Embrace the Technology®

CircuitSolver®

A ThermOmegaTech® brand

Domestic Hot Water Recirculation System Balancing

CircuitSolver® Basics

CircuitSolver® is a self-actuating thermostatic balancing valve that automatically and continuously adjusts flow through a DHWR system to maintain the specified temperature at the end of each branch/riser.

The Need: Domestic hot water recirculation systems need to be balanced in order to ensure that hot water is available throughout the building on every floor, at every fixture, at all times.

The Problem: Many buildings require multiple branches off the hot water supply line and water flows in the path of least resistance which constantly changes in dynamic open systems. Manual balancing valves and fixed flow devices rely on flow and pressure calculations and cannot respond dynamically to changing needs.

The Solution: Install a CircuitSolver® at the end of each branch, downstream of the last fixture, and the system balances itself.

How It Works: The thermal actuator inside the CircuitSolver® modulates the valve between open and closed in response to changing water temperature. This continuous response to temperature variation enables each hot water branch to quickly and consistently direct hot water flow to where it is needed – No manual balancing required.

The valve never fully closes which allows a small amount of bypass flow to the return to avoid deadheading the recirculation pump.

CircuitSolver® Placement Do's and Don't's

(1) ✓ at the end of each branch/riser

(2) ✓ in the return line back to the water heater

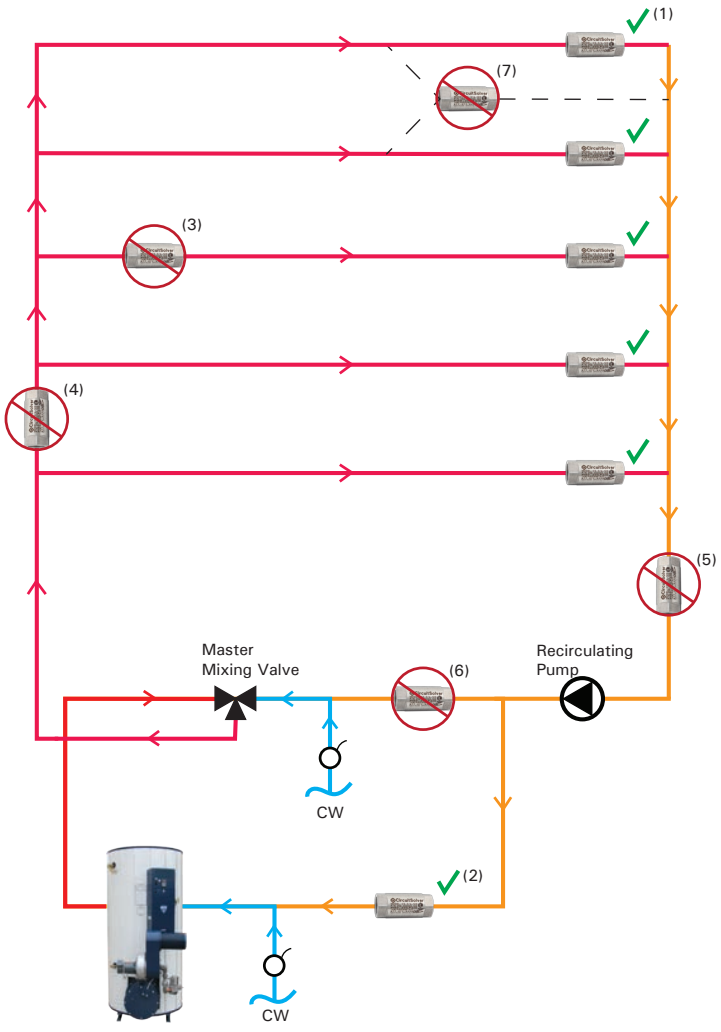
(3) ⊘ not in the middle of a branch/riser

(4) ⊘ not in a supply line

(5) ⊘ not in the return line

(6) ⊘ not after the recirculating pump

(7) ⊘ don't combine 2 branches/ risers



Valve Selection

Size: Select the size equivalent to the branch/riser feeding the return line.

Temperature: Select the set-point temperature equal to the desired return temperature.

Example: A standard CircuitSolver® installed on a 3/4" branch/riser with a 120˚F return temperature would be CS-3/4-120.

CircuitSolver® GPM & Cv

Valve Size	GPM at 5psi Differential		Cv		
	Open	Closed*	Open	Closed*	Design
1/2″	2.9	0.45	1.3	0.2	0.60
3/4″	4.0	0.45	1.8	0.2	0.85
1″	7.4	0.45	3.3	0.2	1.57
1 1/4″	11.4	0.45	5.1	0.2	2.48
1 1/2″	17.0	0.45	7.6	0.2	3.72
2″	31.8	0.45	14.2	0.2	7.02

**CircuitSolver® will never fully close. Built-in bypass leakage eliminates pump deadheading and improves upstream sensitivity.*

Flow rate calculation using Cv factor.

$$GPM = C_v\sqrt{\Delta P}$$

$$C_v = \sqrt{\frac{GPM}{\Delta P}}$$

$$\Delta P = \left[\frac{GPM}{C_v}\right]^2$$

Flow and Pressure Drop vs. CircuitSolver®

	Pressure Drop (PSI) per Valve Size at Design Cv					
GPM	1/2″	3/4″	1″	1 1/2″	1 3/4″	2″
0.25	0.17	0.09	0.03	0.01	0.00	0.00
0.5	0.69	0.35	0.10	0.04	0.02	0.01
0.75	1.56	0.78	0.23	0.09	0.04	0.01
1.0	2.78	1.38	0.41	0.16	0.07	0.02
1.25	4.34	2.16	0.63	0.25	0.11	0.03
1.5	6.25	3.11	0.91	0.37	0.16	0.05
1.75	8.51	4.24	1.24	0.50	0.22	0.06
2.0	11.11	5.54	1.62	0.65	0.20	0.08

CircuitSolver® with Variable Speed Drives

CircuitSolver® marries well with VSD/VFD pumps since they are also dynamic devices. As the CircuitSolver® approaches the desired return temperature the valve modulates to its closed position and the Cv of the valve decreases causing an increase in pressure drop.

This increased pressure drop across the VSD/VFD pump serves as a signal to the pump, when set in constant pressure control mode, to decrease its RPM resulting in increased energy efficiency, optimized recirculating flow rate, and reduced chances of producing excessive flow velocity which can cause pipe erosion and pinhole leaks over time.

CircuitSolver® Compared to Adjustable Thermostatic Balancing Valves

Adjustable thermostatic balancing valves are adjustable over a large temperature range (typically 90˚F to 150˚F) resulting in a low Cv over the 10˚F typical temperature operating range in a DHWR system.
Ex: 0.25 Cv at the return temperature (120˚F) and 0.4 Cv at 10˚F less than the return temperature (110˚F).

In contrast, CircuitSolver® valves are factory set with a 10˚F temperature range from full open to full closed. Therefore, a 3/4″ CircuitSolver® has a 0.2 Cv at the return temperature and a 1.8 Cv at 10˚F less than the return temperature, significantly lowering resistance to flow and a low pressure drop across the valve.

Example of Pressure Drop:

120˚F Return Set-point Temp.	Cv at 110˚F Water Temp.	Flow Rate (GPM)	Pressure Drop (PSI)
CircuitSolver®	1.8	1.5	0.7
Adjustable Balancing Valve (Typ.)	0.4*	1.5	14

*Due to the high pressure drop of the adjustable thermostatic balancing valve and the potential for a limited pressure drop across the branch there is a possibility that the stated flow rate may not be achieved.

www.CircuitSolver.com | 1-877-379-8258 | 353 Ivyland Rd, Warminster, PA 18974