CircuitSolver®
A ThermOmegaTech® brand

FIXED VS. ADJUSTABLE BALANCING VALVES

BALANCING FOR DOMESTIC HOT WATER SYSTEMS

CIRCUITSOLVER® FIXED BALANCING VALVES

CircuitSolver® was the first thermostatic balancing valve designed for Domestic Hot Water Systems (DHWS). It relies on temperature, not flow or pressure, to automatically and continuously respond to a dynamic system's fluctuating needs to maintain a specified temperature at the end of each branch/riser. For over nine years, it has been successfully installed in thousands of systems across North America in all markets including healthcare, hospitality, multi-family, education, commercial, industrial, and government buildings.

Utilizing paraffin wax actuators designed and manufactured in-house, CircuitSolver® valves are available in a wide range of factory set temperatures. Simply select the set-point temperature that equals the desired return line temperature. The valve will be completely open 10°F below that temperature, begin to modulate closed when its in that 10°F range and be completely in its closed position at the desired return temperature to direct flow to other branches still in need of hot water.

For example, a CS-1/2-120 valve is completely open when the water in the line is below 110°F, will start to close when it is above 110°F, and be in the full closed position when the water reaches 120°F. The valve never fully closes which allows a small amount of bypass flow to the return to avoid deadheading the recirculation pump.

This continuous response to temperature variation enables each hot water branch to quickly and consistently direct hot water flow to where it is needed keeping the system balanced at all times.

ADJUSTABLE BALANCING VALVES

In the last couple of years, based on the success of CircuitSolver®, well known plumbing component manufacturers have released their own versions of thermostatic balancing valves. All of these valves are adjustable over a very wide temperature range, typically 50°F. This wide range allows the manufacturers to source a single actuator, that will fully stroke (extend and retract) over the 50°F span, from a third-party manufacturer.

The disadvantage of this type of valve is that over a desired operating range of 5°F/10°F below the desired return temperature in a given branch, there is a very low Cv (high resistance to flow). This is due to the fact that 5°F/10°F represents only 10%/20% of the valves full operating range.

This low Cv produces large pressure drops across the valve when high flows are required to offset heat loss. In some cases, there is not enough available pump head pressure to overcome the high pressure drop across the adjustable balancing valve to overcome the heat loss in the branch.

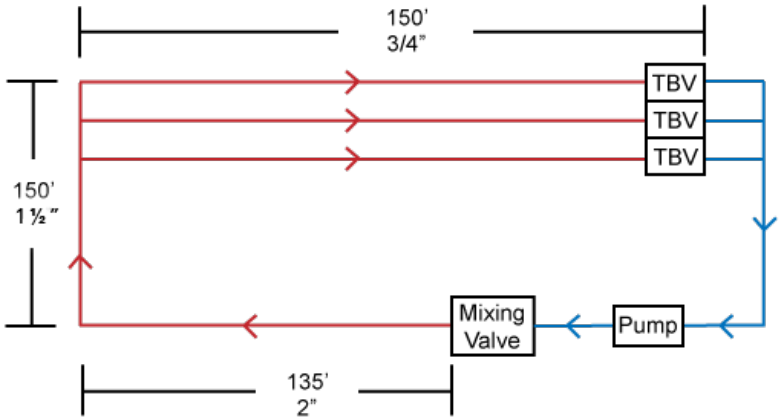
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LOW Cv PERFORMANCE ANALYSIS

Below is an example of a DHWS that illustrates a "real world" topology where there is a high heat loss. Branches with high heat loss require high flows to overcome it. The low Cv of an adjustable balancing valve may impact the ability to reach the desired return temperature.

This design represents a very simplified topology in order to demonstrate the potential problems without performing detailed calculations of segments and nodal analysis.



Design Criteria:

- Represent the system with 3 pipe segments
  - 135' length - 2"
  - 150' length - 1½"
  - 150' length - ¾"
- Utilize 1½" insulation
- Determine flow required to offset heat loss based on a ΔT between hot water source and last fixture of 5°F

1½" Insulation			
Pipe Size	**Length (ft)**	**W/ft (65°F ΔT)**	**BTU/Hr**
2	135	2.9	1,335
1½	150	2.5	1,279
¾	150	2.1	1,074
		Total	**3,688**

The heat loss from the hot water source to the last fixture is estimated at 3,688 BTU/Hr. At a ΔT of 5°F, the flow required to offset heat loss is approximately 1.5 GPM.

GPM required to offset heat loss at 5°F ΔT:
GPM = BTU/Hr / (5°F * 500)
GPM = 3,688/(2500) = 1.5 GPM

For a properly operating DHWS, the variation of water temperature in any given branch should not exceed more than 5°F below the desired return temperature.

Below is a comparison of CircuitSolver® against a typical adjustable thermostatic balancing valve along with their respective Cv's at the desired return temperature and at 5°F below the return temperature. As shown in the last column, for a flow of 1.5 GPM to offset the heat loss in a branch a typical adjustable balancing valve can have close to 4X's the pressure drop of a CircuitSolver®.

Model	Cv at Return Temp	Cv, 5°F below the desired return temp	ΔP(psi), 5°F below the desired return temp at 1.5 GPM
CircuitSolver® ¾	.20	.85	3.1
Adjustable (Typical)	.34	.44	11.6

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The impact of a high pressure drop across the balancing valve on performance

In instances where a high pressure drop across the balancing valve is needed to achieve the required flow, the system can be impacted in multiple ways:

1. Due to the higher pressure requirements, the branch may not be able to achieve the necessary flow required to offset heat loss resulting in the inability to meet the desired return temperature.

2. In order to achieve the flow required to offset the heat loss in a branch, the high pressure drop across the valve will result in the need to select a pump with higher head pressure than would normally be required for the system. In some cases, this increase in pump size could be a significant cost adder and still may not be able to achieve the necessary flow due to other system constraints.

BENEFITS OF CIRCUITSOLVER® OVER ADJUSTABLE

- CircuitSolver® has been providing thermostatic balancing valves to the market for over nine years with thousands of successful installations in all market segments. The number of valves in these installations range from a handful to over 500 valves in one facility. See our installation map here: https:// www.CircuitSolver.com/installations/?cat=0
- CircuitSolver® products are designed and manufactured by ThermOmegaTech® at our manufacturing facility in Warminster, PA. and comply with the "Buy American Act."
- ThermOmegaTech® has 35+ years of experience in designing and manufacturing thermostatic valves.
- For over 20 years, we've been utilizing our exclusive Thermoloid® paraffin wax blend in all our thermal actuators.
- We have a significant number of features/accessories that our competition lacks. This includes unions, propress ends, integrated check valves, thermometers, and strainers. These factory assembled options reduce component and installation cost, leak points and overall assembly size.
- Our valves are available in a variety of sizes from ½" up to 2". 1" balancing valves are being used more frequently every year, the adjustable balancing valves currently on the market only come in ½" and ¾".
- CircuitSolver® eliminates the industry struggles of manually adjusting valves to balance a system.
- The low Cv of adjustable balancing valves can cause large pressure drops, impacting its ability to achieve the required flow to offset heat loss which not only compromises performance, but can require additional costly pumps with higher head pressure.

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Often portrayed as an advantage, adjustable balancing valves actually hinder a DHWS's performance which is why CircuitSolver® is proud to be the only fixed return temperature balancing valve on the market.

Attributes	CircuitSolver®	Typical Adjustable Balancing Valve
Adjustability	✗	✓
Tamper Proof	✓	✗
Union	✓	✗
Integrated Check Valve	✓	✗
Sizes	1/2", 3/4", 1", 1¼", 1½", 2"	1/2", 3/4"
ProPress Ends	✓	✗
Assemblies	✓	✗
Thermal Disinfection	✓	✓

This attribute table demonstrates our commitment to product enhancements in response to the needs of engineers and contractors and the overall advantage of specifying/installing CircuitSolver® balancing valves.

ThermOmegaTech® is the leader in the plumbing industry for thermostatic balancing valves, with thousands of successful installations over the last 9+ years. Our competitors cannot make that claim. We have listened to the engineers and contractors and have responded with a number of product enhancements and will continue to do this into the future. The attribute table above demonstrates our commitment to provide the features needed by the plumbing industry. Although we have the expertise and technology necessary to develop an adjustable thermostatic balancing valve, we recognize that it is an inferior technological solution for balancing domestic hot water systems.

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