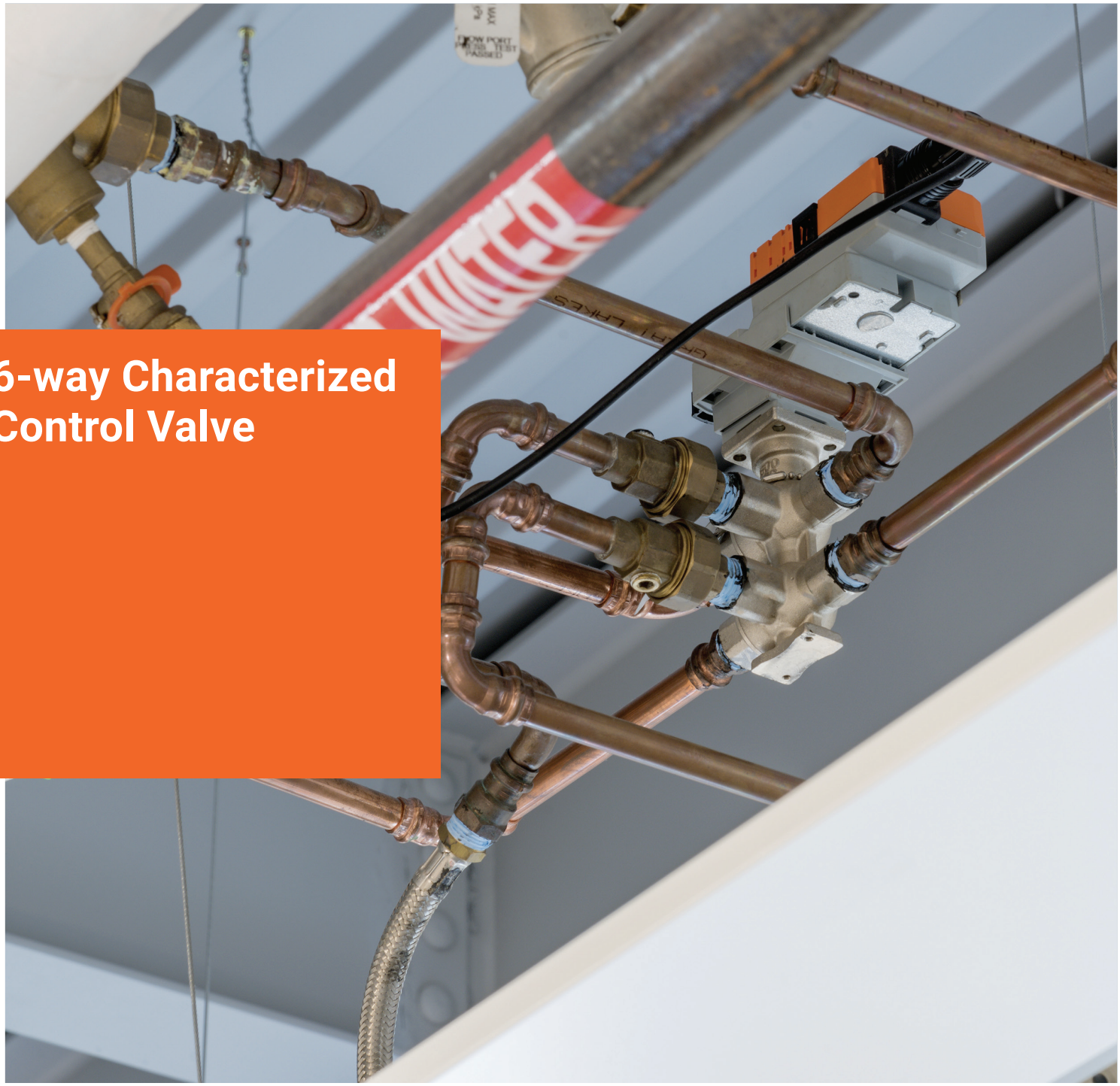


6-way Characterized Control Valve

Technical Documentation

Discover the advantages
www.belimo.com

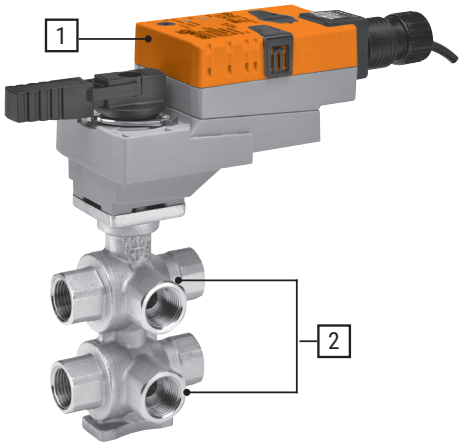
BELIMO

Table of Contents

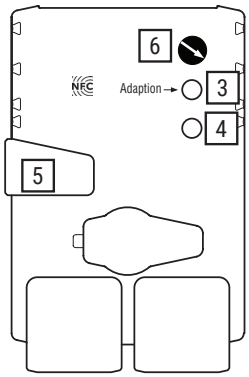
Overview

The 6-way valve is the only one of its kind designed for chilled beams, radiant ceiling panels, and 4-pipe fan coil units. It has the functionality of up to four 2-way control valves and two balancing valves saving material and installation time. The 6-way characterized control valve (CCV) with a non-spring return actuator operates using a single analog DC 2...10 V control signal. It modulates the valve to manage two flow sequences (cooling and heating) for a single coil, utilizing a 90° rotary actuator.

Pressure Dependent (6-way CCV)



Actuator



1 Non-Spring Return Actuator (AC / DC 24 V)

2 6-way Characterized Control Valve

3 Push Button and LED Display- Green
Off: No power supply or malfunction
On: In operation

4 LED Display- Yellow
Off: Standard mode
On: Adaptation or synchronizing process active

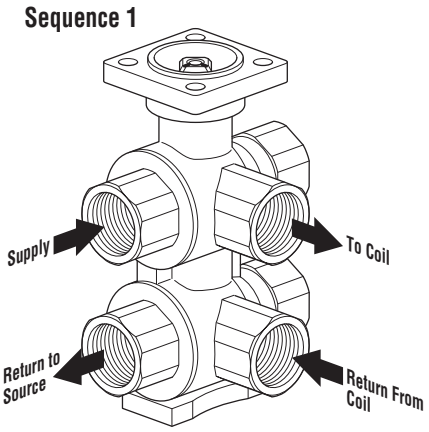
5 Gear Disengagement Button
Press Button: Gear disengages, motor stops, manual override possible
Release Button: Gear engages, synchronization starts, followed by standard mode

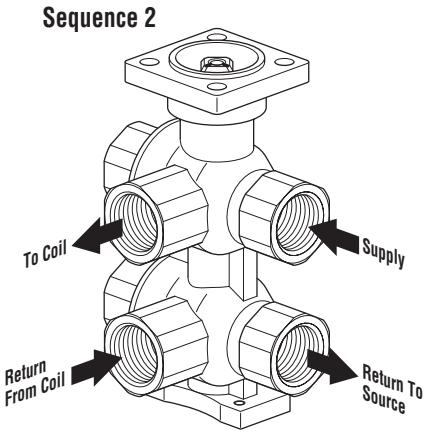
7 Direction of Rotation Switch

Characteristics

Flow Pattern

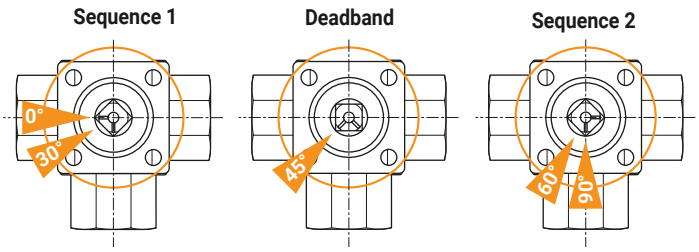
The flow direction must be observed The position of the ball can be identified from the L-marking on the stem. Heating or cooling can be either sequence 1 or 2, but cooling is recommended for sequence 1. This valve is for closed loop systems ONLY.

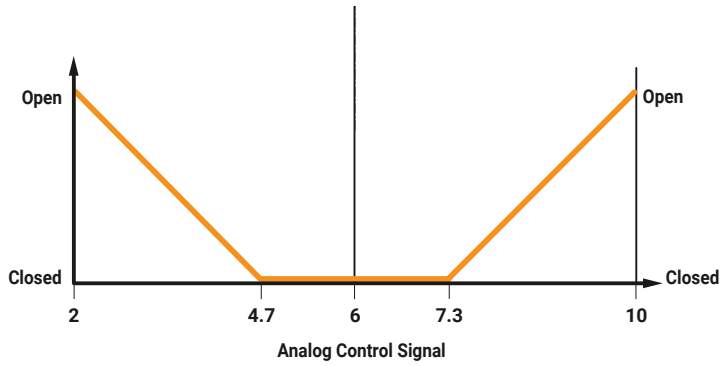




Valve Operation

The position of the ball is identified from the L-marking on the stem. The illustration shows the valve response vs. control signal for the 6-way CCV. The valve will modulate to a valve position proportional to the control signal between closed and open.

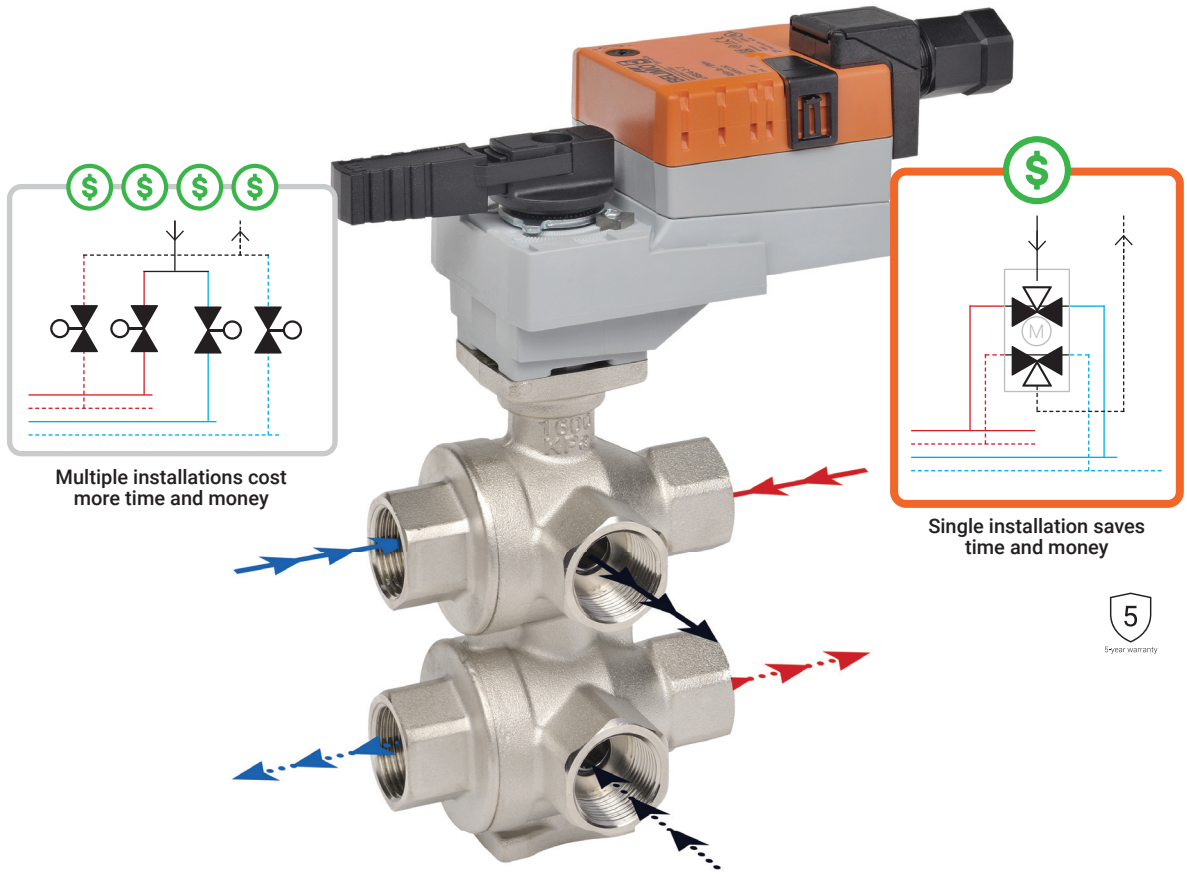




Features

The Belimo 6-way characterized control valve is the only one of its kind and is ideal for chilled beams and radiant ceilings. This compact valve has the functionality of up to four 2-way control valves saving space, material and installation time while providing true flow measurement.

- One valve performs change over and modulating control for single coil 4 pipe system providing less system maintenance.
- Support different flow requirements of both hot and chilled water with one valve (one valve multiple GPM's possible).
- True close-off to isolate both heating and cooling loops providing system efficiency.
- Less power consumption with using only one valve and actuator assembly.
- Reduced installation cost by using only one coil for heating and cooling.



6-Way Characterized Control Valve Nomenclature

B3	15	-029	-	029	+LRB	24	-SR
Valve B3 = 3-way	**Valve Size** 15 = ½" 20 = ¾" 25 = 1"	**Sequence 1** 029 = 0.29 C_V 046 = 0.46 C_V 073 = 0.73 C_V 116 = 1.16 C_V 150 = 1.50 C_V 175 = 1.75 C_V 186 = 1.86 C_V 200 = 2.00 C_V 290 = 2.90 C_V 400 = 4.00 C_V 490 = 4.90 C_V 740 = 7.40 C_V	Two 3-way = 6-way	**Sequence 2** 029 = 0.29 C_V 046 = 0.46 C_V 073 = 0.73 C_V 116 = 1.16 C_V 150 = 1.50 C_V 175 = 1.75 C_V 186 = 1.86 C_V 200 = 2.00 C_V 290 = 2.90 C_V 400 = 4.00 C_V 470 = 4.70 C_V 700 = 7.00 C_V	**Actuator Type** Non Fail-Safe LRB, LRX NRB, NRX	**Power Supply** 24 = AC/DC 24 V	**Control** -SR = Modulating 2...10 V -MFT = Multi-Function Technology

Ordering Example

1 Choose the valve actuator combination.

B315-029-029+LRB24-SR

NO — **Tagging (if needed)**

2 Specify preference or configuration.

Set-Up

Non Fail-Safe Models
NO = Normally Open - Sequence 1
-OR-
NC = Normally Closed - Sequence 1

3 Does order require tagging?

Tagging:
Valves may be tagged per customer specification. ($15.00 charge per tag)

Example:
Sequence 1
Sequence 2

Part number for tagging: 99981-00101

4 Complete Ordering Example: B315-029-029+LRB24-SR

6-Way Characterized Control Valve Product Range

		Valve Nominal Size		Type	Suitable Actuators	
Sequence 1 C_V	Sequence 2 C_V	Inches	DN [mm]	6-way NPT	Non Fail-Safe	
0.29	0.29	½	15	B315-029-029	LRB24-SR	LRX24-MFT
0.29	0.46	½	15	B315-029-046		
0.29	0.73	½	15	B315-029-073		
0.29	1.16	½	15	B315-029-116		
0.29	1.50	½	15	B315-029-150		
0.46	0.29	½	15	B315-046-029		
0.46	0.46	½	15	B315-046-046		
0.46	0.73	½	15	B315-046-073		
0.46	1.16	½	15	B315-046-116		
0.46	1.50	½	15	B315-046-150		
0.73	0.29	½	15	B315-073-029		
0.73	0.46	½	15	B315-073-046		
0.73	0.73	½	15	B315-073-073		
0.73	1.16	½	15	B315-073-116		
0.73	1.50	½	15	B315-073-150		
1.16	0.29	½	15	B315-116-029		
1.16	0.46	½	15	B315-116-046		
1.16	0.73	½	15	B315-116-073		
1.16	1.16	½	15	B315-116-116		
1.16	1.50	½	15	B315-116-150		
1.50	0.29	½	15	B315-150-029		
1.50	0.46	½	15	B315-150-046		
1.50	0.73	½	15	B315-150-073		
1.50	1.16	½	15	B315-150-116		
1.50	1.50	½	15	B315-150-150		
1.75	2.0	½	15	B315-175-200		
2.0	1.75	½	15	B315-200-175		
2.0	2.0	½	15	B315-200-200		

5-year warranty

Linear Characteristic

MODE OF OPERATION

The 6-way CCV has the functionality of four 2-way control valves, and each sequence is controlled individually by the electronic actuator's rotary movement. The valve is bubble-tight in the closed position preventing energy losses and helps reduce operating costs.

PRODUCT FEATURES

One valve performs changeover and modulating control for a single coil in a 4 pipe system. True close-off to isolate both heating and cooling loops.

ACTUATOR SPECIFICATIONS

Control type	modulating 2...10 V, multi-function technology (MFT)
Manual override	LR series
Electrical connection	3 ft. [1 m] cable with ½" conduit fitting

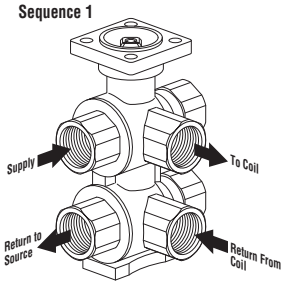
VALVE SPECIFICATIONS

Fluid	chilled or hot water, up to 60% glycol max
Flow characteristic	linear
Controllable flow range	
Sequence 1	0...30° angle
Dead zone	30...60°
Sequence 2	60...90° angle
Sizes	½"
End fitting	NPT female
Materials	
Body	nickel plated brass
Ball	chrome plated brass
Stem	nickel plated brass
Seats	Teflon® PTFE
Seat o-rings	EPDM
Characterizing disc	chrome plated steel
Stem o-rings	EPDM
Fluid temp range	43...180°F [6...82°C]
Body pressure rating	232 psi
Close-off pressure	50 psid
Max. operating differential pressure (ΔP)	15 psid*
Leakage	0%

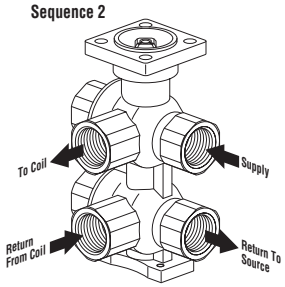
Teflon® is a registered trademark of DuPont™

* See Technical Documentation for further explanation.

Sequence 1

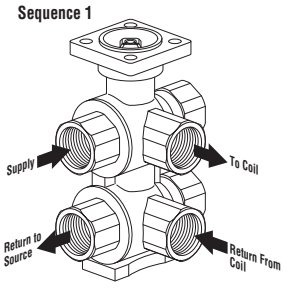


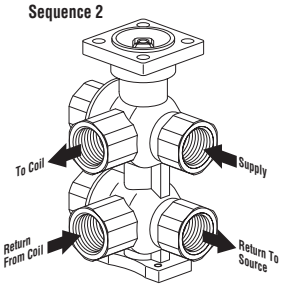
Sequence 2



6-Way Characterized Control Valve Product Range

		Valve Nominal Size		Type	Suitable Actuators	
Sequence 1 C_V	Sequence 2 C_V	Inches	DN [mm]	6-way NPT	Non Fail-Safe	
0.73	0.73	¾	20	B320-073-073	LRB24-SR	LRX24-MFT
0.73	1.16	¾	20	B320-073-116		
0.73	1.86	¾	20	B320-073-186		
0.73	2.9	¾	20	B320-073-290		
1.16	0.73	¾	20	B320-116-073		
1.16	1.16	¾	20	B320-116-116		
1.16	1.86	¾	20	B320-116-186		
1.16	2.9	¾	20	B320-116-290		
1.86	0.73	¾	20	B320-186-073		
1.86	1.16	¾	20	B320-186-116		
1.86	1.86	¾	20	B320-186-186		
1.86	2.9	¾	20	B320-186-290		
2.9	0.73	¾	20	B320-290-073		
2.9	1.16	¾	20	B320-290-116		
2.9	1.86	¾	20	B320-290-186		
2.9	2.9	¾	20	B320-290-290		
2.9	4.0	¾	20	B320-290-400		
2.9	4.7	¾	20	B320-290-470		
4.0	2.9	¾	20	B320-400-290		
4.0	4.0	¾	20	B320-400-400		
4.0	4.7	¾	20	B320-400-470		
4.9	2.9	¾	20	B320-490-290		
4.9	4.0	¾	20	B320-490-400		
4.9	4.7	¾	20	B320-490-470		
7.4	7	1	25	B325-740-700	NRB24-SR	NRX24-MFT





5-year warranty

Linear Characteristic

MODE OF OPERATION

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Stem	nickel plated brass
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Body pressure rating	232 psi
Close-off pressure	50 psid
Max. operating differential pressure (ΔP)	15 psid*
Leakage	0%

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* See later pages for further explanation.

Installation

Four Pipe Common Load Systems

As with all combined heating/cooling elements in 4-pipe systems, mass displacement can occur.

Mass Displacement

With each switch (from cooling to heating operation or from heating to cooling operation) water is displaced from one circuit to the other. Due to the different medium temperatures, the density of this water differs. Due to the constant volume in the heating/cooling element, the quantity of water displaced has a different mass. When switching from cooling to heating, more mass is shifted then when switching from heating to cooling. This mass displacement can lead to the cooling circuit being emptied.

It is important to compensate for this normal behavior.

Media

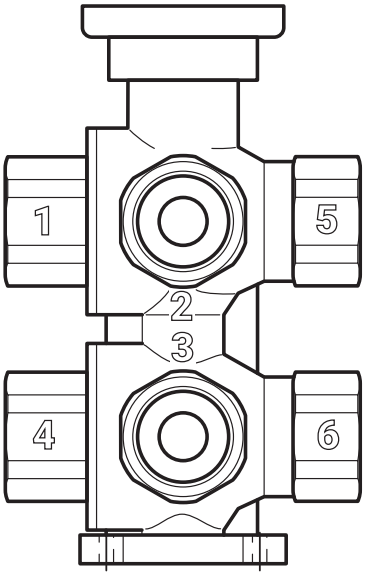
Due to the mass displacement that occurs, the medium in both circuits needs to have the same properties (glycol concentration).

System Pressure

The system pressures in the heating and cooling circuit must have the same value.

Built-in Pressure Relief

A loop pressure relief is designed into port number two (2). This allows the increased pressure to dissipate to the supply loop on port number one (1). This is intended to release any pressure build up in the loop (coil) when the valve is in the closed position and is isolated from the system expansion vessel. The change in pressure occurs due to a change in the media temperature in the coil while isolated from the pressure vessel. The pressure relief does not affect the efficiency of the system because cross-flow cannot occur between the heating and cooling loops.



Max ΔP* = Dpsource - Dpcoil

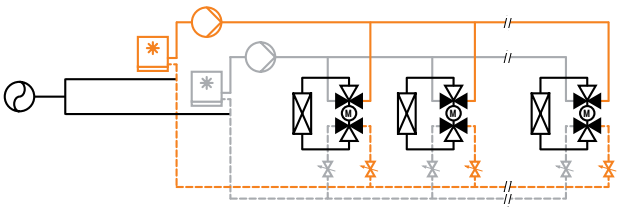
Dpsource = differential pressure between supply and return of the source (Ports 1 & 4 or 5 & 6)

Dpcoil = differential pressure between supply and return of the Coil (Ports 2 & 3)

Recommended Installation

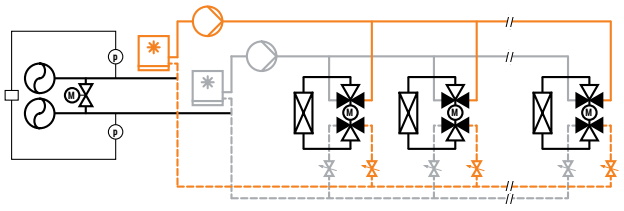
1. One expansion vessel*

- One expansion vessel for both circuits. Connection point on the suction side of the pumps.
- Pumps at the same height.
- Connection line between heating circuit return and cooling circuit return.
- The same static pressure on the suction side of the pumps.



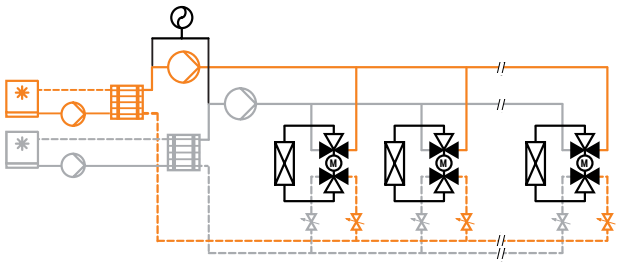
2. Two expansion vessels in a hydraulic coupling system

- The same static pressure on the suction side of the pumps.
- Pumps at the same height.
- The 2-way valve remains closed during operation.
- The 2-way valve will open if the pressures $p_{Heating}$ and $p_{Cooling}$ exhibit a certain difference due to the mass displacement.
- The system pressures are balanced.
- The 2-way valve is closed again after the compensation.



3. One expansion vessel with dedicated resource

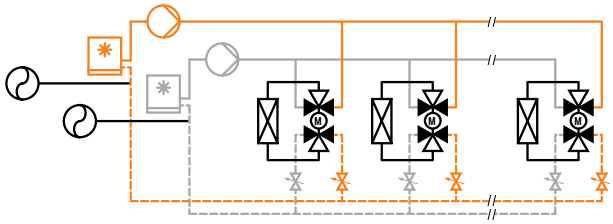
- Secondary circuit isolated from the primary via dedicated source (IE: Heat Exchangers, Heat Pumps, Boilers, Chillers.)
- One expansion vessel for both circuits.
- Pumps at the same height.
- Connection line between heating circuit return and cooling circuit return.
- The same static pressure on the suction side of the pumps.



Non-Recommended Installation

4. Two expansion vessels

- The effect of mass displacement must be compensated for by refilling and emptying the circuit.

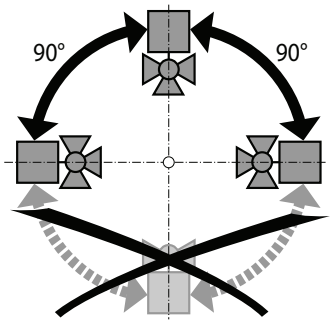


*Per ASHRAE mechanical piping handbook, 4-pipe common load system should share a common expansion tank.

Mounting

The control valve can be mounted either vertically or horizontally.

Do not install the ball valve with the stem pointing downwards.



Installation

Inspect shipping package, valve, linkage, and actuator for physical damage. If shipping damage has occurred notify appropriate carrier. Do not install.

1. Install valve with the proper ports as inlets and outlets. See drawings on page 1. Flow direction arrows must be correct.
2. Blow out all piping and thoroughly clean before valve installation.
3. Clean male pipe threads with wire brush and rag. If threads have been damaged or exposed to weather, running a tap or die over the threads may straighten them. Clean pipes, threads, and valve threads before installation; check for any foreign material that can become lodged in trim components. Strainers should be cleaned after initial startup.
4. Pipe sealing compound should be applied sparingly after cleaning and may not be applied to the two lead threads of a screwed pipe, which are innermost inside the valve. Sealing compound is to be placed on male threads only. The purpose is to lubricate the pipes when tightening.
5. Valve must be installed with the stem towards the vertical, not below horizontal.
6. Start the connection by turning the valve or pipe by hand as far as possible. Be certain the threads mate by the "feel" of the connection.
7. Use wrenches to tighten the valve to the pipe. Do not over tighten or strip the threads. Two wrenches are necessary to avoid damaging the valve.
8. Valves must be installed in closed loop systems only.

Do not force. Do not use the actuator to turn the pipe or the stem. Do not use any toothed tool such as pliers, which may damage the stem.

Warning!

- Valve should not be used for combustible gas applications. Gas leaks and explosions may result. Do not install in systems, which exceed the ratings of the valve.
- Avoid installations where valve may be exposed to excessive moisture, corrosive fumes, vibration, high ambient temperatures, elements, or high traffic areas with potential for mechanical damage.
- Valve assembly location must be within ambient ratings of actuator. If temperature is below -22°F a heater is required.
- The valve assembly will require heat shielding, thermal isolation, or cooling if combined effect of medium and ambient temperatures – conduction, convection, and radiation – is above 180°F for prolonged time periods at the actuator.
- Following standard procedure, a strainer should be installed before the coil and valve or in another appropriate place in the system.
- Visual access must be provided. Assembly must be accessible for routine schedule service. Contractor should provide unions for removal from line and isolation valves.
- Avoid excessive stresses. Mechanical support must be provided where reducers have been used and the piping system may have less structural integrity than full pipe sizes.
- Sufficient upstream and downstream piping runs must be provided to ensure proper valve capacity and flow response. Five diameters in each direction are recommended.
- Life span of valve stems and O-rings is dependent on maintaining non-damaging conditions. Poor water treatment or filtration, corrosion, scale, other particulate can result in damage to trim components. A water treatment specialist should be consulted.
- Normal thread engagement between male pipe thread and valve body should be observed. Pipe run that is in too far will damage the valve.

Storage: The valves should be stored in the open or closed position. The valves must always be either completely open or completely closed to avoid deformation of the PTFE seat on one side. The valves must be protected against dust and dirt.

Wiring

INSTALLATION NOTES

1 Provide overload protection and disconnect as required.

2 Actuators may be connected in parallel. Power consumption and input impedance must be observed.

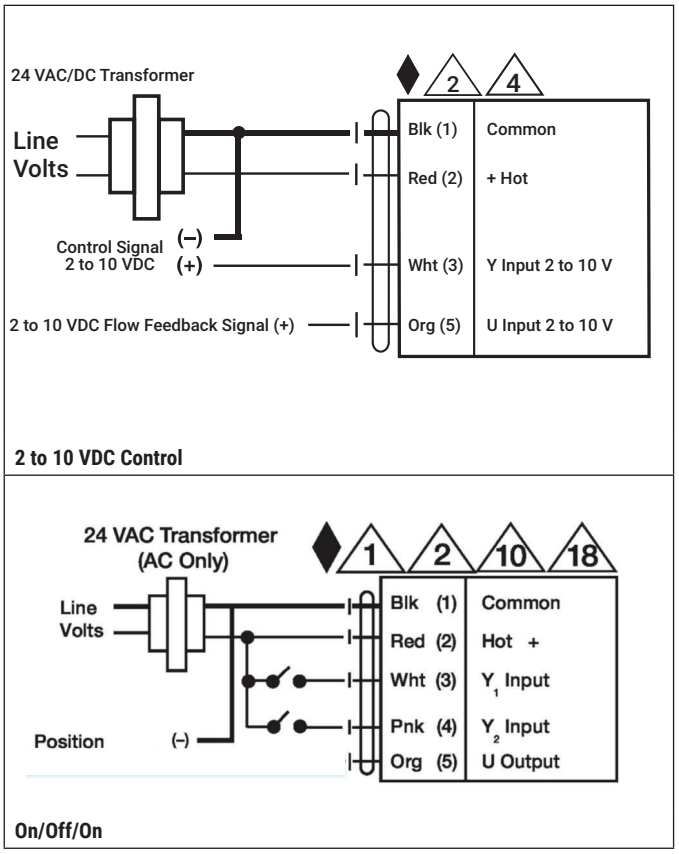
4 Actuators are provided with color coded wires. Wire numbers are provided for reference.

◆ Meets cULus requirements without the need of an electrical ground connection.

! **WARNING! LIVE ELECTRICAL COMPONENTS!**
During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

10 For triac sink the Common connection from the actuator must be connected to the Hot connection of the controller. Position feedback cannot be used with a triac sink controller; the actuator internal common reference is not compatible.

18 Actuators with plenum cable do not have numbers; use color codes instead.



2 to 10 VDC Control

On/Off/On