Multifamily Central Domestic Hot Water Recirculation Controls

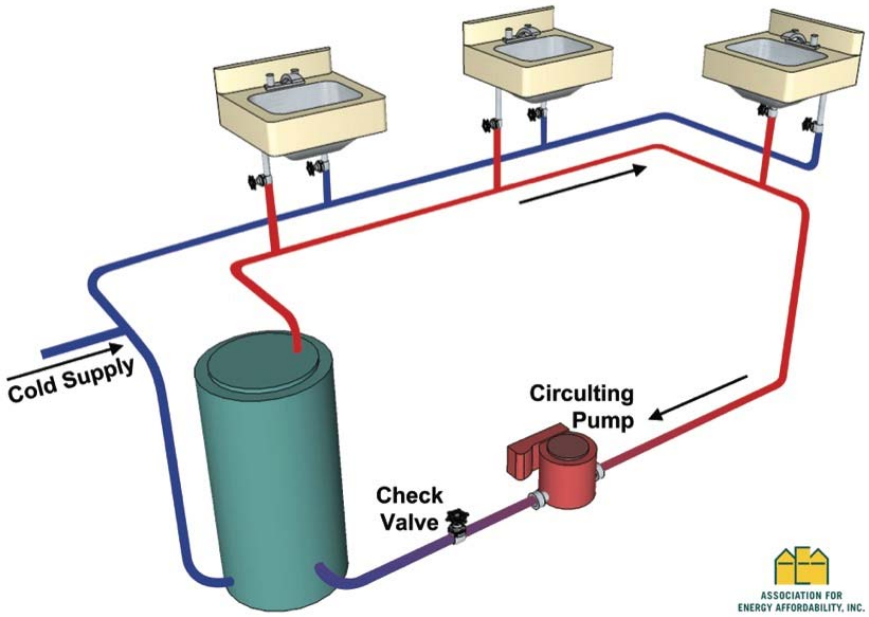
Silver bullet for energy savings or can of worms?

Nick Dirr
ndirr@aea.us.org

Recent studies paint a rosy picture for DHW recirculation control strategies with 10% to 45% reported savings

However, successful implementation can be difficult…

What are DHW recirculation systems?



This presentation will:

- Highlight types of recirc control strategies
- Explain issues that may arise when implementing controls
- Provide suggestions for evaluating existing buildings – will controls work?
- Discuss options for new construction projects

Three types of control strategies

- None (continuous)
- Those that continuously **maintain water loop** at a usable temperature (105 – 120° F)
- Strategies that **lower loop** below usable temperature (<105° F) when usage is not predicted or isn't happening

Strategies that maintain setpoint:

On off temperature control (pump turns off when return temperature is hot, turns on once pipe cools below useful comfort level)

Strategies that maintain setpoint:

Throttled pump
(pump continuous, balancing valve used to slow speed)

Variable Speed Pump
(varies speed to maintain set temperature)

Strategies that lower setpoint:

"Demand": Determined by pump based on previous usage data it collects **or** by a flow switch. Uses this information and a return temperature sensor to run pump *only* when return line is cold and demand is anticipated or sensed

Single family "Demand": Initiated by occupant with push of button, activation of motion sensor, etc. that triggers pump

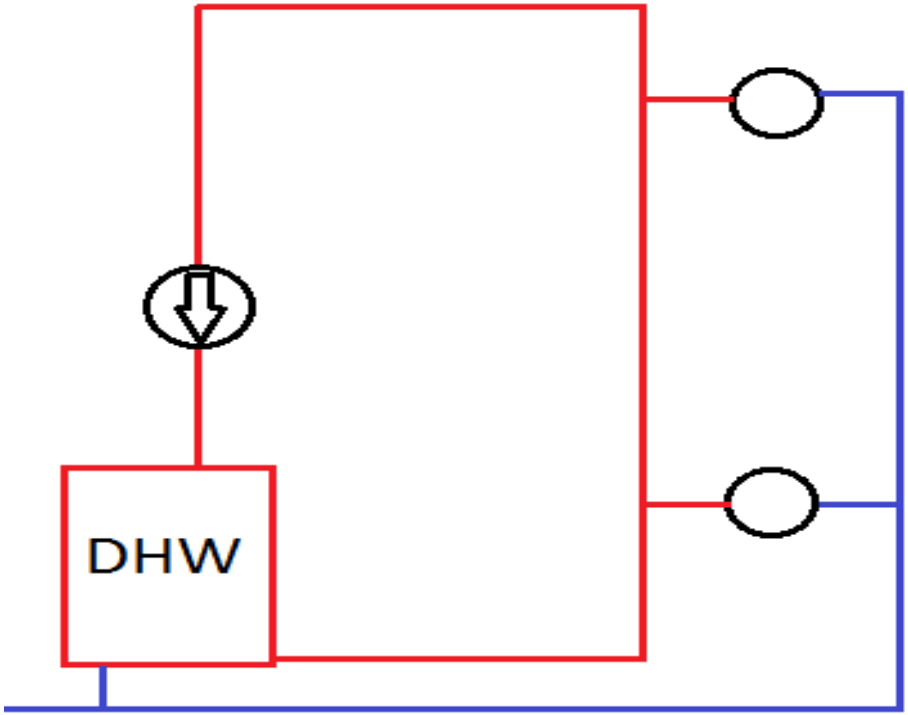
Strategies that lower setpoint:

Boiler setpoint modulation: (reduces supply temp in response to predicted load - not a recirc control, but a load match control)

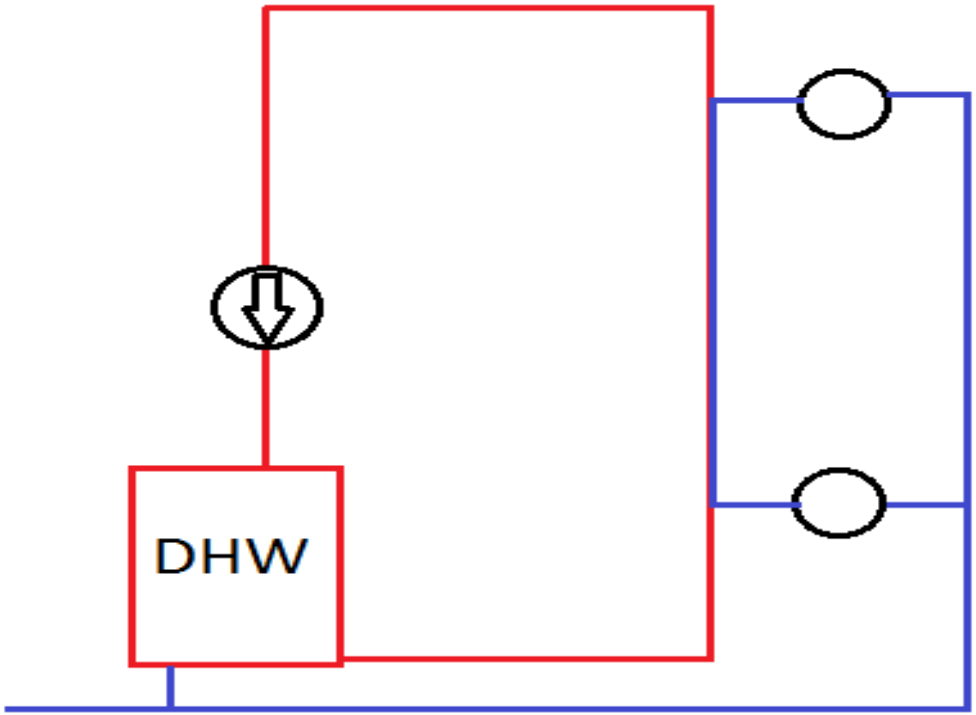
Timer: Off at night assuming no DHW use. Or, off during peak demand assuming draw maintains temp. (NOT recommended)

Issues when implementing controls

What happens when shower cartridge seals fail?

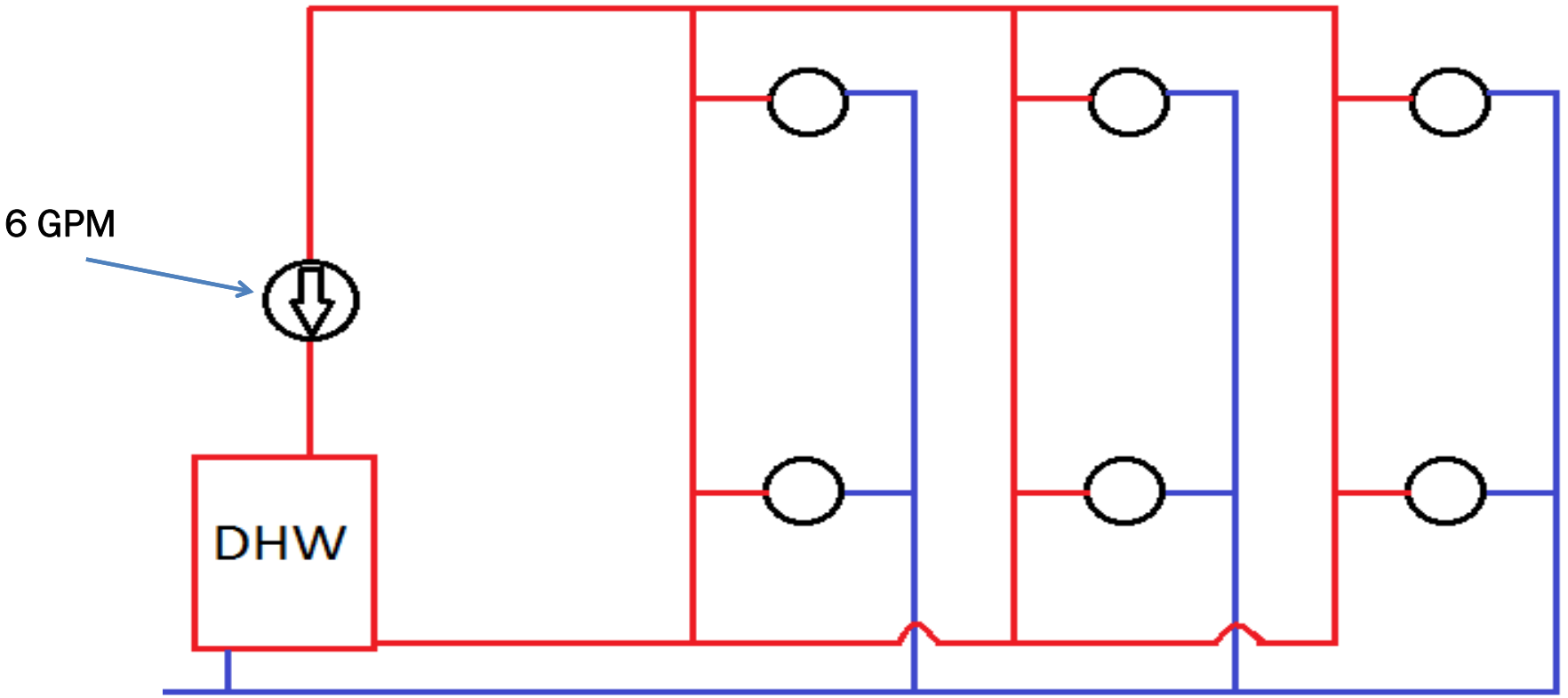


Crossover!

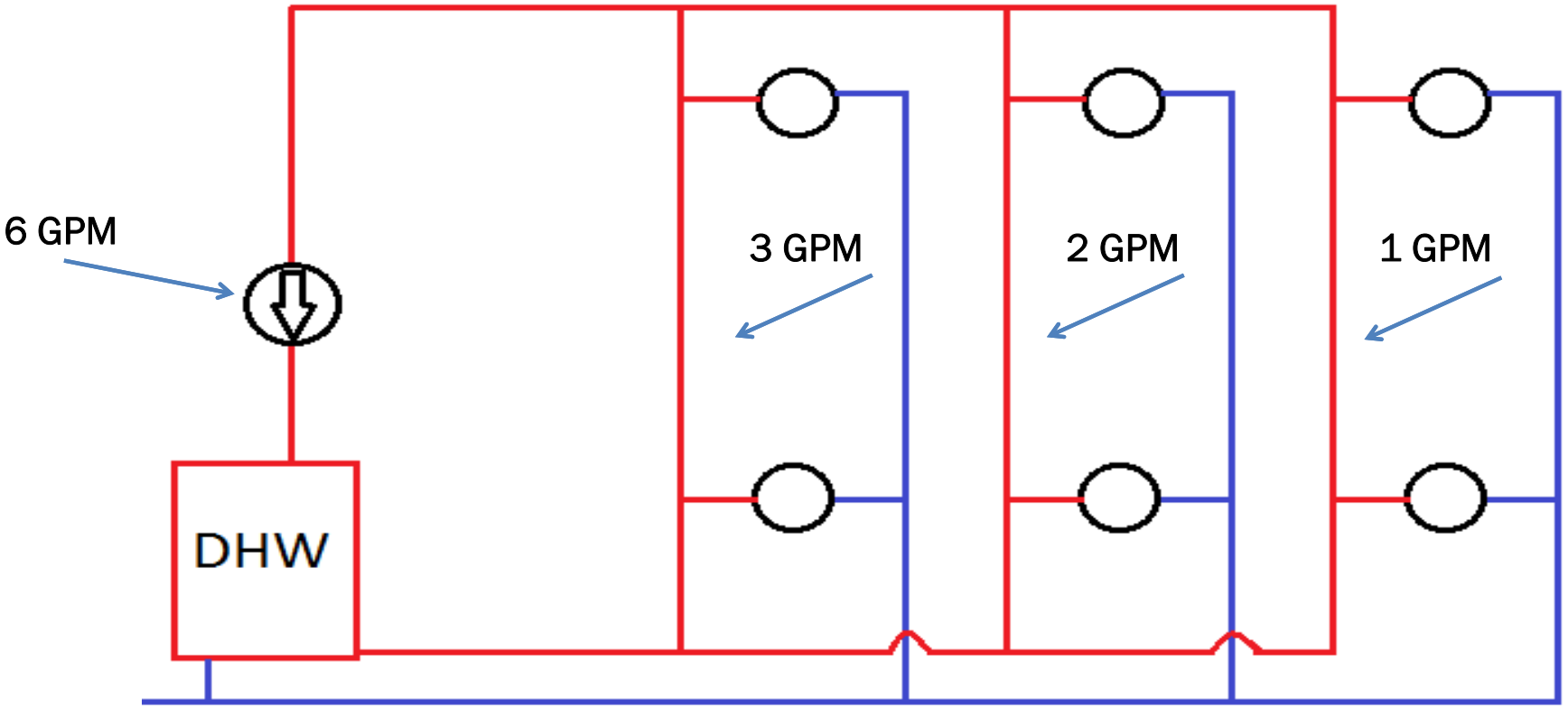


To read more about diagnostics (in a single family home) and to "get" the theory, check out Rheem's diagnostic manual

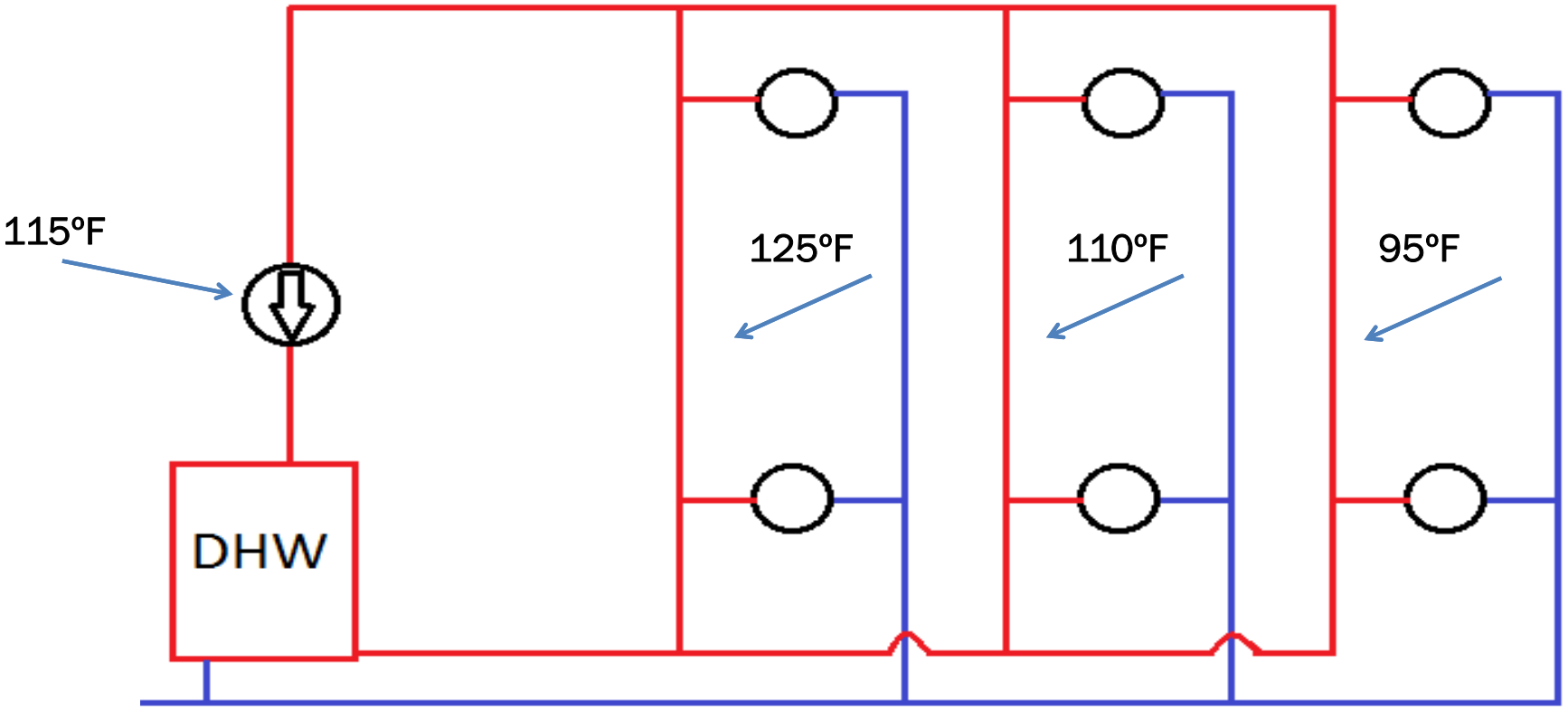
Balancing



Balancing!



Balancing!



Other Issues

- **Showerhead & aerator:** flow rate reduction will further slow delivery
- **Contractor knowledge**
- **Owner checkbook:** diagnostics and repairs?
- **DHW mixing valve compatibility:** issues w/ intermittent recirc
- **Easy to turn off:** If larger "demand" pump is installed & then bypassed, energy use will increase and durability will decrease
- **Long one-way pipes off of main loop:** lower main loop temperature can exacerbate the issue

Issues When Implementing Controls

- **Water waste!** Future studies need to include water consumption monitoring

- **Problems will only get worse:** Controls will aggravate existing long wait times or temp imbalances, not solve them.

How Do We Know Whether DHW Control Will Work?

- Field verify wait times, aerator flow rates, and DHW temp in sample locations

- Investigate the piping distribution: Are there access panels? Are there balancing valves? How many risers and branch return lines are there? Where do pipes run? Are pipes well-insulated?

- Review existing plumbing plans where available

How Do We Know Whether DHW Control Will Work?

Interview staff

- Temperature complaints? (ask residents as well)
- “If current pump turns off, how long will it take to have a resident complain?”
- How often do you change cartridge mixing valves?
- Have you had problems with cross over in your building?

How Do We Know Whether DHW Control Will Work?

- Study and understand the existing distribution system – ask for help if needed

- Read Dan Holohan's books. **Think like water.**

  Until someone opens a tap DHW recirc is a lot like a hydronic distribution system

- Find the problem before it finds you – and develop a solution

Make It Work

- Identify and budget for necessary repairs – **controls will make situation worse if there are existing distribution/ maintenance issues.**

- Identify which control strategy is most appropriate - walk through plumbing diagram to understand how control will work in practice

- Confirm Owner and staff buy in. Make need for repairs visible to owner – they don't know the problem exists, so why fix it?

Make It Work

Phase improvements to DHW system to isolate issues to make troubleshooting more effective

1. **Solve problems first** – ensure all units quickly receive consistent hot water

2. **Install low flow devices** – confirm no new problems

3. **Install recirc controls** – confirm no new problems

New Construction Takeaways

- Include **balancing** mechanism in distribution *(circuit setter, thermostatically operated valves, reverse return, etc.)*
  - *Require 3rd party test and balance of system (TAB)*

- **Pipe insulation:** Require (and verify) pipes be well insulated
  - Commercial-grade fiberglass meeting Energy Codes

- **Coordinate plumbing layout with Architects:** Specify a maximum distance from fixtures to recirculation loop. Refer to EPA WaterSense standards for maximum volume of water

New Construction Takeaways

Control pump

Variable speed pumping with electrically commutated motor (ECM) pump

- Small building “unicorn” pump

Demand controlled pumping

- Ensure flow switch can be activated by 1 tap
- Ensure pump can overcome temp loss in pipes quickly

New Construction Takeaways

- Where in-unit DHW exist but are remote from fixtures, or where fixtures are remote from a central recirc line, install small **in unit demand controlled** pumps

- **Direct meter or Sub-meter** tenants for cold and hot water consumption

- Where solar thermal will not be practical in future, move away from central systems to unitary (efficient) **point-of-use DHW and meter tenants for usage**

Thank You!

Questions?