

# ***Hot Water Temperature Maintenance:***

*Heat-Tracing Versus Recirculation*

- ***Design***
- ***Energy and Water use***

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# Hot Water Temperature Maintenance



- Design objectives for a efficient hot water distribution system
  - Provide adequate amounts of hot water at the prescribed temperature to all fixtures & equipment at all times.
  - A system that performs its function safely.
  - The utilization of an economical heat source.
  - A cost effective & durable installation.
  - A economical operating system with reasonable maintenance.
  - Conform with the regulations of the authority having jurisdiction.
    - From ASPE 2007

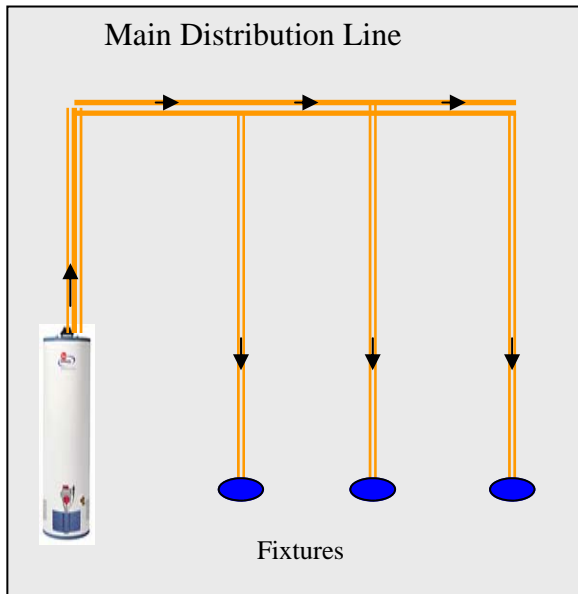


## Hot Water System – Non-circulated

Heat Source = water heater  
Distribution System = pipes  
Fixture = faucet

### Water and energy wasted.

Entire piping system cools down so very long wait time for hot water at a tap.



## Hot Water System – Re-circulated Distribution System

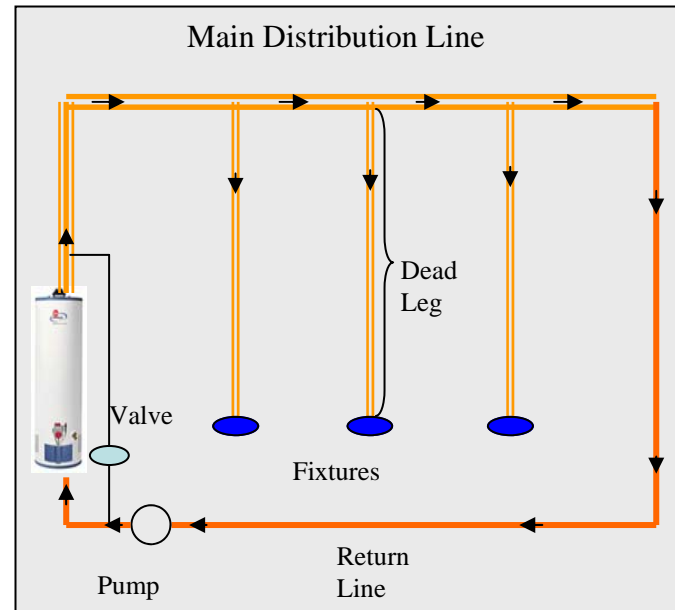
Heat Source = water heater  
Distribution System = pipes  
Fixture = faucet  
Pump

### Water and energy wasted.

Dead legs cool down creating wait time at tap.  
Re-circ loop increased heat loss  
Pump energy used.  
Water overheat.

### Reliability:

Water heater bypass or balancing valve  
Pump maintenance

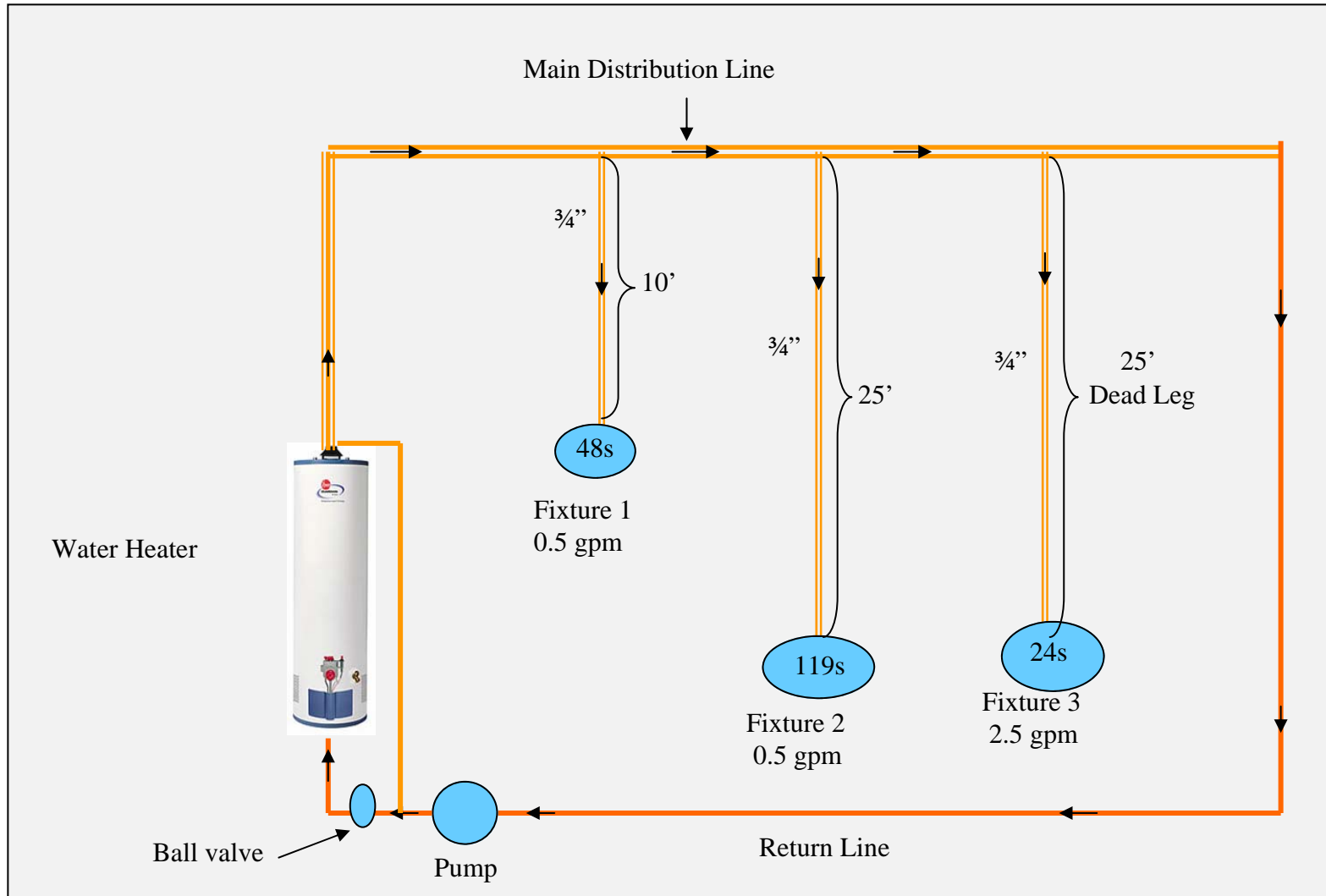


# Hot Water Temperature Maintenance



		Delivery Time in Seconds							
Fixture Flow Rate		0.5 GPM		1.5 GPM		2.5 GPM		4.0 GPM	
Piping Length	Pipe Size	10 Feet	25 Feet	10 Feet	25 Feet	10 Feet	25 Feet	10 Feet	25 Feet
Copper	1/2"	25	63	8	21	5	13	3	8
Copper	3/4"	48	119	16	40	10	24	6	15
Steel Pipe Schd 40	1/2"	63	157	21	52	13	31	8	20
Steel Pipe Schd 40	3/4"	91	228	30	76	18	46	11	28
CPVC Schd 40	1/2"	64	159	21	53	13	32	8	20
CPVC Schd 40	3/4"	95	238	32	79	19	48	12	30
		<b>Acceptable Performance</b>			1-10 seconds				
		<b>Marginal Performance</b>			11-30 seconds				
		<b>Unacceptable Performance</b>			31+ seconds				

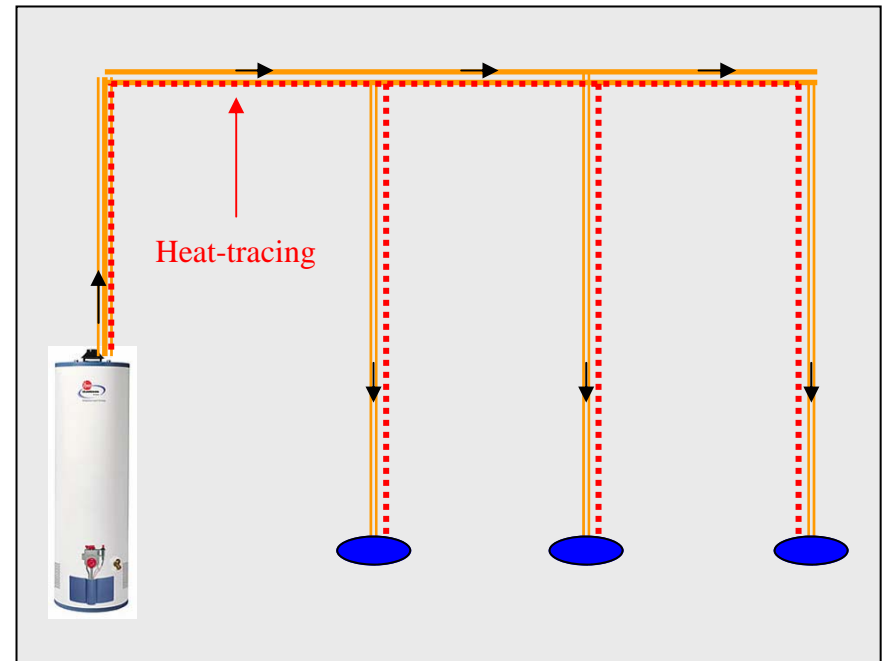
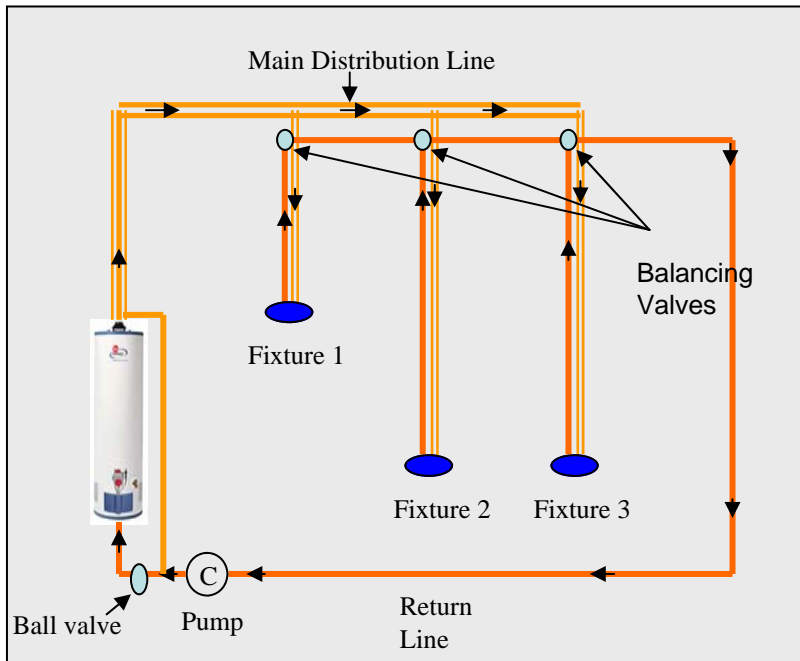
# Time to tap example



# How do you get hot water to the fixture faster?

To satisfy water deliver time there are a few ways to provide hot water to the fixture:

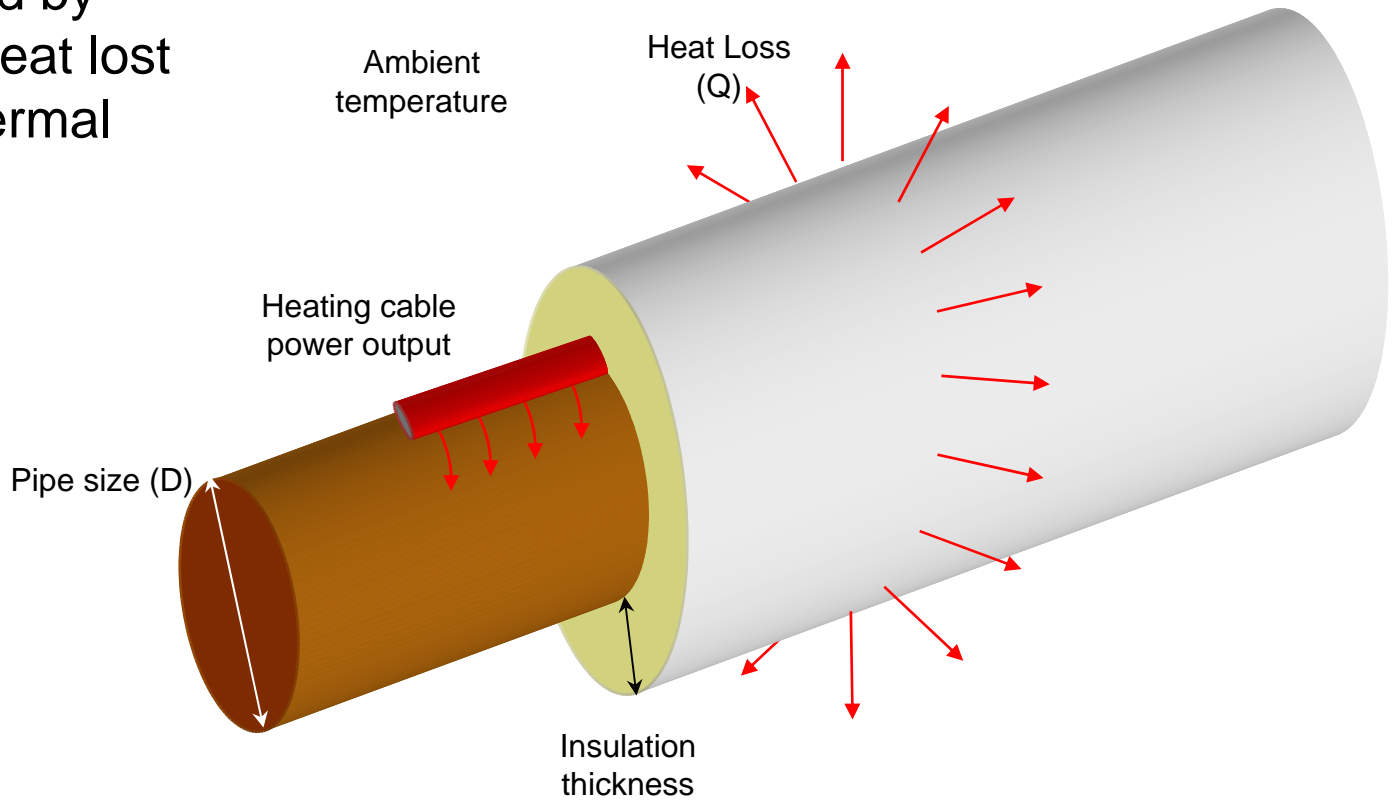
- Shorter dead legs
- Re-circulate to fixture
- Smaller diameter branches
- Point of use hot water heaters
- Electrical heat tracing



# How Heat-Tracing is designed to work.



The heating cable only maintains the temperature of stagnant fluid by replacing the heat lost through the thermal insulation.





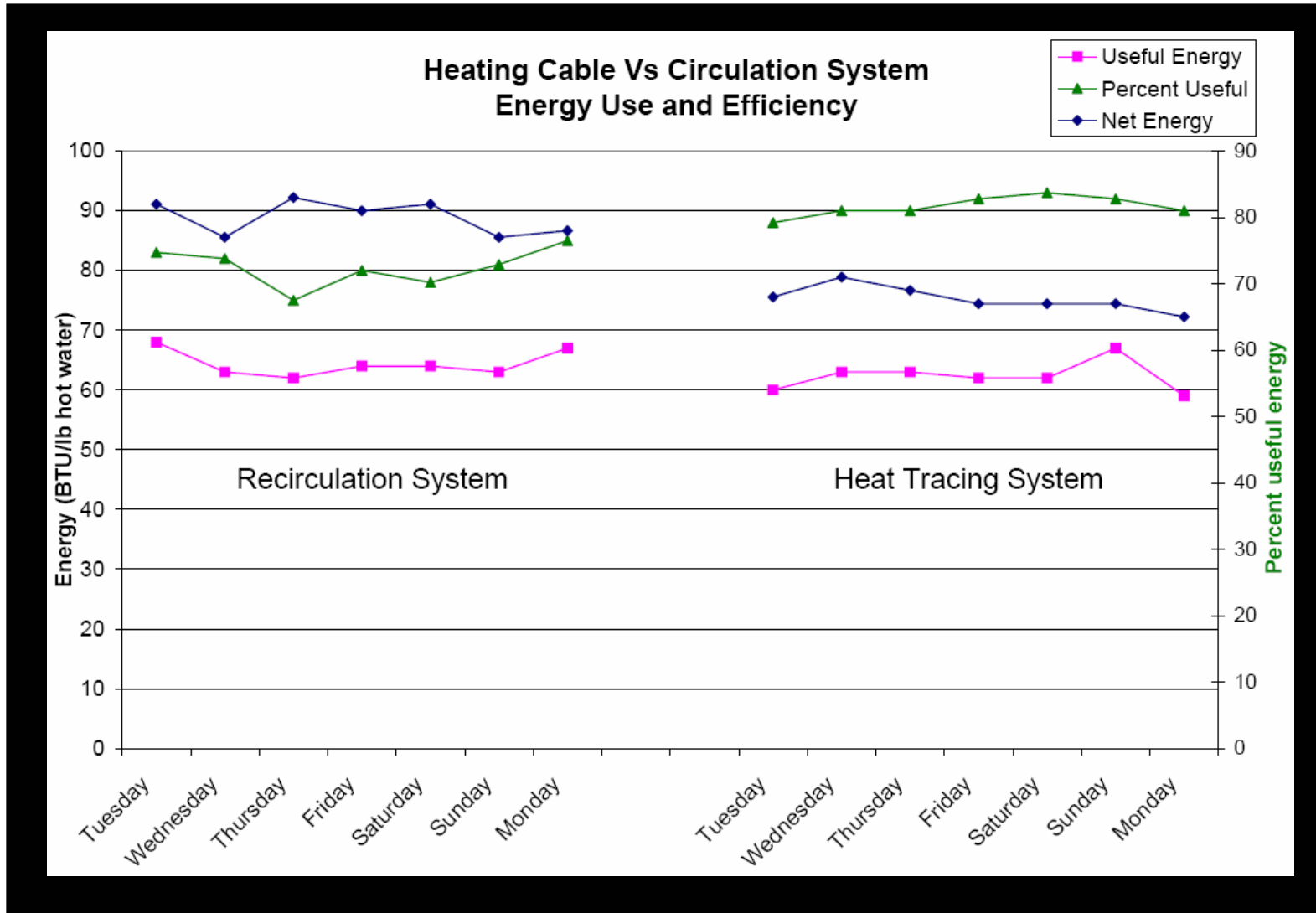
- Foam or Fiberglass
- Verify appropriate insulation schedule
- Schedule insulation on drawings & in the contract specifications
- Tees, Crosses & End Seals must be insulated.
- Use pipe hanger system systems that isolate the pipe from the hanger to minimize point heat losses

Pipe Size	Insulation Thickness Standard	Alt. Schedule 1 2 runs of cable	Alt. Schedule 2 1 GPM min. flow
1/2"	1/2"		
3/4"	3/4"		
1"	1"		
1 1/4"	1 1/4"		
1 1/2"	1 1/2"		
2"	2"		
2 1/2"	2 1/2"	1"*	2"***
3"	3"	1"*	2"***
3 1/2"	3 1/2"	1"*	2"***
4"	4"	1 1/2"*	2"***
5"	5"	2"*	2"***
6"	6"	2"*	2"***

\* 2 runs of cable required per foot of pipe. See HWAT design guide H57538

\*\*\*A minimum flow rate of 1 GPM required. See design note H58029

# Study Conclusions



# Electronic Controller



- Flexible temperature control
- Insulation schedule
- Energy savings
- 9 pre-defined programs
- Heat-up cycle
- Alarm events
- Water heater sensor
- BMS interface
- Master/slave function
- Power correction factor



# Advantages of a Heat-Tracing System for Hot Water Maintenance



- Easy to design
- No flow-balancing issues
- No circulating pump maintenance
- Compatible with low-flow fixtures
- Easy to provide instant hot water to the point of use
- Low installed and operating costs
- Water conservation/Reduced time to tap