELS ARE DEPENDANT ON THE LOCATION OF THE BUILDING TO THE NETWORK

CHLORINE ANALYSIS SHOULD BE UNDERTAKEN FOR EACH AREA

CHLORINE IS MOST AGGRESSIVE AT HIGH TEMPERATURE AND WHEN EXPOSED TO AIR

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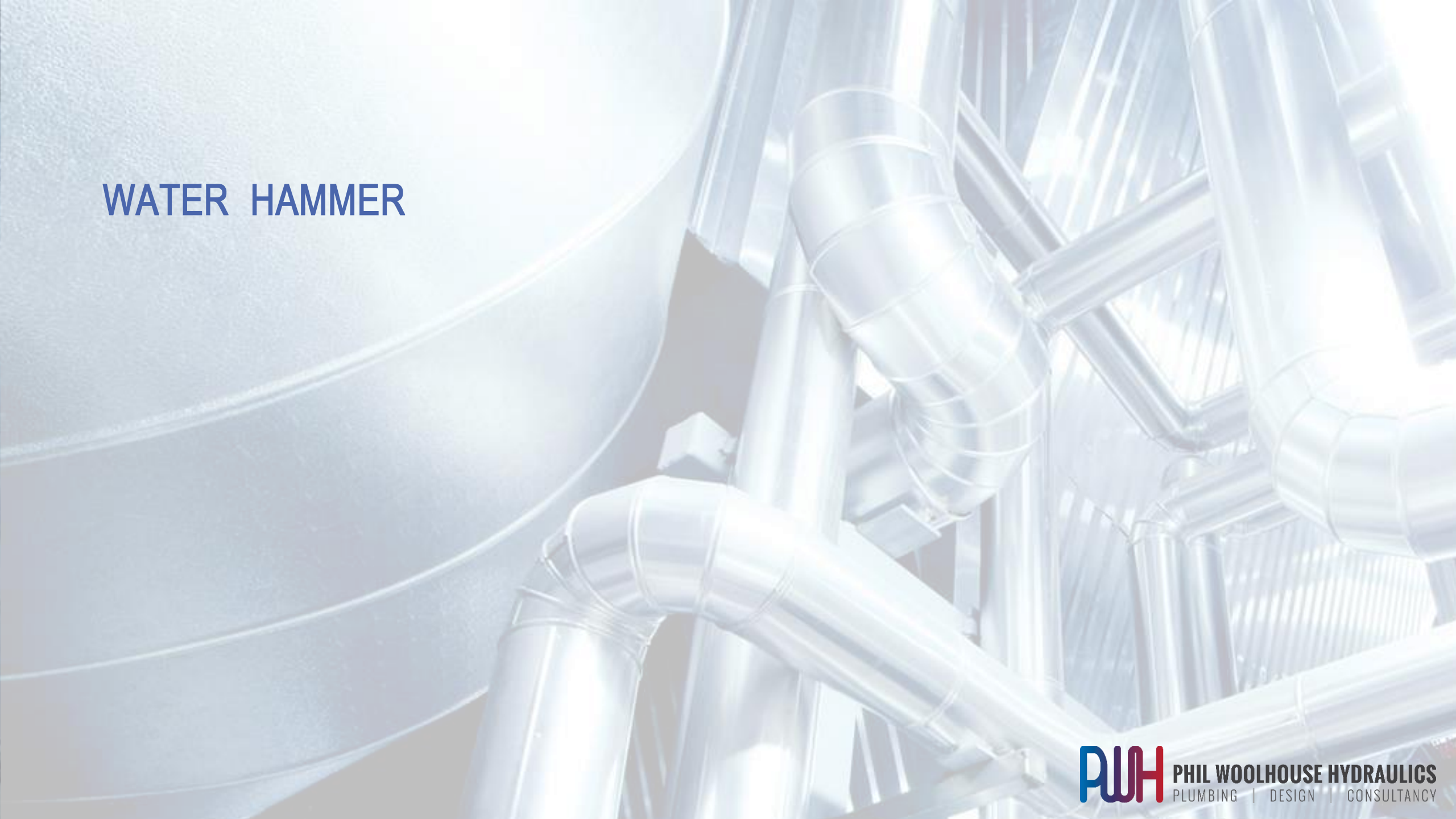
WATER HAMMER



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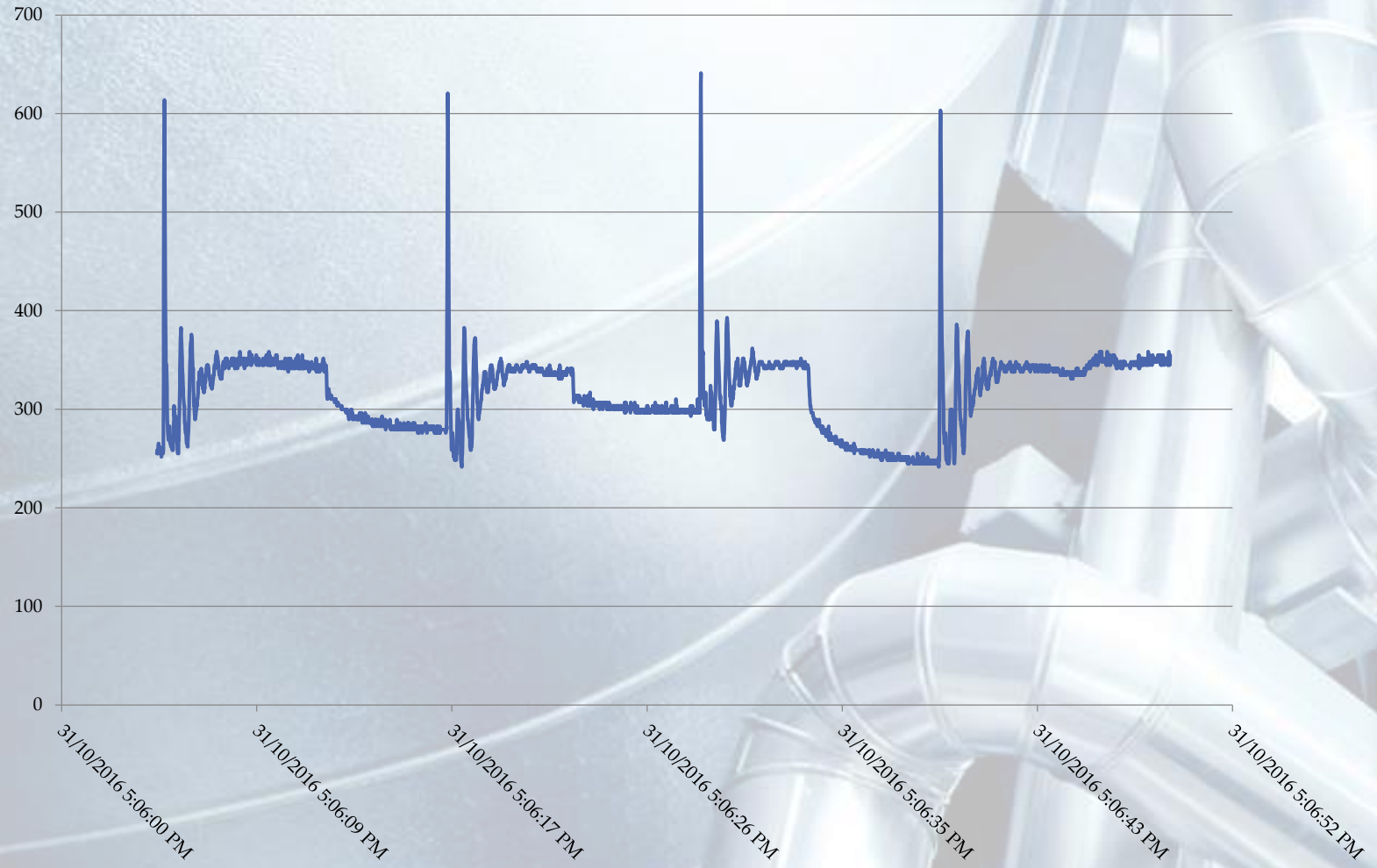
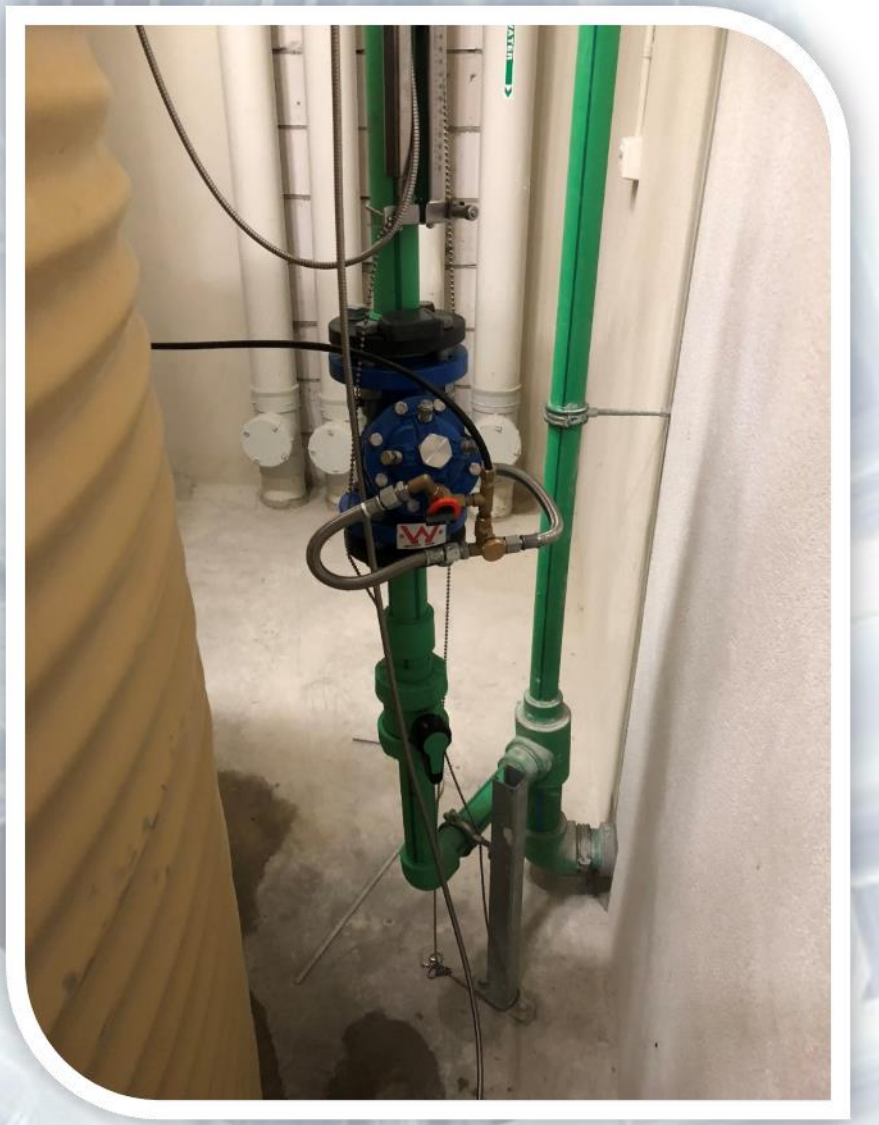
WATER HAMMER





PRESSURE SHOCKS OCCURRING DURING NORMAL OPERATION OF A TAP

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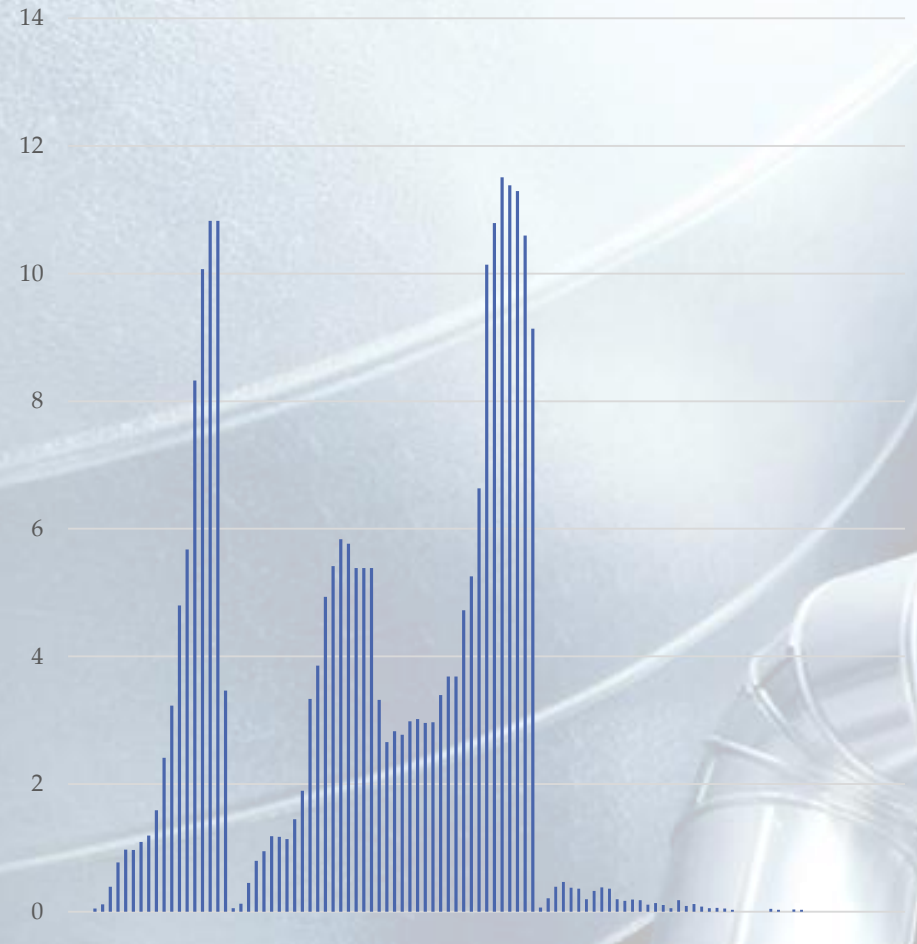
WATER HAMMER

Velocity



Pressure

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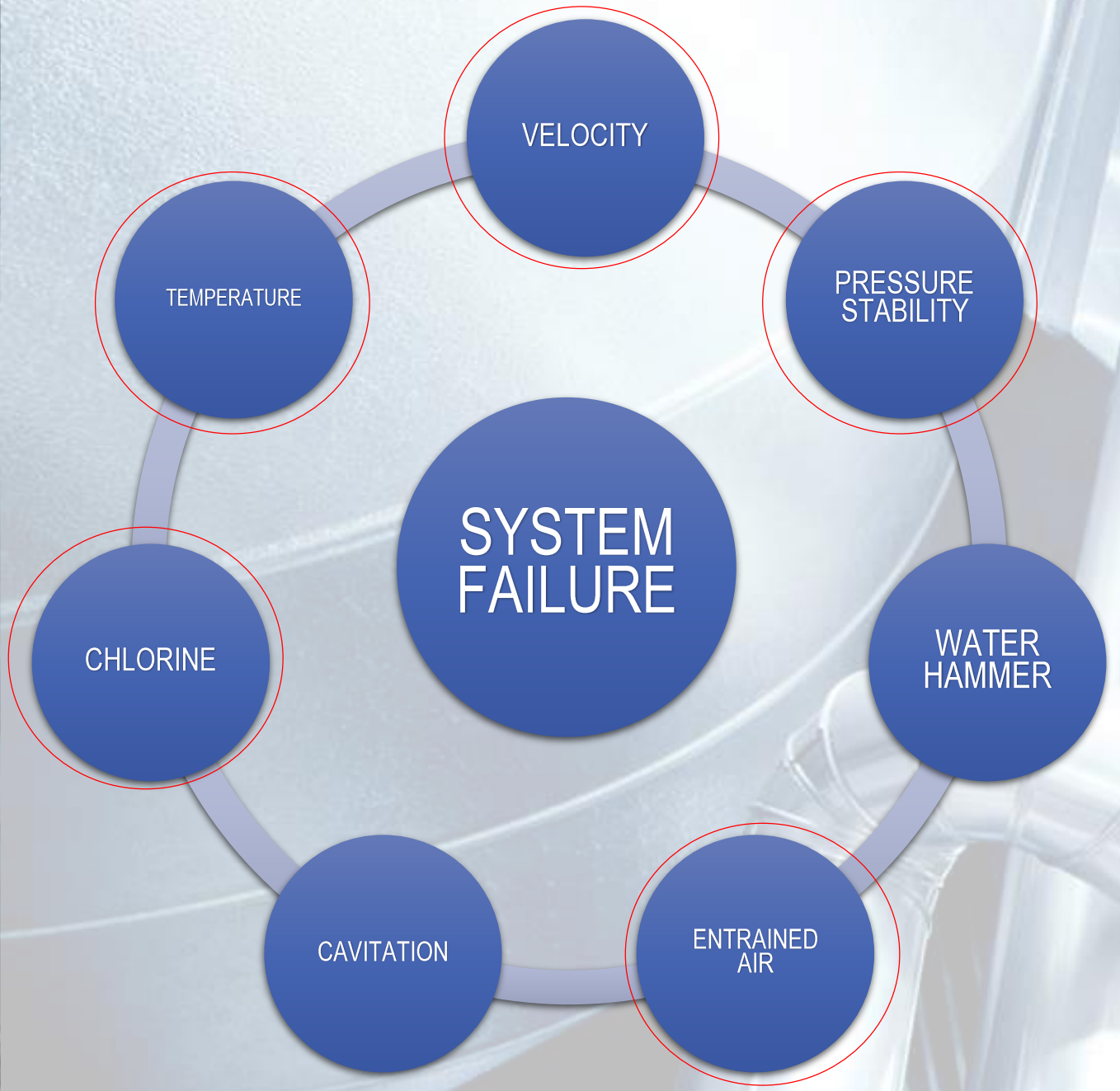

SUMMARY

WE HAVE CONTROL OVER THE FUNCTIONS CIRCLED IN RED.

BY ADDRESSING THESE WE CAN ELIMINATE THE OTHER TWO

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CONCLUSION

98% OF ALL BUILDINGS WITH SYSTEM FAILURES INVESTIGATED BY PWH HAVE HAD A COMBINATION OF FOUR OR MORE OF THESE ACTIONS

IT IS THE COMBINATION OF THESE ACTIONS THAT LEADS TO FAILURE - NOT ONE OCCURRING INDIVIDUALLY

IT HAS TAKEN SIX YEARS TO ESTABLISH AND IDENTIFY THESE PROBLEMS

THROUGH A COLLABORATIVE INDUSTRY APPROACH WE CAN DELIVER SOLUTIONS TO PROVIDE BETTER PLUMBING SYSTEMS INTO THE FUTURE

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THANKS
FOR LISTENING

ANYONE WILLING TO HELP OR SUPPORT CHANGE SO WE CAN IMPROVE PLUMBING SYSTEMS IN AUSTRALIA CAN CONTACT ME AT

phil@pwhydraulics.com

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