

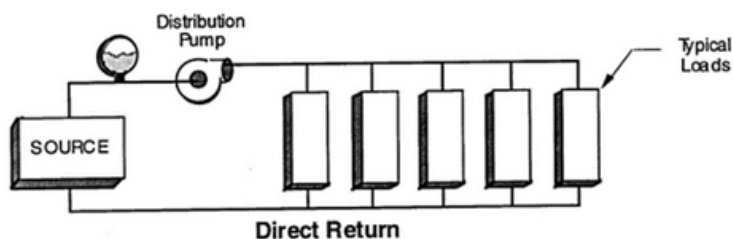
EDGE'S INSIGHTS

ISSUE 5
DECEMBER
2023



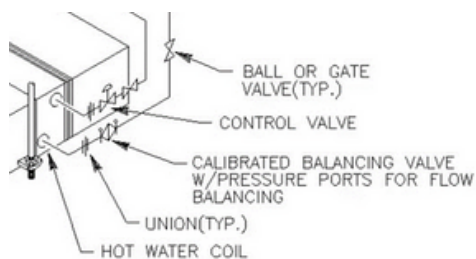
HVAC Hydronic System Balancing

Hydronic balancing allows water in a building's heating or cooling system to be appropriately distributed to meet each unit's design flow. The balancing design used to achieve this will significantly impact the temperature delivered, energy efficiency, and system lifetime.



Balancing Valve Purpose

A balancing valve's purpose is to limit each coil's flow to the maximum or design GPM specified in the drawings. It also measures the flow through the high and low-pressure ports by connecting a flow meter. Balancing valves are placed on all equipment with maximum flow rate capacity. An overflow could cause severe damage to the equipment, flooding, or an inefficiently run system.

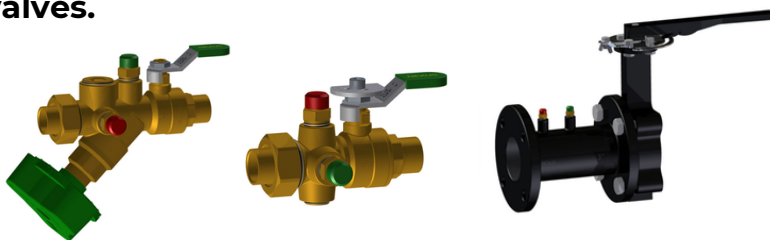


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Balancing Valve Options

Hydronic systems are balanced with **manual, automatic, or pressure-independent control valves.**



- **Manual Balancing Valves**

These valves balance flow when manually adjusted by the handwheel or lever until the differential pressure reading across the two ports reaches the desired set point. Refer to your manufacturer's balancing valve chart to determine the pressure drop needed to get your unit's corresponding design flow rate.



- **Automatic Balancing Valves**

Automatic balancing valves do not require adjusting since a cartridge inside the valve automatically adjusts the opening to give you the design flow. Balancers need to verify that the pressure drop across the two ports is within the range of the cartridge. If the reading from the meter is proved to be within the working range, then the flow should already be balanced to design, assuming you have the proper cartridge for the design flow.

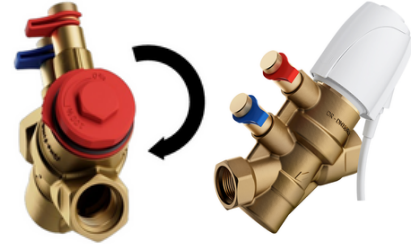
EDGE'S INSIGHTS

ISSUE 6
DECEMBER
2023



Pressure Independent Balancing & Control Valves

Another option to reach design flow is through your pressure independent control valve which should have an integrated balancing feature. Most PICV's are included with a presetting tool that allow you to adjust the valve until your design flow is achieved. This adjustment is made without the actuator mounted.



Pre-setting Data

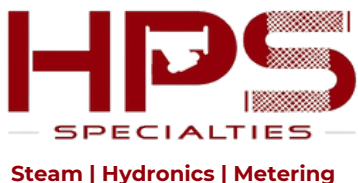
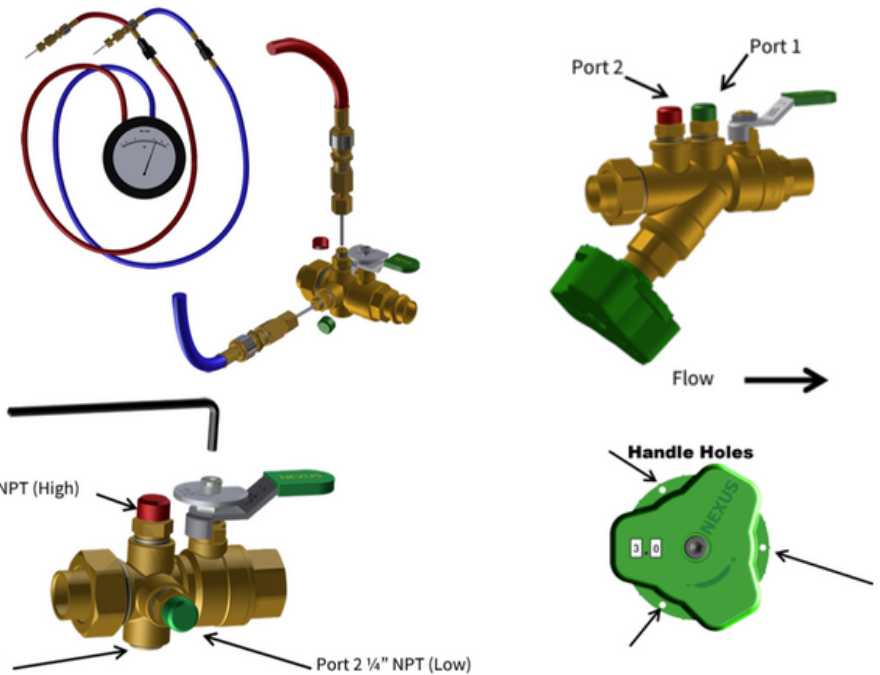
	DC050L DC050S	
	DC050L	DC050S
100%	0.52	1.98
95%	0.52	1.97
90%	0.51	1.95
85%	0.50	1.93
80%	0.49	1.92
75%	0.48	1.90
70%	0.48	1.89
65%	0.47	1.85
60%	0.46	1.82
55%	0.44	1.79
50%	0.43	1.76
45%	0.40	1.71
40%	0.37	1.66
35%	0.34	1.59

Setting a Pressure Independent Control Valve

This valve will deliver the set flow regardless of pressure changes. A chart from your manufacturer will specify which flow will be delivered for each set point. Even if the inlet pressure changes, your valve will sense this change and adjust to maintain the flow the valve was set for. Using the pre-setting data chart and setting your model DC050S valve to 50% opening, without even taking a measurement, you can know that the maximum or design flow will be 1.76 GPM. A balancer could verify this by measuring the pressure ports if required. In the next issue, we will discuss how this valve improves system performance in partial loads.

Setting Manual Balancing Valves

Initially, ramp up your pump to full speed and make sure all valves are set to wide open. Connect the hoses to the high-pressure upstream port and low-pressure downstream port. Adjust your valve slowly until you reach the desired flow or pressure drop. Depending on your meter, you may have to cross-reference the inches of water or pressure drop to the flow.



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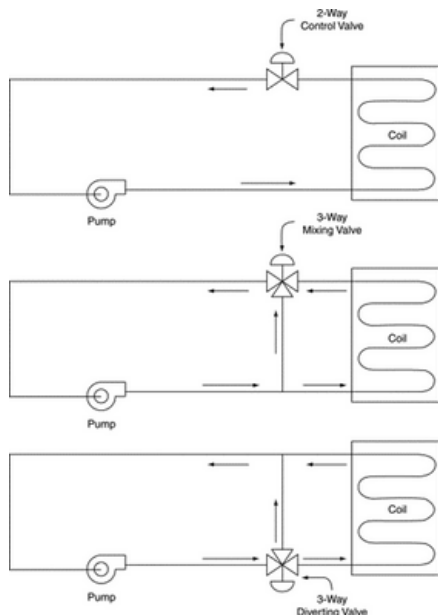
ISSUE 7
DECEMBER
2023



Control Valve Purpose

Control valves regulate the flow of water by varying the opening position. These can be 2-way, which increase or decrease resistance to the flow. Another control valve type is a 3-way, which either mixes two streams of water or diverts one stream into 2, as shown to the right.

Control valve actuators are wired into the controller or BMS system. Usually, a 0-10V signal is sent to the control valve, and the actuator changes the opening set point accordingly. The signal to the control valve changes based on how much heating or cooling is required from the thermostat set point.

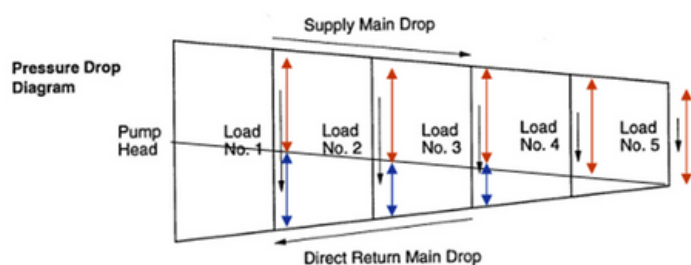


How Variable Speed Pumps Work?

A variable frequency drive or VFD works by modulating the voltage and frequency to change the rotational speed of the pump. VFD's have one or more sensors placed throughout the system and constantly send measurements for the pump to determine whether it needs to ramp up or down to meet the system demand.

System Pressure Drop

You may ask why balancing is so important when the pump can adjust accordingly. The first reason is that your pump can only run at one speed. Each zone in your building will call for different flows simultaneously. The figure below shows a system without balancing valves. The flow will take the least path of resistance and overflow the closest or least resistive units. This causes the further or more resistive units not to get enough flow.



Won't the Control Valves Balance?

You may ask why an additional balancing valve is needed when the control valve aims to control the flow. The first point is that the control valve is sized based on the design flow. Without a balancing valve there is no telling what flow rate the control valve will experience.

Therefore, it will be much harder for a control valve sized for 1.76 GPM to control 10 GPMs, for example. According to an ASHRAE study, the control valve authority without a balancing valve can have a maximum flow 63% greater than the design.

Have you ever had a project with units not getting enough flow? This could be due to units closer to your pump overflowing from the lack of proper balancing and, therefore, starving other units of flow.

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