313 HEATING DISTRIBUTION

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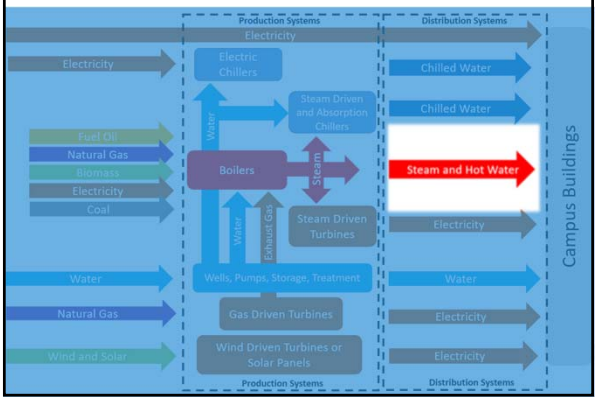
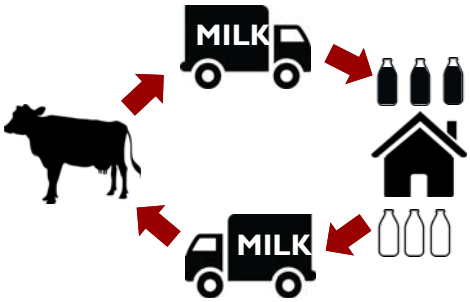
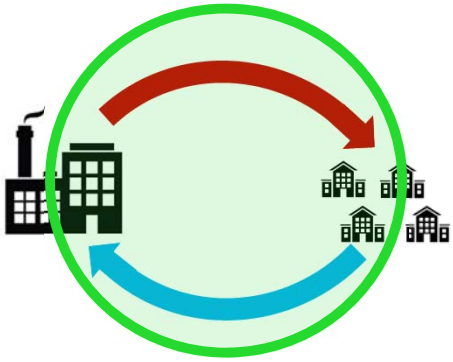
HEATING DISTRIBUTION



HEATING A CAMPUS



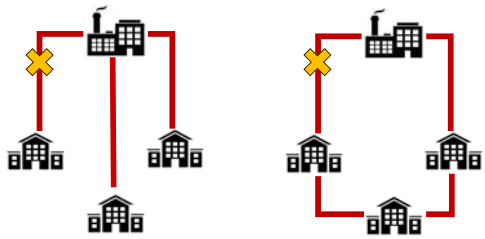
HEATING A CAMPUS



OVERVIEW

- Radial or Looped
- How Pipe Fails
- Steam or Hot Water
- Pipe Materials
- Direct Buried or Tunnel
- Costs

RADIAL OR LOOPED



Radial Looped

HOW PIPE FAILS

Corrosion
Expansion
Water Hammer
Excavation

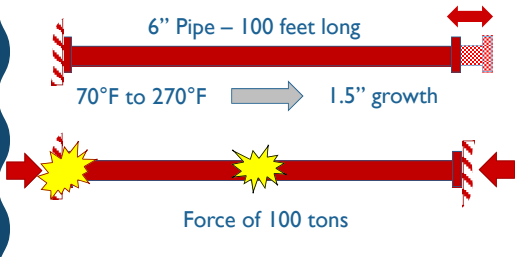
CORROSION

External and Internal

Water + Iron + Oxygen = Rust

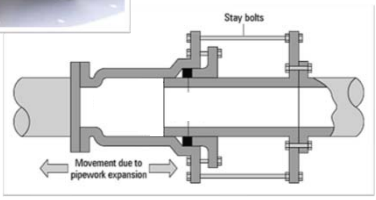
Solution:
No Water,
No Iron, or
No Oxygen

EXPANSION



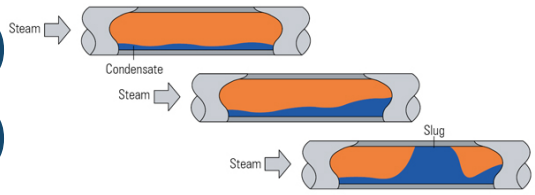
Solution:
Add Flexibility

EXPANSION



EXPANSION

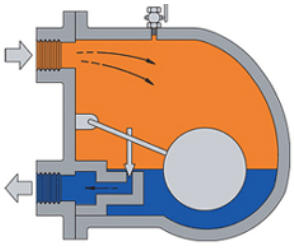
STEAM INDUCED WATER HAMMER



Solution:
Remove condensate from steam line

STEAM INDUCED WATER HAMMER

STEAM INDUCED WATER HAMMER



Traps

Float

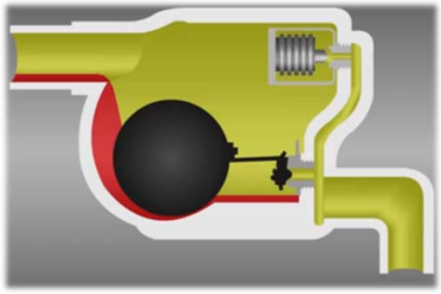
Inverted Bucket

Thermostatic

Thermodynamic

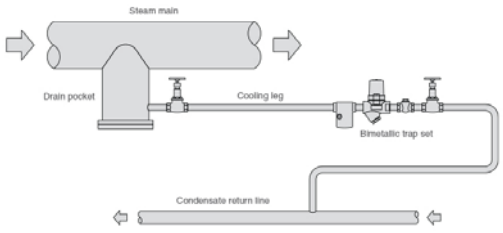
Nozzle

FLOAT TRAP

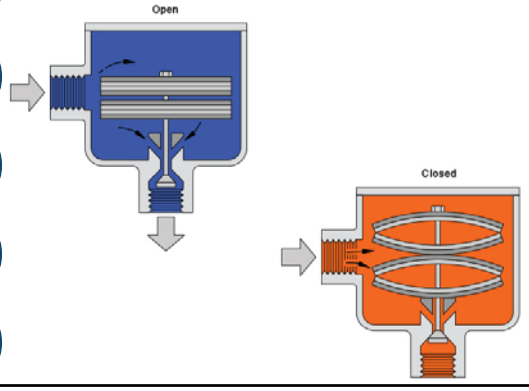


INVERTED BUCKET TRAP

STEAM TRAPS



STEAM TRAPS



STEAM INDUCED WATER HAMMER

STEAM INDUCED WATER HAMMER

STEAM INDUCED WATER HAMMER

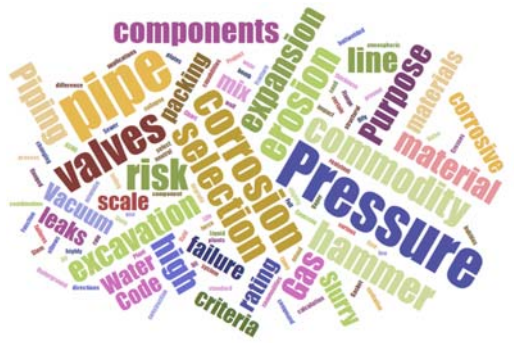
EXCAVATION

STEAM OR HOT WATER

1100 Btu/lb
~350°F

180 Btu/lb
150°F – 300°F

PIPE



DIRECT BURIED PIPE

STEEL

High Temp. = Steel

- Corrosion
+ Expansion
+ Water Hammer
- Excavation

$500 - $1,000/ft

DIRECT BURIED STEEL PIPE

DIRECT BURIED PIPE

PLASTIC

Low Temperature: Plastic is an option

+ Corrosion
+ Expansion
+ Water Hammer
- Excavation?

$400 - $700/ft

TUNNELS

+ Corrosion
+ Expansion
+ Water Hammer
+ Excavation

$4,000 - $7,000/ft

SHALLOW TRENCH

+ Corrosion
+ Expansion
+ Water Hammer
+ Excavation

$2,000 - $3,000/ft

COMPARISON

Direct-Buried
+ Simple and fast
+ Lowest cost

- Less reliable
- More disruption

Tunnel
+ High reliability
+ No disruption

- Very expensive
- Low flexibility

Shallow Trench
+ Good reliability
+ Low disruption

- Expensive
- Low flexibility

PIPE CAPACITY

100,000 GSF
1,000 feet

What size pipe?

125 psig system
4" pipe - $400,000 (100,000 GSF)

10" pipe - $500,000 (1,200,000 GSF)

+25% Cost = +1200% capacity

QUESTIONS?

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