

Digester Heating 101

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Engineers...Working Wonders With Water®

Agenda

- Review hot water system theory and operation
- Discussion on typical components
- Highlight typical problems

Heating System - Considerations

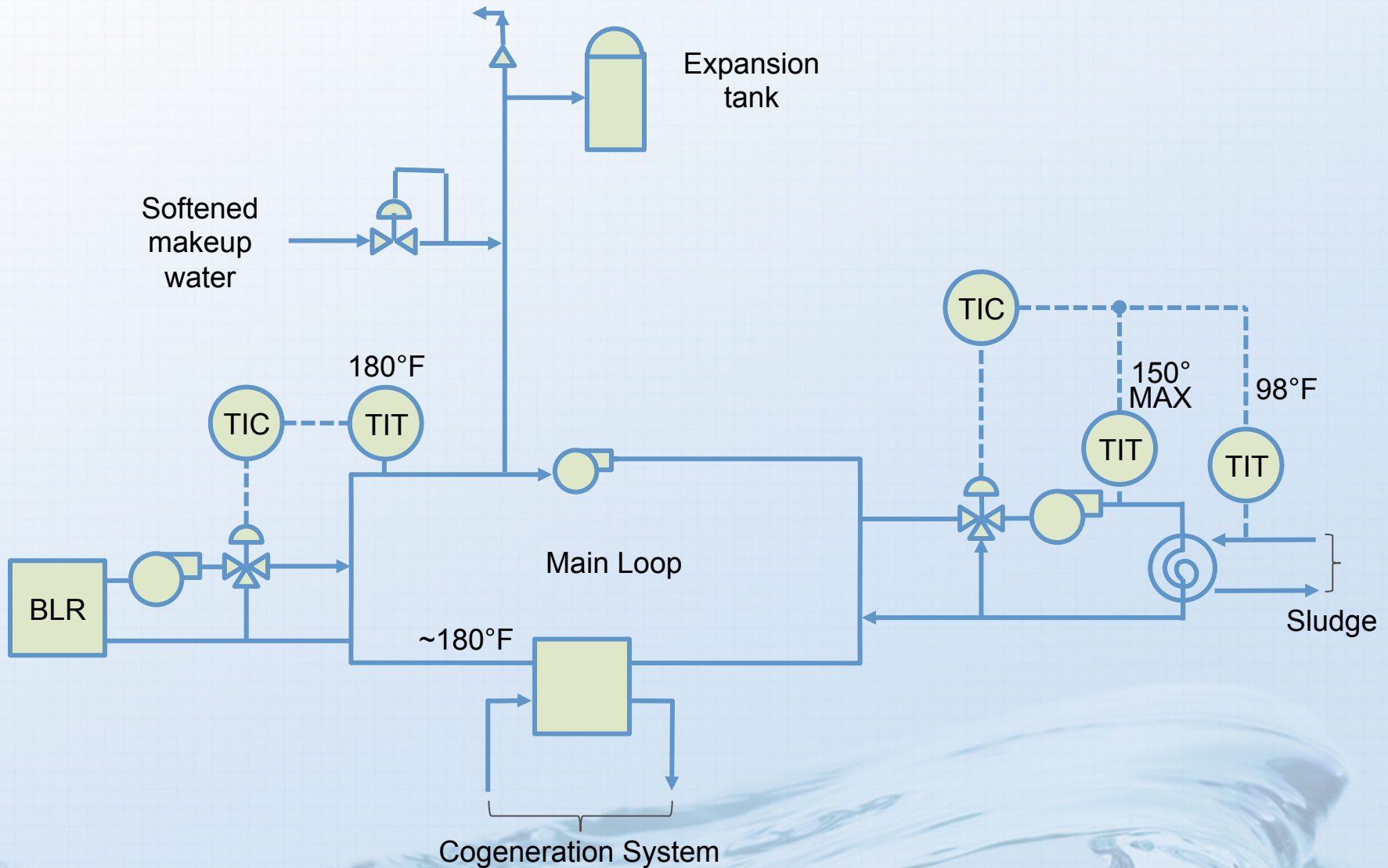
- Move heat from sources to uses
- Hydraulics
- Allow for future expansion and/or cogeneration
- Space requirements
- Complexity of system
- Flexibility
- Operations and maintenance

Heating System Types

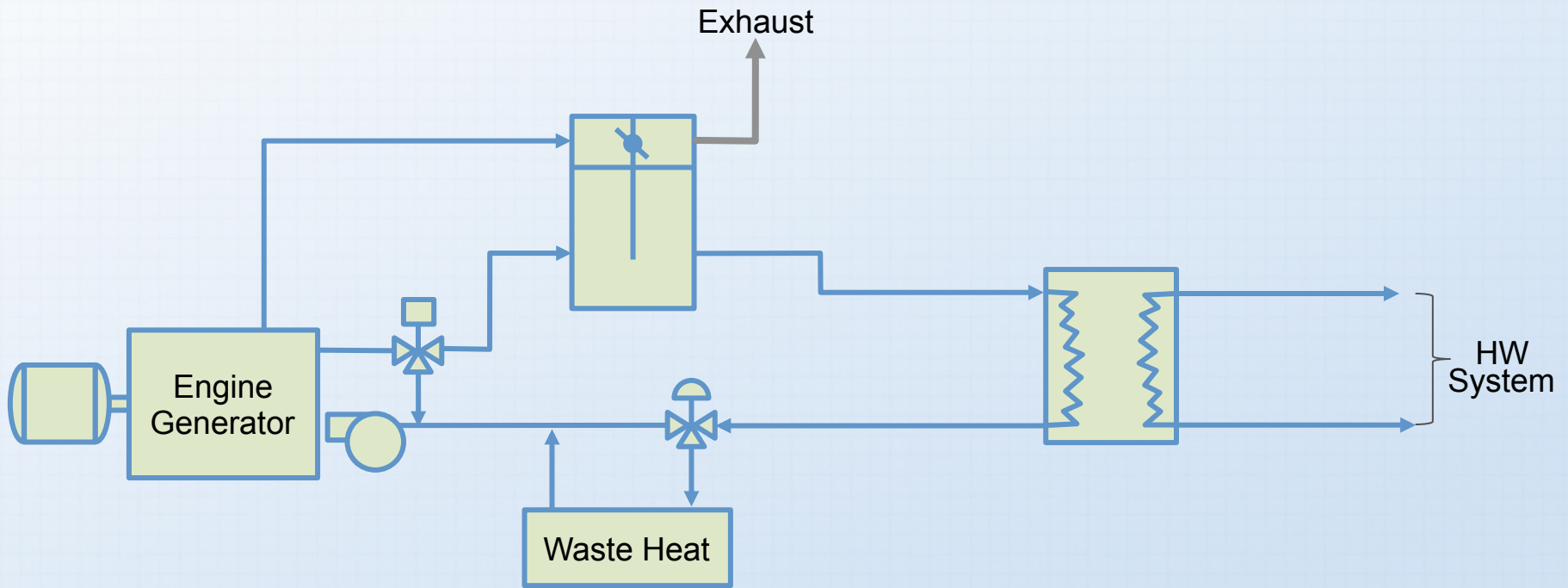
- Primary loop
- Primary-secondary loop
- Constant flow
- Variable flow
- Hybrid systems

*There are
Literally 100's of
configurations!*

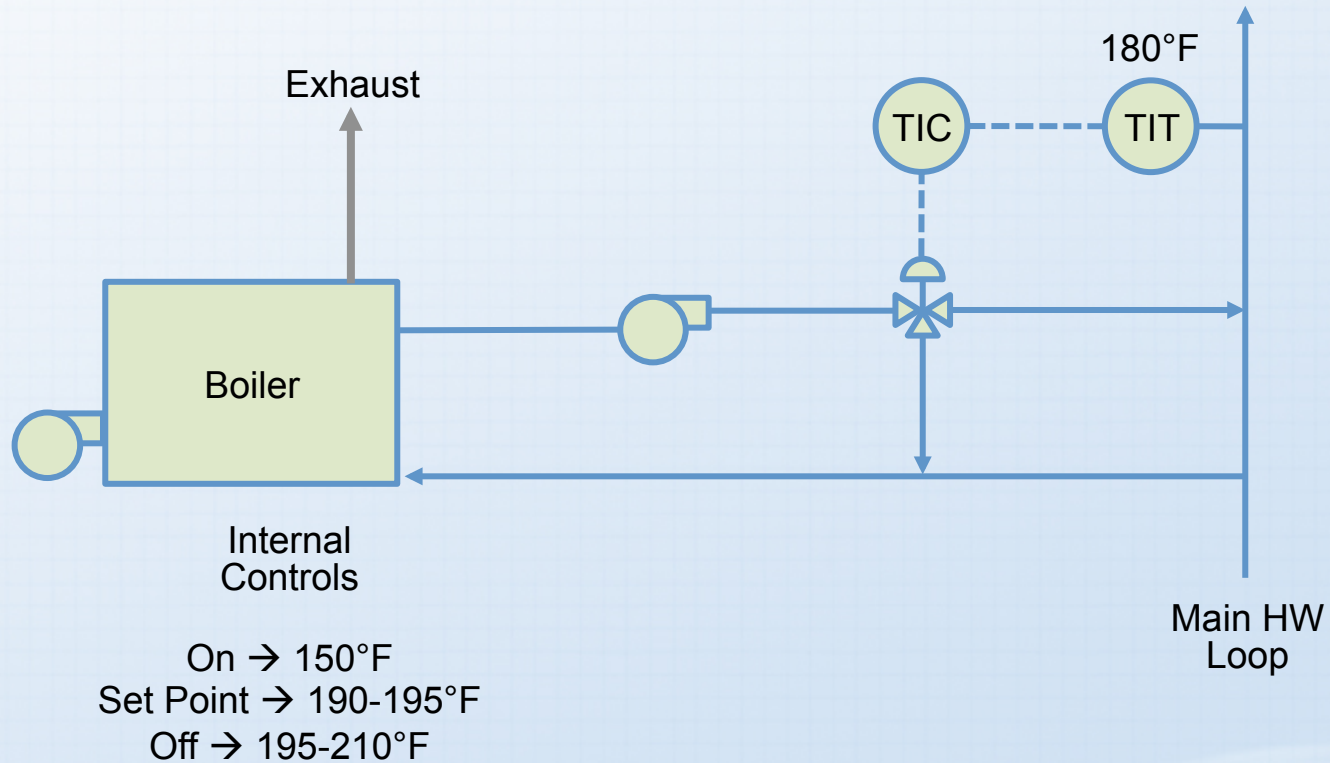
Simplified Hot Water System Schematic



Typical Cogeneration System



Typical Boiler System



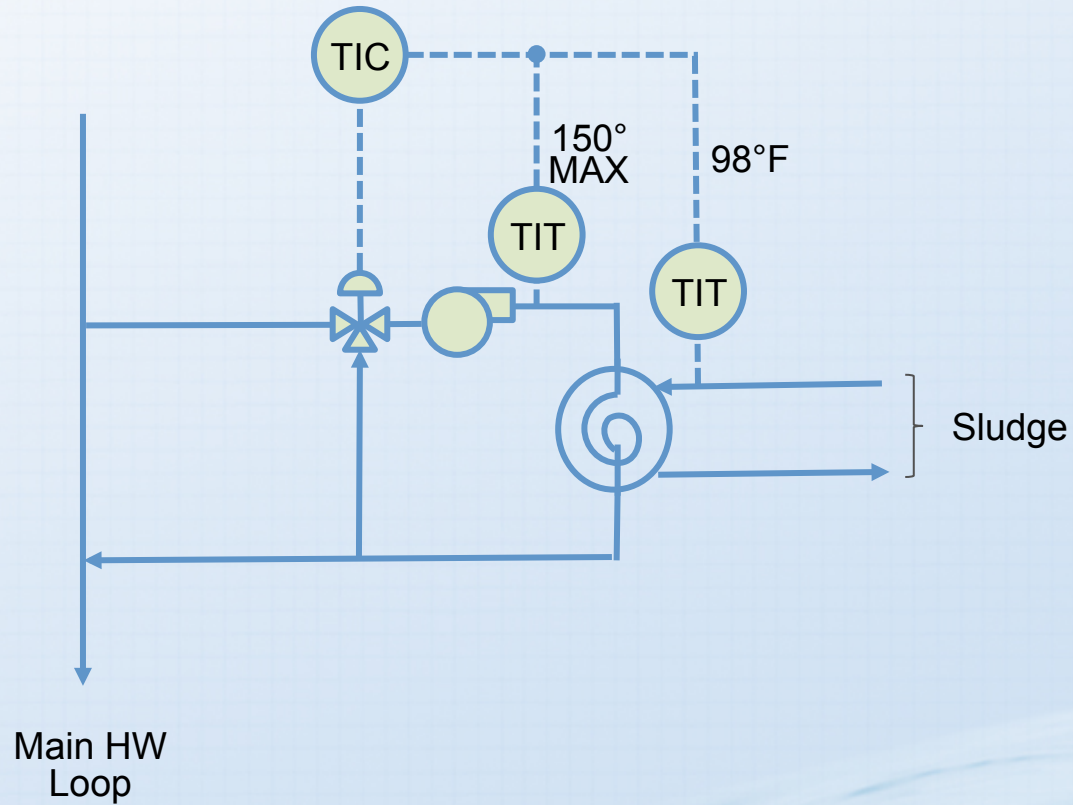
Internal Controls

Main HW Loop

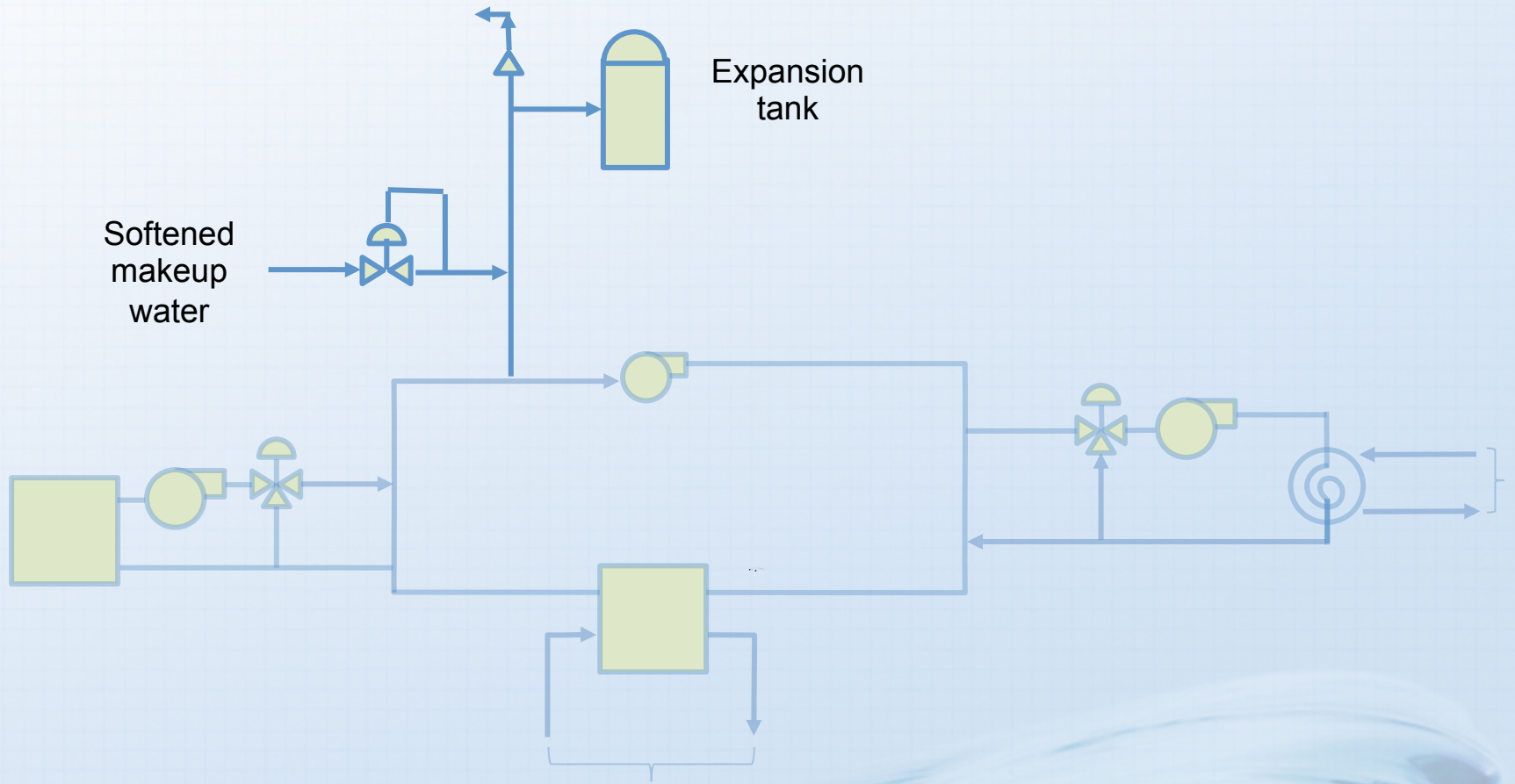
On → 150°F
Set Point → 190-195°F
Off → 195-210°F

(Typical)

Typical Digester Heating System

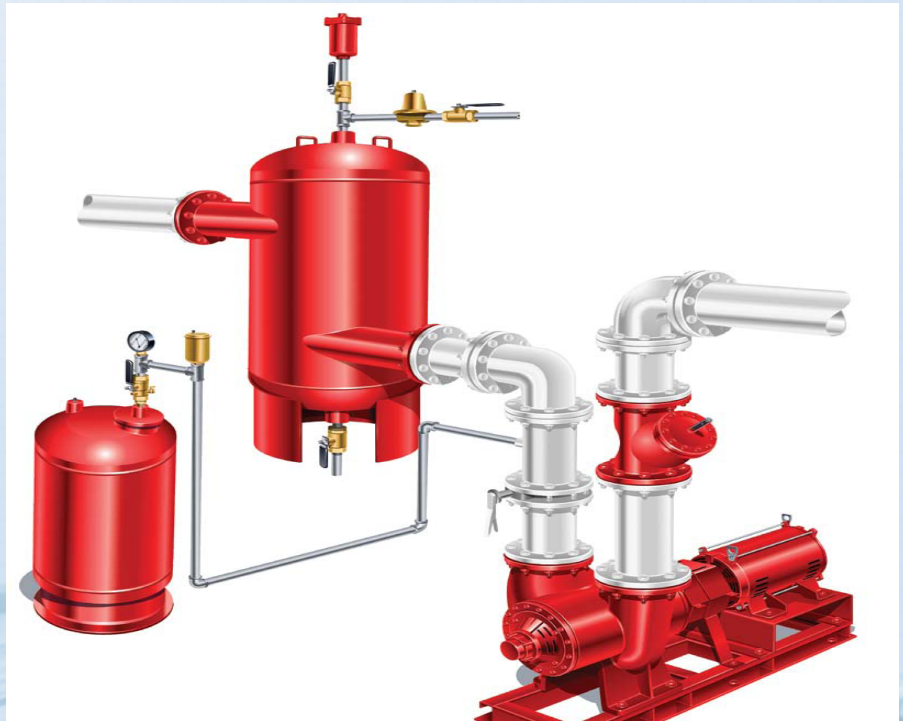


Hot Water System Pressure Control



Typical Hot Water System Components

- Pumps
- Air separator
- Expansion tank
- Makeup water connection
- Chemical feeder
- Air relief valves
- Control valves
- Balancing Valves
- Strainers
- Pressure relief valves
- Boilers
- Valves
- Heat exchangers

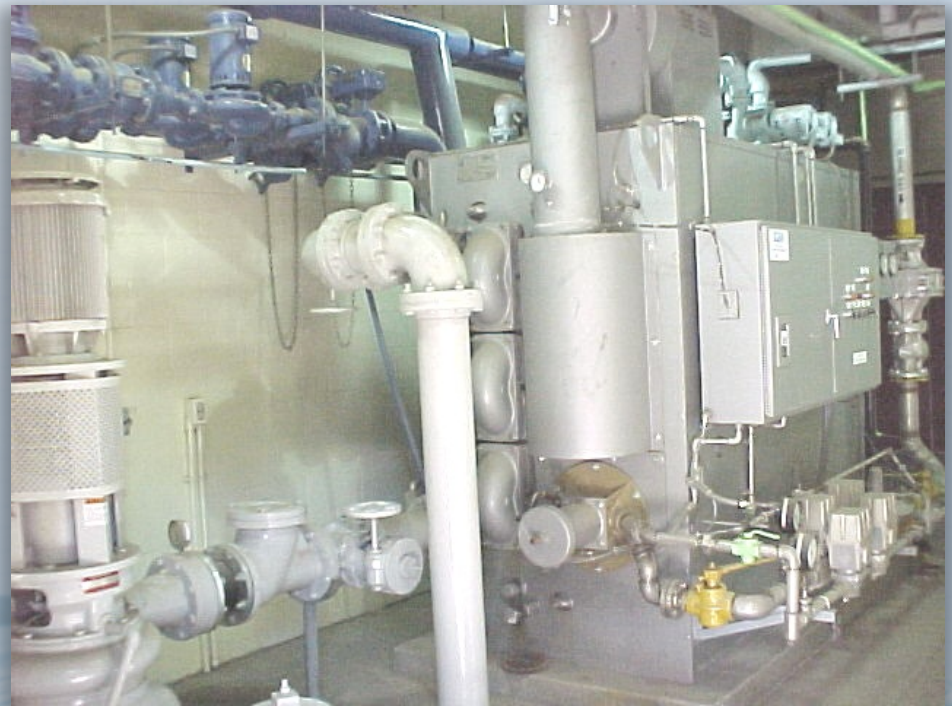


Digester Heat Exchangers



Shell and Tube Sludge Heater

- Combined boiler and heat exchanger
- Hard to incorporate future hot water systems
- Least efficient
- Less flexible



Tube-in-Tube Heat Exchangers

- Primarily used for thicker sludge or where plugging is likely
- More expensive
- Larger footprint
- Hard to predict heat transfer



Spiral Heat Exchangers

- Most efficient
- Predictable heat transfer
- Less expensive
- Smallest footprint
- Easy to clean
- More likely to plug with thicker sludges or poor screening



Typical Problems

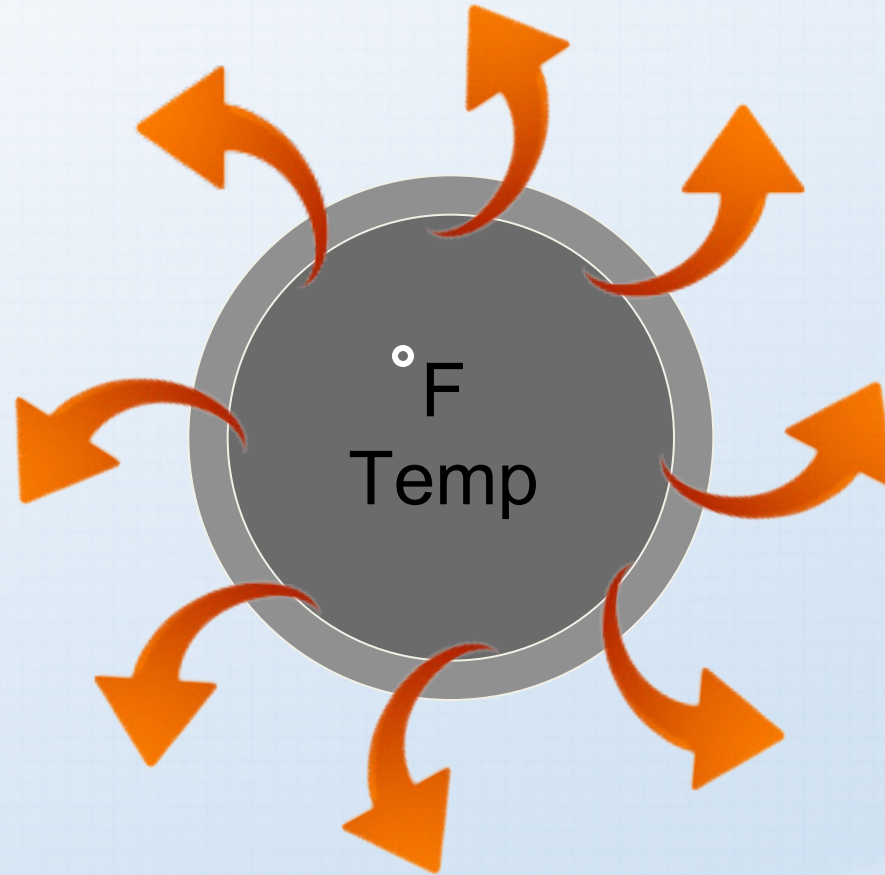
- Corrosion
 - Air intrusion
 - Water treatment
- Flow rate control
 - Balancing
- HW system expansion after expansion after expansion
- Complication!



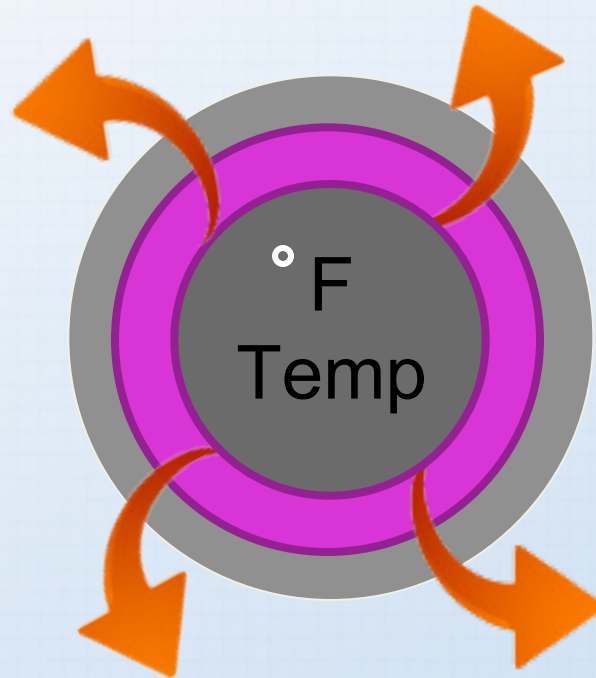
Heat Exchanger Scale – Vivianite, Baked on Sludge

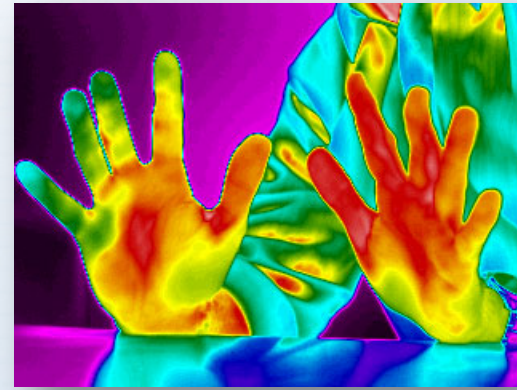


Ductile Iron is an Excellent Heat Conductor



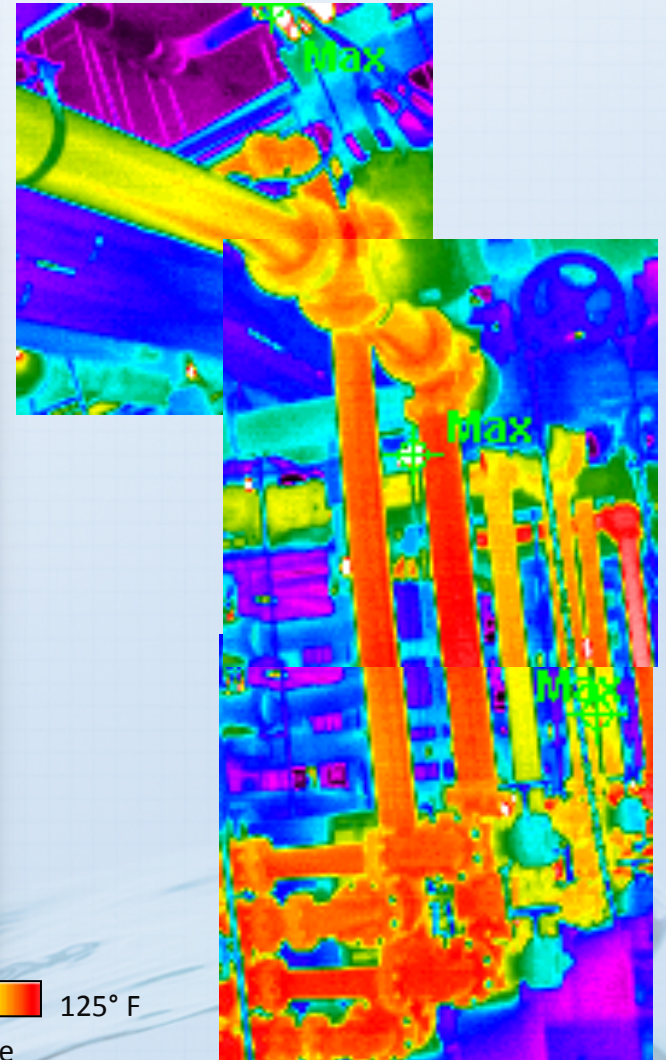
Scaling Decreases Heat Transfer






Thermal imaging provides a quick non-destructive method to determine the extent of scaling

What is the extent of scaling in the digester piping?



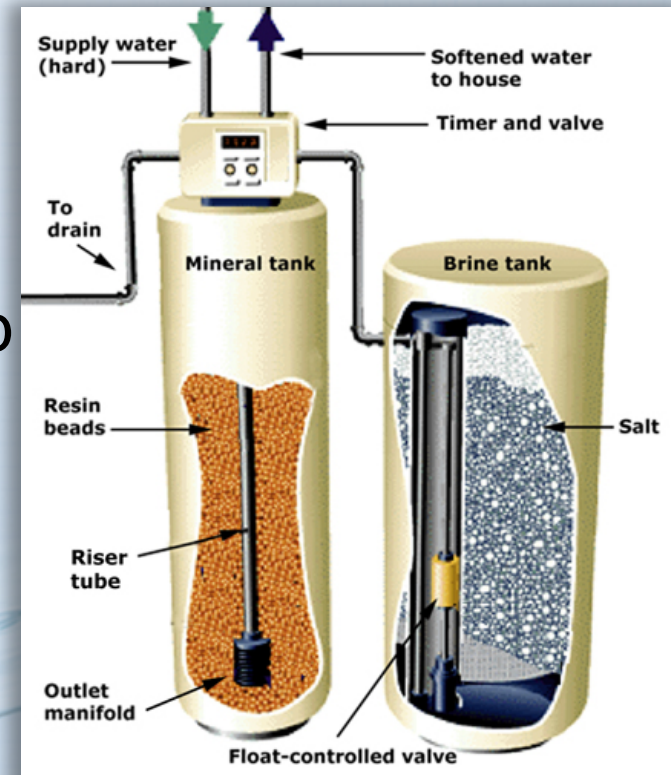
100° F  125° F
Temperature

Prevention and planning can prevent scaling problems

- Tools available for cost-effective detection
- Mitigation involves removing conditions that favor scaling:
 - Remove phosphorus
 - Prevent large temperature changes
 - Prevent large pH changes

Water Treatment

- Companies such as Nalco provide sampling and treatment chemical packages
- Chemicals typically include:
 - Scale inhibitor
 - Oxygen scavenger
 - Biocide
- Use water softener for all make-up



Questions?