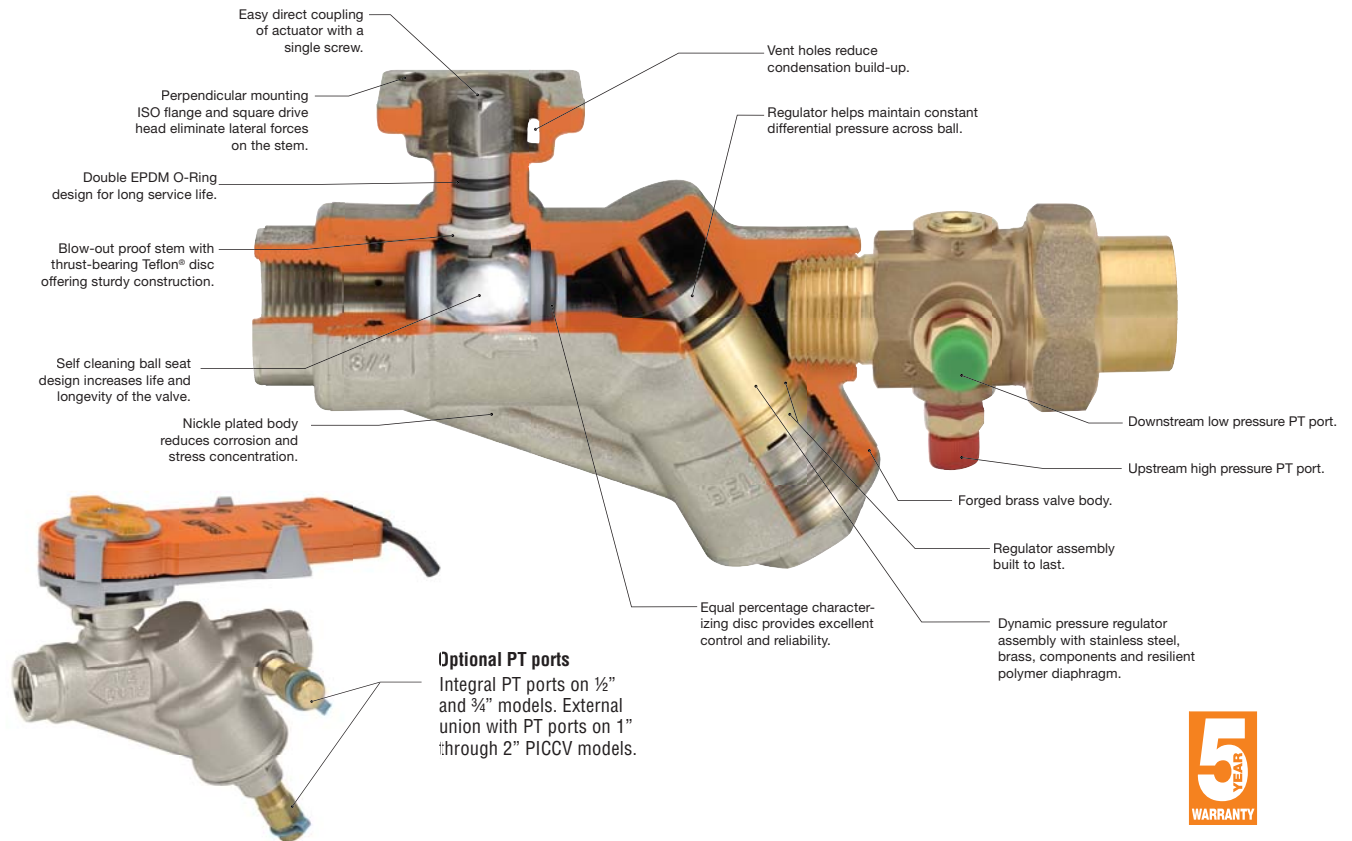


# Pressure Independent Characterized Control Valves™ (PICCV)



## Disadvantages of Today's Systems

- Time consuming balancing effort
- Rebalancing required when adding to system or remodeling
- Poor valve authority at average or low load
- Balancing procedure dictates quality
- Low  $\Delta T$  at the coils yields overflow and increases pumping costs
- Potential spreading of control problems can occur when one or more loops are unstable, due to interactive nature of circuits

## Features

- Automatic dynamic system balancing
- Field adjustable flow rate
- 5 – 50 PSI differential pressure operating range (gradual flow will increase from 0-5 psi)
- 0.5 – 100 GPM (1/2" – 2")
- 5 year warranty

## Advantages of the PICCV

- Easy selection, no  $C_v$  calculation required
- Hydronic balancing is simplified, as the circuits are not interactive
- Flexible commissioning
- One piece installation saves 50% of labor costs, installation space, and investment for balancing valve
- Reduces pumping costs by maintain flow regardless of pressure fluctuations
- Visualizes flow in a BMS system and provides accurate flow for each degree of opening
- Prevents overflow or underflow for fast start-up

## Options

- Belimo PC-Tool/ZTH-GEN US for commissioning
- Weather shields
- Auxiliary switches
- Flow verification orifice (-F models) available only with field set LRB24-SA and KRB24-3

SET-UP

**2-WAY VALVE**  
**SPECIFY UPON ORDERING**

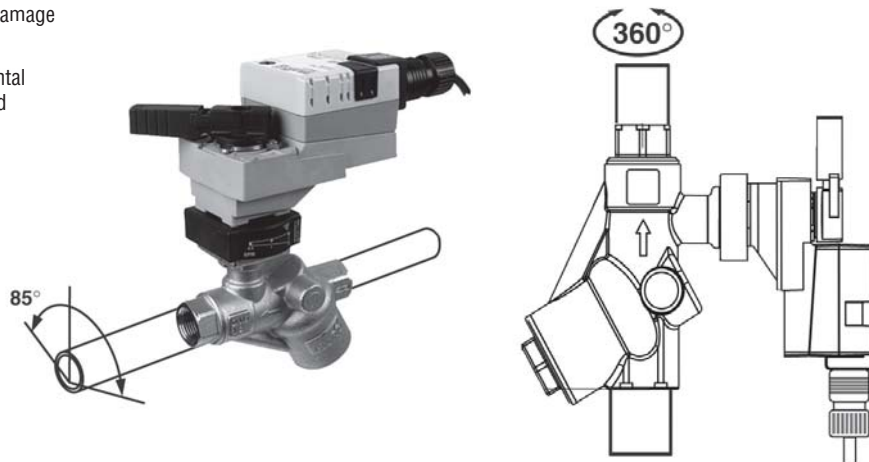
<b>NON-SPRING RETURN</b> Stays in Last Position	<b>LRB24-3, KRB24-3</b> Floating type actuators	<b>NC:</b> Normally Closed-Factory default with the directional switch in the 1 position. Power to pin 2 will drive valve CW. Power to pin 3 will drive valve CCW.	<b>NO:</b> Normally Open- <b>LRB Only</b> - Change directional switch from default "1" position to the "0" position.		
	<b>LRX24-MFT</b> <b>ARX24-MFT</b> MFT type actuators*	<b>NC:</b> Normally Closed-valve will open as voltage increases. Actuator switch on Y2.	<b>NO:</b> Normally Open-valve will close as voltage increases. Actuator switch on Y1.		
	<b>LRB24-SA</b>	<b>NC ONLY:</b> Normally Closed-valve will open as voltage increases. Actuator switch on Y2			
<b>SPRING RETURN</b> Note Fail Position	<b>LF24-MFT US</b> <b>AFRX24-MFT</b> MFT type actuators†	<b>NC/FO Valve:</b> Normally Closed-valve will open as voltage increases. Actuator switch on CW. Spring Action: Will fail open upon power loss.	<b>NC/FC Valve:</b> Normally Closed-valve will open as voltage increases. Actuator switch on CW. Spring Action: Will fail closed upon power loss.	<b>NO/FC Valve:</b> Normally Open-valve will close as voltage increases. Actuator switch on CCW. Spring Action: Will fail closed upon power loss.	<b>NO/FO Valve:</b> Normally Open-valve will close as voltage increases. Actuator switch on CCW. Spring Action: Will fail open upon power loss.
	<b>TFRX24-MFT</b>	<b>NC/FO Valve:</b> Normally Closed-valve will open as voltage increases. Switch on  (arrow setting) Spring Action: Will fail open upon power loss.	<b>NC/FC Valve:</b> Normally Closed-Valve will open as voltage increases. Switch on  (arrow setting) Spring Action: Will fail closed upon power loss.	<b>NO/FC Valve:</b> Normally Open-valve will close as voltage increases. Switch on  (arrow setting) Spring Action: Will fail closed upon power loss.	<b>NO/FO Valve:</b> Normally Open-valve will close as voltage increases. Switch on  (arrow setting) Spring Action: Will fail open upon power loss.

\*The design flow rate of PICCVs with MFT actuators are dependent on their Minimum and Maximum Percentages of rotation. Actuators must be re-programmed for different Minimum and Maximum Settings if actuator set-ups must be changed. Please refer to PICCV online technical documentation, MFT Adjustment Tables, for re-programming the settings.

**INSTALLATION**

PICCVs should be installed with flow in the direction of the arrow on the valve body. If installed backwards, there could be damage to either the diaphragm or the regulator.

The valve assembly can be installed in a vertical or horizontal arrangement, as long as the actuator is positioned to avoid condensation from dripping on the actuator.



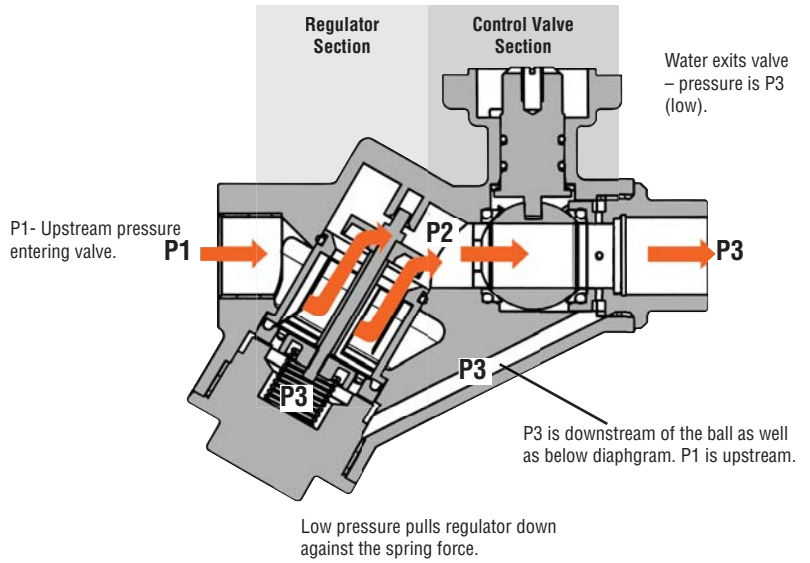
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**FLOW PATTERN**

PICCV consists of a differential pressure regulator in series with a control valve.

The control valve is throttled to match the flow command of the control signal. The differential pressure regulator holds the pressure drop across the ball of the valve. As system pressures change, the differential pressure regulator moves in response to keep the flow stable.

Pressure P1 at the inlet of the PICCV is high and pressure P3 at the outlet is low. The differential pressure between P1 and P3 must be between 5-50 PSID to achieve pressure independent flow. When differential pressure increases the regulator opening is reduced. When differential pressure decreases the regulator opening is increased. This allows for the constant pressure differential across the ball of the valve.

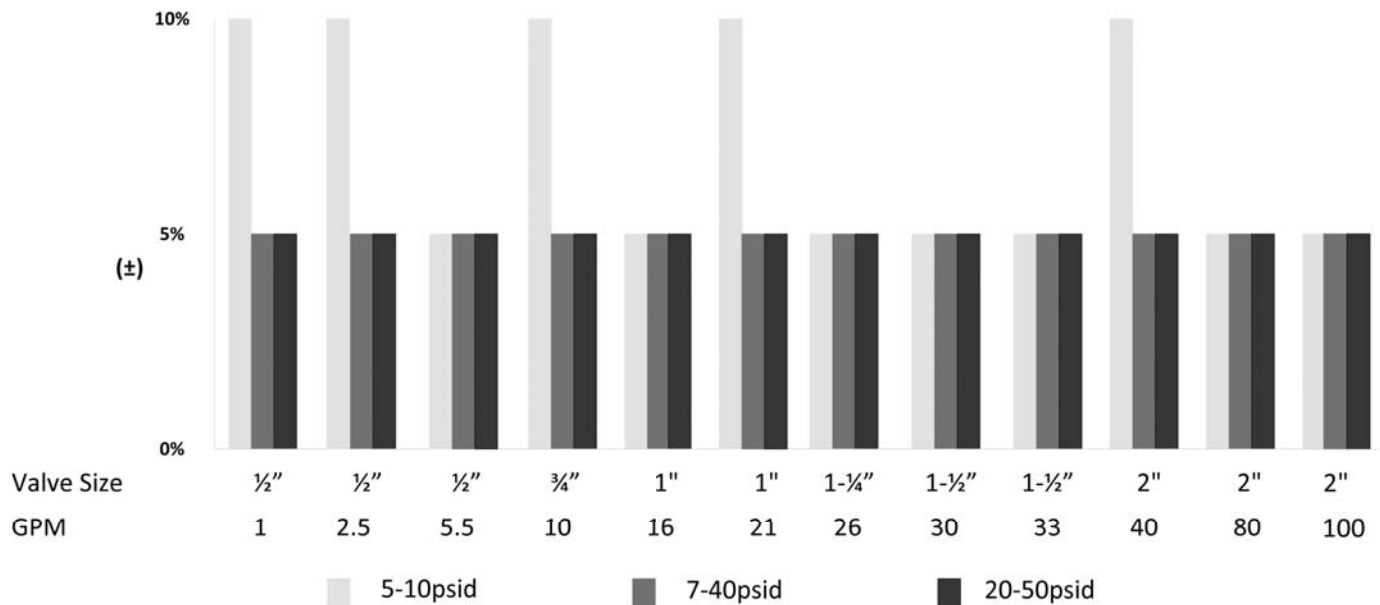


**THE BEST WAY TO CONTROL FLOW**

**Maintain design flow independent of pressure variations.**

The PICCV is a two-way valve that will supply a specific flow for each degree of ball opening regardless of pressure variations in a system.

**Valve Accuracy**



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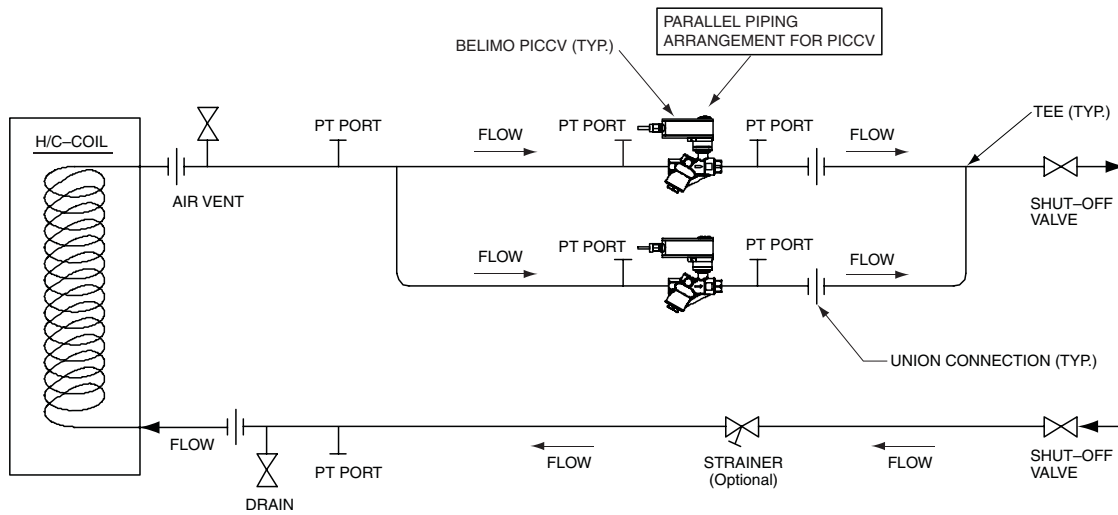
The Pressure Independent Characterized Control Valves can be piped in a parallel orientation to achieve increased flow rates.

PICCVs are available in flow values from 0.5 to 100 GPM. To achieve higher flows, it is recommended to pipe the two valves in parallel. To correctly operate these valves, the Belimo Multi Function Technology (MFT) will be employed to utilize one common control signal.

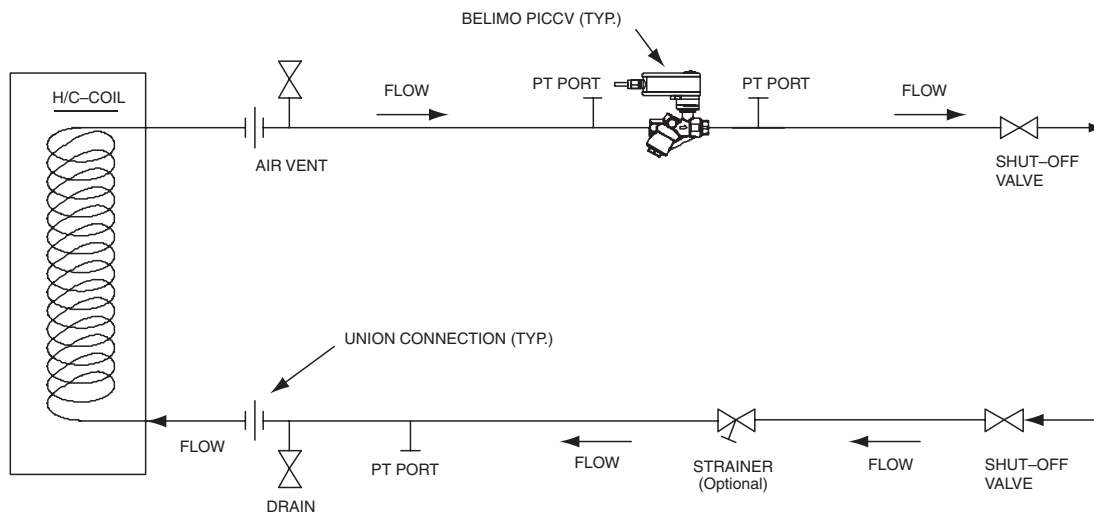
This recommended configuration provides the control of flows up to 200 GPM by using two valves. The top diagram details valves piped in a parallel arrangement. The bottom diagram features a typical single piping arrangement.

If more than three valves are piped in parallel, please call Belimo to discuss control options.

## TYPICAL PARALLEL PIPING IN RELATION TO THE INPUT AND OUTPUT (SCALE: NONE)

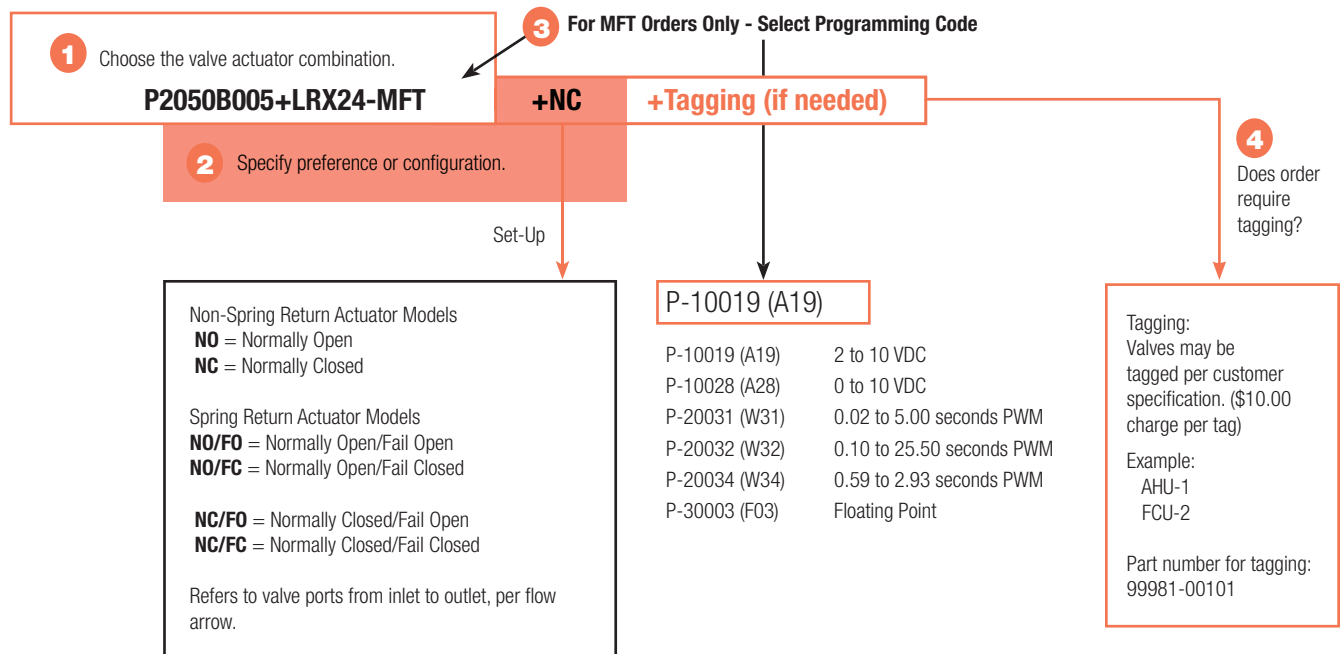


## TYPICAL PIPING IN RELATION TO THE INPUT AND OUTPUT (SCALE: NONE)



P	2	050	B	005		LRX	24	-MFT
<b>Valve Type</b> P= Pressure Independent Characterized Control Valve	<b>Porting</b> 2 = Two Way	<b>Valve Body Size</b> 050 = 1/2" 075 = 3/4"	<b>Body Type</b> B = Chrome Plated	<b>Flow Rate</b> 005 = .50 GPM 010 = 1 GPM 015 = 1.5 GPM 020 = 2 GPM 025 = 2.5 GPM 030 = 3 GPM 035 = 3.5 GPM 040 = 4 GPM 045 = 4.5 GPM 050 = 5 GPM 055 = 5.5 GPM 060 = 6 GPM 065 = 6.5 GPM 070 = 7 GPM 075 = 7.5 GPM 080 = 8 GPM 085 = 8.5 GPM 090 = 9 GPM 095 = 9.5 GPM 100 = 10 GPM	<b>Options</b> -P = PT Port -F = Flow Orifice	<b>Actuator Type</b> Non-Spring Return LRB... LRX... KRB... Spring Return TF... LF...	<b>Power Supply</b> 24 = 24 VAC /DC 120 = 120 VAC	<b>Control</b> -3 = Floating Point -MFT = Multi-Function Technology -SA = Proportional 2-10VDC

### Ordering Example

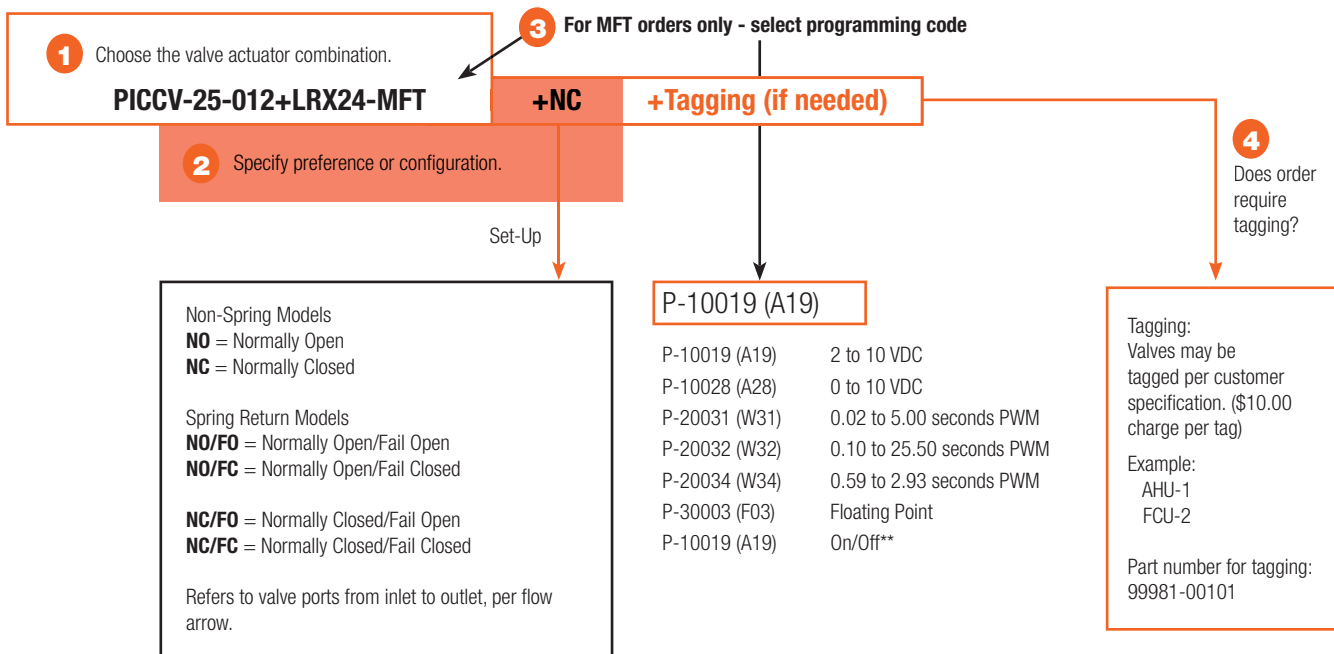


**5** Complete Ordering Example: **P2050B005+LRX24-MFT+NC+A19**

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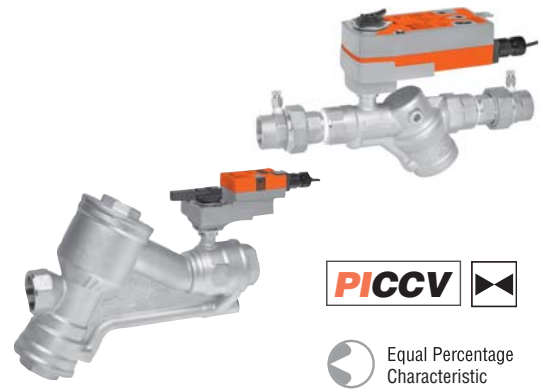
PICCV	25	-012		+LRX	24	-MFT	
<b>Pressure Independent Characterized Control Valve</b> 2-way Chrome Plated Brass Ball and Brass Stem	<b>Valve Size</b> 25 = 1" 32 = 1¼" 40 = 1½" 50 = 2"	<b>Flow Rate</b> 3 GPM Refer to table	<b>Options</b> -P = PT Port -F = Flow Orifice	<b>Actuator Type</b> Non-Spring Return LRB... LRX... ARX... Spring Return TF... LF... AF...	<b>Power Supply</b> 24 = 24 VAC/DC 120 = 120 VAC	<b>Control</b> -3 = Floating Point -MFT = Multi-Function Technology -SA = Proportional 2-10 VDC	S = Built-in Auxiliary Switch

Ordering Example



\*\* Wire for On/Off

	GPM**	Valve Nominal Size		Type	Suitable Actuators		
		Inches	DN [mm]	2-way NPT	Non-Spring Return	Spring Return	
Models with (-P) have integral PT ports Forged Body	0.5	½	15	P2050B005 (-P)	LRB24-3 LRX24-MFT LRX120-3 LRCB24-3 (Heat Pump Only) TFRX24-MFT LF24-MFT US		
	1	½	15	P2050B010 (-P)			
	1.5	½	15	P2050B015 (-P)			
	2	½	15	P2050B020 (-P)			
	2.5	½	15	P2050B025 (-P)			
	3	½	15	P2050B030 (-P)			
	3.5	½	15	P2050B035 (-P)			
	4	½	15	P2050B040 (-P)			
	4.5	½	15	P2050B045 (-P)			
	5	½	15	P2050B050 (-P)			
	5.5	½	15	P2050B055 (-P)			
	6	¾	20	P2075B060 (-P)			
	6.5	¾	20	P2075B065 (-P)			
	7	¾	20	P2075B070 (-P)			
	7.5	¾	20	P2075B075 (-P)			
	8	¾	20	P2075B080 (-P)			
	8.5	¾	20	P2075B085 (-P)			
	9	¾	20	P2075B090 (-P)			
	9.5	¾	20	P2075B095 (-P)			
10	¾	20	P2075B100 (-P)				
Models with (-P) have external IPT ports Cast Body	11	1	25	PICCV-25-011 (-P)			
	12	1	25	PICCV-25-012 (-P)			
	13	1	25	PICCV-25-013 (-P)			
	14	1	25	PICCV-25-014 (-P)			
	15	1	25	PICCV-25-015 (-P)			
	16	1	25	PICCV-25-016 (-P)			
	17	1	25	PICCV-25-017 (-P)			
	18	1	25	PICCV-25-018 (-P)			
	19	1	25	PICCV-25-019 (-P)			
	18	1¼	32	PICCV-32-018 (-P)			
	19	1¼	32	PICCV-32-019 (-P)			
	20	1¼	32	PICCV-32-020 (-P)			
	21	1¼	32	PICCV-32-021 (-P)			
	22	1¼	32	PICCV-32-022 (-P)			
	23	1¼	32	PICCV-32-023 (-P)			
	24	1¼	32	PICCV-32-024 (-P)			
	25	1¼	32	PICCV-32-025 (-P)			
	26	1¼	32	PICCV-32-026 (-P)			
	26	1½	40	PICCV-40-026 (-P)			
	27	1½	40	PICCV-40-027 (-P)			
	28	1½	40	PICCV-40-028 (-P)			
	29	1½	40	PICCV-40-029 (-P)			
	30	1½	40	PICCV-40-030 (-P)			
	31	1½	40	PICCV-40-031 (-P)			
	32	1½	40	PICCV-40-032 (-P)			
	33	1½	40	PICCV-40-033 (-P)			
	33	2	50	PICCV-50-033 (-P)			
	34	2	50	PICCV-50-034 (-P)			
	35	2	50	PICCV-50-035 (-P)			
	36	2	50	PICCV-50-036 (-P)			
	37	2	50	PICCV-40-037 (-P)			
	38	2	50	PICCV-40-038 (-P)			
	39	2	50	PICCV-40-039 (-P)			
	40	2	50	PICCV-50-040 (-P)			
	44	2	50	PICCV-50-044 (-P)			
	48	2	50	PICCV-50-048 (-P)			
	52	2	50	PICCV-50-052 (-P)			
	56	2	50	PICCV-50-056 (-P)			
	60	2	50	PICCV-50-060 (-P)			
	65	2	50	PICCV-50-065 (-P)			
	70	2	50	PICCV-50-070 (-P)			
	75	2	50	PICCV-50-075 (-P)			
80	2	50	PICCV-50-080 (-P)				
90	2	50	PICCV-50-090 (-P)				
100	2	50	PICCV-50-100 (-P)				



**PICCV**

Equal Percentage Characteristic

### Mode of Operation

The Pressure Independent Characterized Control Valve (PICCV) is a two-way valve which combines the functionality of a control valve and a pressure regulating valve, creating one precise product which is unaffected by pressure variations in a system.

### Product Features

Constant flow regardless of pressure variations in the system at set degrees of ball opening. Maximizes chiller ΔT, preventing energizing additional chillers due to low ΔT. Simplified valve sizing and selection, no C<sub>v</sub> calculations required.

(-P) ΔP verification across valve using PT ports.

### Actuator Specifications

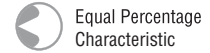
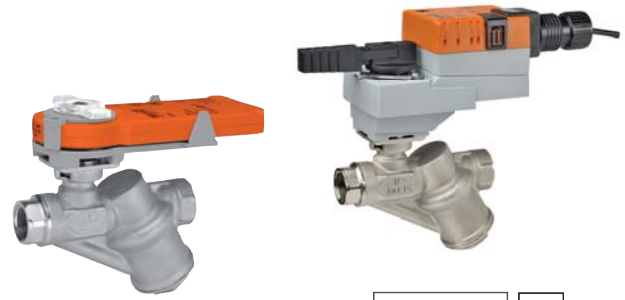
Control type	-3 on/off, floating point -MFT proportional, 2-10 VDC (configurable)
Manual override	(LRB, LRX, AFRX, ARX)
Electrical connection	3 ft. [1m] cable with ½" conduit fitting (additional cable lengths are available)

### Valve Specifications

Service	chilled or hot water, 60% glycol max
Flow characteristic	equal percentage
Controllable flow range	75°
Sizes	½", ¾", 1", 1¼", 1½", 2"
End fitting	NPT female ends
Materials	
Body	brass, nickel plated
Ball	chrome plated brass
Stem	chrome plated brass
Seats	
½" and ¾"	Teflon® PTFE
1" to 2"	Teflon® PTFE /Tefzel®
Seat o-rings	Viton®
Characterizing disc	
½" and ¾"	brass
1" to 2"	Tefzel®
O-rings	EPDM (lubricated)
Diaphragm	
½" and ¾"	Nomex reinforced silicone
1" to 2"	polyester reinforced silicone
Regulator components	stainless steel/brass/Nitrile
Spring	stainless steel
Media temp range	0°F to 212°F [-18°C to +100°C]
PT Ports	optional, ½" to ¾" internal 1" to 2" external (-P)
Body pressure rating	
600 psi	½", ¾", 1"
400 psi	1¼", 1½", 2"
Close off pressure	200 psi
Differential pressure (ΔP) range	5 to 50 psid
Leakage	ANSI Class IV (0.01% of rated valve capacity at 50 psi differential)

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# Field Set Pressure Independent Characterized Control Valves (PICCV) Product Range Overview – P2..., 2-way



GPM Range	Valve Nominal Size		Type	Suitable Actuators	
	Inches	DN [mm]	2-way NPT	Non-Spring Return	
0...(0.5-1.5)	½	15	P2050B010	KRB24-3	LRB24-SA
0...(1.6-3.0)	½	15	P2050B025		
0...(3.0-5.6)	½	15	P2050B055		
0...(5.7-10)	¾	20	P2075B100		
0...(11-16)	1	25	PICCV-25-016		
0...(17-21)	1	25	PICCV-25-021		

## ΔP verification across valve using PT ports (-P)

GPM Range	Valve Nominal Size		Type	Suitable Actuators	
	Inches	DN [mm]	2-way NPT	Non-Spring Return	
0...(0.5-1.5)	½	15	P2050B010-P	KRB24-3	LRB24-SA
0...(1.6-3.0)	½	15	P2050B025-P		
0...(3.0-5.6)	½	15	P2050B055-P		
0...(5.7-10)	¾	20	P2075B100-P		
0...(11-16)	1	25	PICCV-25-016-P		
0...(17-21)	1	25	PICCV-25-021-P		

## Flow verification using ΔP across orifice (-F)

GPM Range	Valve Nominal Size		Type	Suitable Actuators	
	Inches	DN [mm]	2-way NPT	Non-Spring Return	
0...(0.5-1.5)	½	15	P2050B010-F	KRB24-3	LRB24-SA
0...(1.6-3.0)	½	15	P2050B025-F		
0...(3.0-5.6)	½	15	P2050B055-F		
0...(5.7-10)	¾	20	P2075B100-F		
0...(11-16)	1	25	PICCV-25-016-F		
0...(17-21)	1	25	PICCV-25-021-F		

## Mode of Operation

The Pressure Independent Characterized Control Valve (PICCV) is a two-way valve which combines the functionality of a control valve and a pressure regulating valve, creating one precise product which is unaffected by pressure variations in a system.

## Product Features

Once field set the valve will provide constant flow regardless of pressure variations in the system at set degrees of ball opening. Maximizes chiller ΔT, preventing energizing additional chillers due to low ΔT. Simplified valve sizing and selection, no C<sub>v</sub> calculations required.

(-P) ΔP verification across valve using PT ports.

(-F) Flow verification using ΔP across orifice.

**Valve is supplied at maximum flow in the full open position only. Field adjustment is necessary to achieve lower flow.**

## Actuator Specifications

Control type	on/off, floating point
Manual override	KRB, LRB...-SA
Electrical connection	3 ft. [1m] cable (no conduit on KR) ½" conduit fitting on LR only

## Valve Specifications

Service	chilled or hot water, 60% glycol max
Flow characteristic	equal percentage
Controllable flow range	75°
Sizes	½", ¾", 1"
End fitting	NPT female ends

## Materials

Body	brass, nickel plated
Ball	chrome plated brass
Stem	chrome plated brass
Seats	
½" and ¾"	Teflon® PTFE
1"	Teflon® PTFE /Tefzel®
Seat o-rings	Viton®
Characterizing disc	
½" and ¾"	brass
1"	Tefzel®
O-rings	EPDM (lubricated)
Diaphragm	
½" and ¾"	Nomex reinforced silicone
1"	polyester reinforced silicone
Regulator components	stainless steel/brass/Nitrile
Spring	stainless steel

Media temp range	0°F to 212°F [-18°C to +100°C]
KR valve assembly	0°F to 176°F [-18°C to +80°C]

Body pressure rating	600 psi
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Close off pressure	200 psi
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Differential pressure	5 to 50 psid
-----------------------	--------------

(ΔP) range	
------------	--

Leakage	ANSI Class IV (0.01% of rated valve capacity at 50 psi differential)
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# Factory Set

## P2... Series Pressure Independent Characterized Control Valves (PICCV) Chrome Plated Brass Ball and Brass Stem, NPT Female Ends



### Application

The Pressure Independent Characterized Control Valve is typically used in air handling units on heating and cooling coils, and fan coil unit heating or cooling coils. Some other common applications include unit ventilators and VAV re-heat coils. This valve is suitable for use in a hydronic system with constant or variable flow.

This valve is designed with MFT functionality which facilitates the use of various control input.

Technical Data	
Service	chilled or hot water, 60% glycol
Flow characteristic	equal percentage
Size	½", ¾", 1"
Type of end fitting	female, NPT
Materials	
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	chrome plated brass
Seat O-rings	Viton
Seat	fiberglass reinforced Teflon® PTFE
Characterizing disc	½" & ¾" Brass 1" TEFZEL®
Packing	2 EPDM O-rings, lubricated
Diaphragm	½" & ¾" silicone and Nomex 1" polyester reinforced silicone
Regulator components	stainless steel/brass/Nitrile
Spring	stainless steel
Body pressure rating	600 PSI
Media temp. range	0°F to 212°F [-18°C to +100°C]
Close off pressure	200 PSI
Leakage	ANSI Class IV (0.01% of rated valve capacity at 50 psi differential)
Rangeability	100 : 1
Differential pressure	5 to 50 PSI operating range
Valve accuracy	± 5%*
Weight of valve body	½" = 2.52 lbs ¾" = 2.52 lbs 1" = 4.98 lbs

½" body has three discs with different flow capabilities (.50 GPM to 1 GPM), (1.5 GPM to 2.5 GPM), (3 GPM to 5.5 GPM)

1" body has two discs with different flow capabilities (11 GPM to 16 GPM), (17 GPM to 19 GPM)

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\* See page 3 for more details.

Valve Model	Flow Rate		Valve Nominal Size			Suitable Actuators	
	GPM	Liter/sec	Inches	DN mm	Close-off PSI	Spring Return	Non-Spring Return
P2050B005(-P)	0.5	0.03	½	15	200	TFR24-MFT US	
P2050B010(-P)	1	0.06	½	15	200		
P2050B015(-P)	1.5	0.09	½	15	200		
P2050B020(-P)	2	0.13	½	15	200		
P2050B025(-P)	2.5	0.16	½	15	200		
P2050B030(-P)	3	0.19	½	15	200		
P2050B035(-P)	3.5	0.22	½	15	200		
P2050B040(-P)	4	0.25	½	15	200		
P2050B045(-P)	4.5	0.28	½	15	200		
P2050B050(-P)	5	0.32	½	15	200		
P2050B055(-P)	5.5	0.35	½	15	200	LF24-MFT US	LRB(X)24-3
P2075B060(-P)	6	0.38	¾	20	200		
P2075B065(-P)	6.5	0.41	¾	20	200		
P2075B070(-P)	7	0.44	¾	20	200		
P2075B075(-P)	7.5	0.47	¾	20	200		
P2075B080(-P)	8	0.50	¾	20	200		
P2075B085(-P)	8.5	0.54	¾	20	200		
P2075B090(-P)	9	0.57	¾	20	200		
P2075B095(-P)	9.5	0.60	¾	20	200		
P2075B100(-P)	10	0.63	¾	20	200		
PICCV-25-011(-P)	11	0.69	1	25	200		
PICCV-25-012(-P)	12	0.76	1	25	200		
PICCV-25-013(-P)	13	0.82	1	25	200		
PICCV-25-014(-P)	14	0.88	1	25	200		
PICCV-25-015(-P)	15	0.95	1	25	200		
PICCV-25-016(-P)	16	1.01	1	25	200		
PICCV-25-017(-P)	17	1.07	1	25	200		
PICCV-25-018(-P)	18	1.14	1	25	200		
PICCV-25-019(-P)	19	1.20	1	25	200	LRCB24-3 Heat Pump Only	

(-P) optional, ΔP verification across valve using PT ports

# Field Set

## P2... Series Pressure Independent Characterized Control Valves

### Chrome Plated Brass Ball and Brass Stem, NPT Female Ends



Valve is supplied at maximum flow in the full open position only. Field adjustment is necessary to achieve lower flow.

#### Application

The Pressure Independent Characterized Control Valve is typically used in air handling units on heating and cooling coils, and fan coil unit heating or cooling coils. Some other common applications include unit ventilators and VAV re-heat coils. This valve is suitable for use in a hydronic system with constant or variable flow.

Technical Data	
Service	chilled or hot water, 60% glycol
Flow characteristic	equal percentage
Size	½", ¾", 1"
Type of end fitting	female, NPT
Materials	
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	chrome plated brass
Seat O-rings	Viton
Seat	fiberglass reinforced Teflon® PTFE
Characterizing disc	½" & ¾" brass 1" TEFZEL®
Packing	2 EPDM O-rings, lubricated
Diaphragm	½" & ¾" silicone and Nomex 1" polyester reinforced silicone
Regulator components	stainless steel/brass/Nitrile
Spring	stainless steel
Body pressure rating	600 PSI
Media temp. range	
LRB24-SA	0°F to 212°F [-18°C to +100°C]
KRB24-3	0°F to 176°F [-18°C to +80°C]
Close off pressure	200 PSI
Leakage	ANSI Class IV (0.01% of rated valve capacity at 50 psi differential)
Rangeability	100 : 1
Differential pressure	5 to 50 psi operating range
Valve accuracy	± 5%*
Weight of valve body	½" = 2.52 lbs [1.14 kg] ¾" = 2.52 lbs [1.14 kg] 1" = 4.98 lbs [2.26 kg]

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\*See page 3 for more details.

Valve Model	GPM Range	Valve Nominal Size			Suitable Actuators	
		Inches	DN mm	Close-off PSI	Non-Spring Return	
P2050B010	0...(0.5-1.5)	½	15	200	KRB24-3	LRB24-SA
P2050B025	0...(1.6-3.0)	½	15	200		
P2050B055	0...(3.0-5.6)	½	15	200		
P2075B100	0...(5.7-10)	¾	20	200		
PICCV-25-016	0...(11-16)	1	25	200		
PICCV-25-021	0...(17-21)	1	25	200		

Valve Model	GPM Range	Valve Nominal Size			Suitable Actuators	
		Inches	DN mm	Close-off PSI	Non-Spring Return	
P2050B010-P	0...(0.5-1.5)	½	15	200	KRB24-3	LRB24-SA
P2050B025-P	0...(1.6-3.0)	½	15	200		
P2050B055-P	0...(3.0-5.6)	½	15	200		
P2075B100-P	0...(5.7-10)	¾	20	200		
PICCV-25-016-P	0...(11-16)	1	25	200		
PICCV-25-021-P	0...(17-21)	1	25	200		

(-P) optional, ΔP verification across valve using PT ports.

Valve Model	GPM Range	Valve Nominal Size			Suitable Actuators	
		Inches	DN mm	Close-off PSI	Non-Spring Return	
P2050B010-F	0...(0.5-1.5)	½	15	200	KRB24-3	LRB24-SA
P2050B025-F	0...(1.6-3.0)	½	15	200		
P2050B055-F	0...(3.0-5.6)	½	15	200		
P2075B100-F	0...(5.7-10)	¾	20	200		
PICCV-25-016-F	0...(11-16)	1	25	200		
PICCV-25-021-F	0...(17-21)	1	25	200		

(-F) optional, flow verification using ΔP across orifice.

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# Factory Set P2... Series Pressure Independent Characterized Control Valves (PICCV) Chrome Plated Brass Ball and Brass Stem, NPT Female Ends



### Application

The Pressure Independent Characterized Control Valve is typically used in air handling units on heating and cooling coils, and fan coil unit heating or cooling coils. Some other common applications include unit ventilators and VAV re-heat coils. This valve is suitable for use in a hydronic system with constant or variable flow.

This valve is designed with MFT functionality which facilitates the use of various control input.

Technical Data	
Service	chilled or hot water, 60% glycol
Flow characteristic	equal percentage
Size	1¼", 1½", 2"
Type of end fitting	female, NPT
Materials	
Body	forged brass, nickel plated
Ball	chrome plated brass
Stem	chrome plated brass
Seat O-rings	Viton
Seat	fiberglass reinforced Teflon® PTFE
Characterizing disc	TEFZEL®
Packing	2 EPDM O-rings, lubricated
Diaphragm	polyester reinforced silicone
Regulator components	stainless steel/brass/Nitrile
Spring	stainless steel
Body pressure rating	400 PSI
Media temp. range	0°F to 212°F [-18°C to 100°C]
Close-off pressure	200 PSI
Leakage	ANSI Class IV (0.01% of rated valve capacity at 50 psi differential)
Rangeability	100 : 1
Differential pressure	5 to 50 PSI operating range
Valve accuracy	± 5%*
Weight of valve body	1¼" = 8.31 lbs 1½" = 7.70 lbs 2" = 9.38 lbs 2" large = 29.10 lbs

2" body has two different flow capacities (44 GPM to 80 GPM) (90 GPM & 100 GPM)  
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\*See page 3 for more details.

Valve Model	Flow Rate		Valve Nominal Size		Close-off PSI	Suitable Actuators	
	GPM	Liter/sec	Inches	DN mm		Spring Return	Non-Spring Return
PICCV-32-018(-P)	18	1.14	1¼	32	200	AFRX24-MFT US	ARX24-MFT
PICCV-32-019(-P)	19	1.20	1¼	32	200		
PICCV-32-020(-P)	20	1.26	1¼	32	200		
PICCV-32-021(-P)	21	1.32	1¼	32	200		
PICCV-32-022(-P)	22	1.39	1¼	32	200		
PICCV-32-023(-P)	23	1.45	1¼	32	200		
PICCV-32-024(-P)	24	1.51	1¼	32	200		
PICCV-32-025(-P)	25	1.58	1¼	32	200		
PICCV-32-026(-P)	26	1.64	1¼	32	200		
PICCV-40-026(-P)	26	1.64	1½	40	200		
PICCV-40-027(-P)	27	1.70	1½	40	200		
PICCV-40-028(-P)	28	1.77	1½	40	200		
PICCV-40-029(-P)	29	1.83	1½	40	200		
PICCV-40-030(-P)	30	1.89	1½	40	200		
PICCV-40-031(-P)	31	1.96	1½	40	200		
PICCV-40-032(-P)	32	2.01	1½	40	200		
PICCV-40-033(-P)	33	2.08	1½	40	200		
PICCV-50-033(-P)	33	2.08	2	50	200		
PICCV-50-034(-P)	34	2.15	2	50	200		
PICCV-50-035(-P)	35	2.21	2	50	200		
PICCV-50-036(-P)	36	2.27	2	50	200		
PICCV-50-037(-P)	37	2.33	2	50	200		
PICCV-50-038(-P)	38	2.40	2	50	200		
PICCV-50-039(-P)	39	2.46	2	50	200		
PICCV-50-040(-P)	40	2.52	2	50	200		
PICCV-50-044(-P)	44	2.78	2	50	200		
PICCV-50-048(-P)	48	3.03	2	50	200		
PICCV-50-052(-P)	52	3.28	2	50	200		
PICCV-50-056(-P)	56	3.53	2	50	200		
PICCV-50-060(-P)	60	3.79	2	50	200		
PICCV-50-065(-P)	65	4.10	2	50	200		
PICCV-50-070(-P)	70	4.42	2	50	200		
PICCV-50-075(-P)	75	4.73	2	50	200		
PICCV-50-080(-P)	80	5.05	2	50	200		
PICCV-50-090(-P)	90	5.68	2	50	200		
PICCV-50-100(-P)	100	6.31	2	50	200		

(-P) optional, ΔP verification across valve using PT ports

# Optimize Your Heat Pump Application

by Using a Pressure Independent Characterized Control Valve

## What are the benefits?

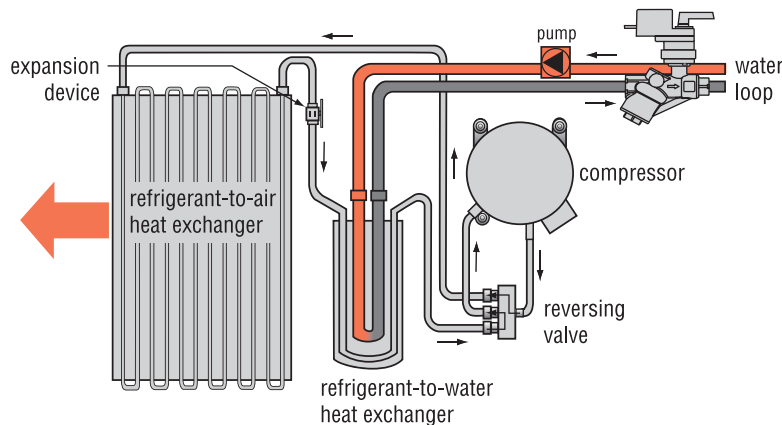
A PICCV dynamically balances a system by responding to changes in differential pressure. The PICCV regulator modulates in response to differential pressures in the system to maintain a constant differential pressure across the ball of the valve. The PICCV will maintain a constant flow at part load and during morning start-up when all loops become critical. With the PICCV, each terminal gets the required flow, no overflow or underflow at this critical time. The PICCV allows a mechanic to easily commission additional circuits after the initial system is up and running, again thanks to dynamic balancing capability. The PICCV is available in flow rates from .5 to 100 GPM. Choosing the right PICCV is as easy as determining the appropriate flow for your heat pump and then choosing the valve that satisfies the flow requirement.

## How does it work?

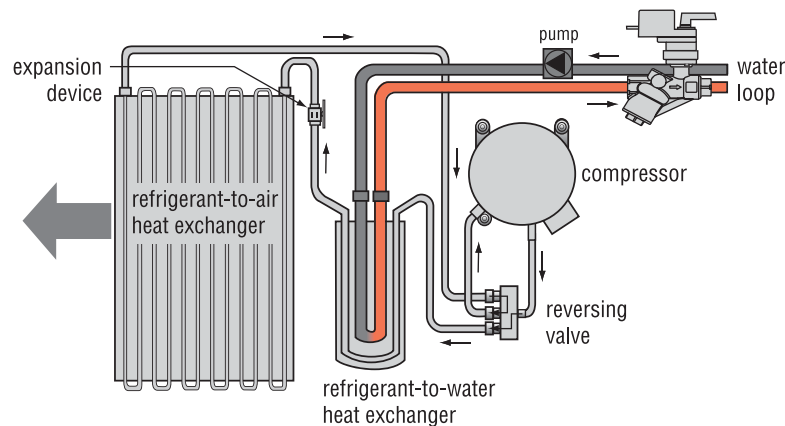
The PICCV is ideally suited to save pumping cost associated with water source heat pumps. The PICCV with On/Off control actuator is used to isolate the zone coil from the main hydronic circuit when the space is not calling for heating or cooling. Hydronic friction is reduced and when the system pump is controlled with a VFD, the flow is matched to the load of the building. This combination of PICCV and VFD saves pumping energy 90% of the time when the building load is less than full.

The PICCV is available with integral -S travel switch models. The switch is wired in series with the compressor enable circuitry to assure water is flowing through the coil before the compressor starts.

## WATER SOURCE HEAT PUMP IN HEATING MODE



## WATER SOURCE HEAT PUMP IN COOLING MODE



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## Instructions for Non-Spring Actuator Utilizing the FlowSetR

### NON-SPRING RETURN ACTUATOR: LRB24-3

#### DEFAULT SET-UP:

#### FlowSetR™

The factory setting corresponds to the ordered flow rate (selected from Belimo's standard product range). The valves factory setting is in open position (valve always closes in CW direction).

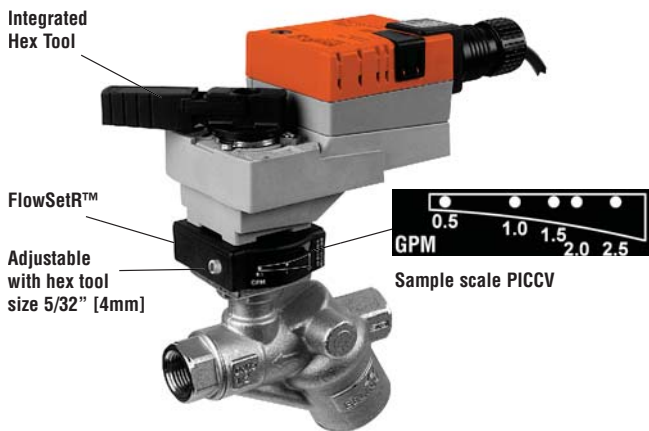
#### To set or adjust desired maximum flow (actuator, FlowSetR™ and valve are connected):

1. Fully close the valve via actuator control signal or via manual override (press button and turn handle in clockwise direction).

**NOTE:** The FlowSetR™ fixed clockwise end stop purposely prevents the actuator from returning to its full zero-degree position, eliminating excess rotation.

2. Use the integrated hex tool in the actuator lever to turn adjustment screw in plus (+) or minus (-) direction in order to move scale indicator to desired flow rate. A standard hex tool (i.e. Allen wrench) size 5/32" or 4mm can also be used to turn adjustment screw.

PICCV flow can be field adjusted by using a hex tool. Therefore, the maximum flow can be increased or decreased within the valves adjustable flow range.



On Floating Point actuators, the running time is constant but dependent on the overall angle of rotation.

**Avoid disconnecting FlowSetR™ from actuator or valve! If necessary, refer to instruction sheet on how to install FlowSetR™ to valve, and actuator to FlowSetR™.**

## Valve Sizing and Selection

### PRESSURE INDEPENDENT, ON/OFF, PROPORTIONAL, FLOATING ACTUATOR

#### REQUIRED INFORMATION

FOR SIZING:  
flow in GPM

FOR SELECTION:  
2-way valves only  
pipe size  
media temperature  
spring return or non-spring return  
required close-off pressure (COP)  
voltage requirement  
ambient temperature  
required accessories

#### EQUATIONS USED

No equations are required. Choose the PICCV that has the closest GPM to the requirement and round up to next available flow.

#### PROCEDURE

- 1) Obtain required GPM
- 2) Choose valve model number that has closest GPM rating (round up)
- 3) Verify that valve size is not larger than pipe size and in general, do not select a valve less than 1/2 of the line size
- 4) Select actuator based upon selection parameters above
- 5) Based upon actuator/valve selection, verify close-off pressure (COP) meets project requirements

#### EXAMPLE OF CV CALCULATION

87 GPM is needed – choose 90 GPM valve PICCV-50-090

**Note:** All MFT actuators have constant running time of 100 seconds. Whether they are set for on/off, floating or proportional control, the running time remains constant.

Floating Point Control with LR...-3, these actuators have a constant running time. The running time is dependent on the model number or FlowSetR™ position as indicated in the table below. Some DDC controllers need an adjustment of the running time, otherwise they lose the position information. In any case, we recommend a position reset once a day.

Valve	Flow Rate (GPM)	Running Time (seconds)
		LRB24-3/LRX120-3
P2050B005	0.5	45
P2050B010	1	61
P2050B015	1.5	73
P2050B020	2	79
P2050B025	2.5	84
P2050B030	3	75
P2050B035	3.5	77
P2050B040	4	79
P2050B045	4.5	81
P2050B050	5	83
P2050B055	5.5	87
P2075B060	6	55
P2075B065	6.5	57
P2075B070	7	59
P2075B075	7.5	61
P2075B080	8	63
P2075B085	8.5	65
P2075B090	9	69
P2075B095	9.5	71
P2075B100	10	81
PICCV-25-011	11	60
PICCV-25-012	12	62
PICCV-25-013	13	64
PICCV-25-014	14	67
PICCV-25-015	15	69
PICCV-25-016	16	86
PICCV-25-017	17	65
PICCV-25-018	18	67
PICCV-25-019	19	78

This document details the flow verification and commissioning procedures for PICCV (pressure independent characterized control valves). The flow verification techniques contained within this document are optional and at the discretion of the Mechanical Engineer/Designer. These procedures are not mandatory to ensure proper operation of PICCV valves. Pressure independent control valves are very different from pressure dependent control valves. Pressure variations in the system will not affect flow through the valve. The ability to adjust and/or control the flow rate which passes through the PI valve is not possible through another mechanical device. Additional mechanical devices should not be used. This makes the TAB/Commissioning process much different than with standard control valves. Pressure independent valves offer numerous maximum design flow values in each valve body size. It is important to note that most pressure independent valves will not travel a full 90 degrees of rotation when commanded to full design flow position. Design flow in a PICCV is adjusted through the maximum angle of ball travel. Therefore, if the valve's maximum flow setting is not at the end of the range, the valve will travel to a point less than 90 degrees. This is normal operation for pressure independent control valves.

**Note to Mechanical Designer/Owner:** It is essential that the mechanical contractor install three (3) independent pressure/temperature ports if the PICCV is not supplied with PT ports or a flow orifice device. Please refer to Figure A contained in this document for PT port locations. PT ports allow for true independent verification of proper PICCV operating parameters. Additionally, the PT ports allow for future comprehensive troubleshooting and diagnosis once the system has been in operation for an extended time period.

For proper and accurate flow verification of the PICCV, it is essential that the mechanical contractor install one additional separate independent pressure/temperature ports (PT) if the PICCV valve body is supplied with integrated ports.

I. PT port #1 and PT port #2 are used for measuring pressure differential across the coil (used to measure water pressure drop to equate to flow or to measure water temperature delta T through the coil).

II. PT port #2 and PT port #3a are used to measure pressure drop across the PICCV (must be between 5-50 psi pressure across valve body). Pressure Independent valve body must have required differential pressure within this range WITH VALVE ASSEMBLY COMMANDED TO DESIGN FLOW. Valve shall be commanded to design flow position via EMS signal. Do not manually open the valve with override handle. This pressure difference across the PICCV is necessary to ensure the valve is working pressure independently.

## Pre Flow Verification System Checklist

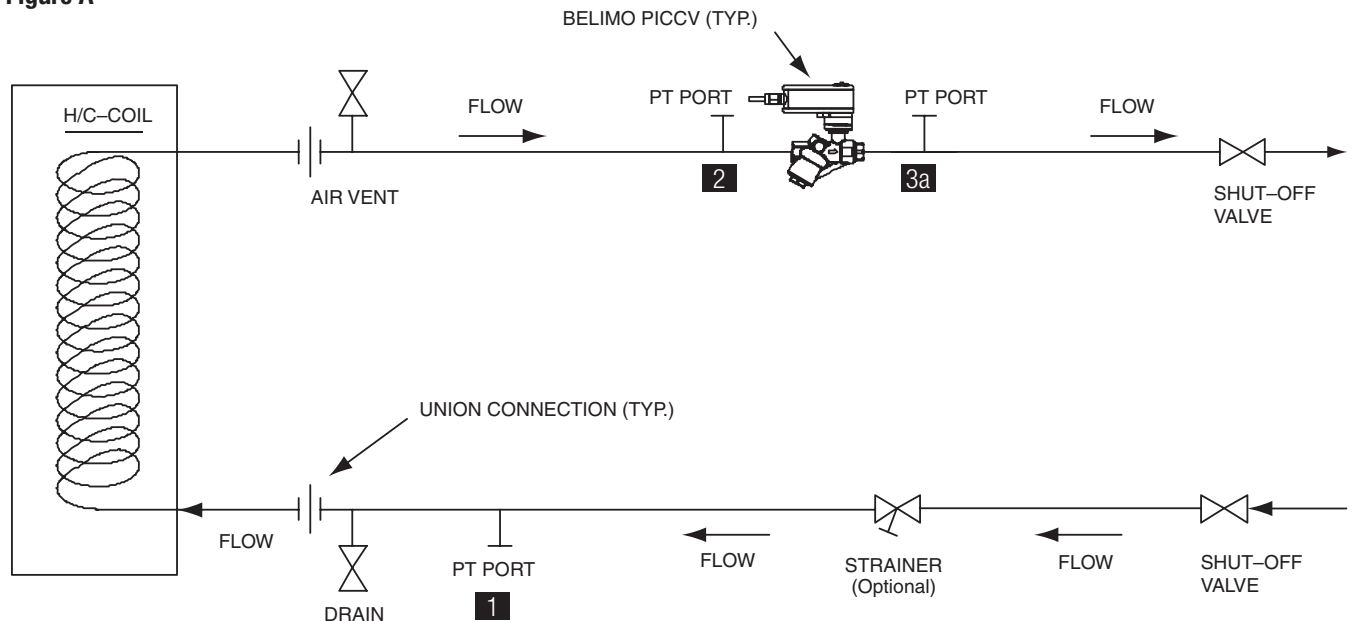
In order to ensure a properly functioning hydronic system utilizing Pressure Independent Characterizing Control Valves, the mechanical contractor and/or T&B professional must verify that the following items have been confirmed before beginning flow verification.

Each flow verification / commissioning procedure presented in this document begins with a reference to the checklist contained below. This serves as a constant reminder to the flow verification professional that these parameters must be met so that proper flow results can be measured / obtained.

\*Items to check before beginning flow verification procedure:

- Verify that System is purged of air and filled to proper pressure.
- Verify that each PICCV valve has at least 5 psi but less than 50 psi dP across the valve (fig. A) by following one of the following two measurement options:
  - Reading taken across PT ports 2 & 3a
  - Reading taken across PT port 2
  - Reading taken across PT ports incorporated on valve body
- Verify Proper pump operation per manufacturers specifications.
- Verify proper supply water temperature is available and is at design temperature.
- Proper Air filter maintenance has been completed.
- Fan belts are in proper working order.
- Heat transfer devices (coils) are clean.
- Strainers are clean.
- All manual shutoff valves are open.
- All bypass valves are closed.
- No automatic or manual balancing valves exist (or if they do, they must be set fully open and locked so as not to interfere with the pressure independency of the PICCV).

**Figure A**



Below are the accepted procedures for verifying/commissioning pressure independent control valves.

## Procedure #1 (System Verification) – Total System Flow Method

### Verification for PICCV Cooling Valves/Heating Valves

1. Verify that System is in proper working order. \*See Items to check before beginning flow verification procedure contained at the beginning of this document.
2. Command open all PICCVs in a given system via the building automation system if the total connected load matches the pump capacity and system diversity = 100%. Systems with less than 100% diversity need to have a % of valves closed to match pump capacity.
3. Ensure that pumps are commanded to 100% speed (or VFD control loop has high enough dP setpoint to satisfy connected load).
4. Verify total system flow is at system design flow rate via accurate method:
  - Calibrated Circuit Setter on main lines
  - Orifice
  - Venturi
  - Ultrasonic Flowmeter
5. Decrease the pump speed (or decrease dP setpoint if under control) until a measureable flow decrease occurs.
6. Increase pump speed (or increase dP setpoint if under control) slowly until design flow is reestablished. Make note of this final measured dP. This will be the correct system dP operating setpoint.

NOTE: If total flow does not match design flow then troubleshooting must be done to determine cause. This may involve verifying flows at the terminal level.

## Procedure #2 (Terminal Level Verification) – Air DeltaT Method

### Verification for PICCV Cooling Valves/Heating Valves

1. Verify that System is in proper working order. \*See Items to check before beginning flow verification procedure contained at the beginning of this document.
2. Ensure that water is at design temperature.
3. Ensure that terminal airflow is at design airflow rate (cfm).
4. Command open pressure independent characterized control valve to maximum design flow position
5. Reference approved engineering document containing design air delta T for heating/cooling coil associated with corresponding pressure independent characterized control valve.
6. Measure coil inlet air temperature and coil discharge air temperature.
7. Difference between coil inlet air reading and coil discharge air reading should equal or exceed design air delta T.

## Procedure #3 (Terminal Level Verification) – Water DeltaT Method

### Verification for PICCV Cooling Valves/Heating Valves

1. Verify that System is in proper working order. \*See Items to check before beginning flow verification procedure contained at the beginning of this document.
2. Ensure that water is at design temperature.
3. Ensure that terminal airflow is at design flow rate (cfm).
4. Command open pressure independent characterized control valve to maximum design flow position.

5. Reference approved engineering document containing design water deltaT for heating/cooling coil associated with corresponding pressure independent characterized control valve.
6. Measure water temperature differential of coil by using PT ports #1 and #2 as referenced in Figure A. PICCV models with factory provided PT ports measure the water temperature differential of the coil.
7. Measured temperature differential should be equal to designed water temperature differential.

## Procedure #4 (Terminal Level Verification) – Coil dP (DeltaP) Method

### Verification for PICCV Cooling Valves and PICCV Heating Valves

1. Verify that System is in proper working order. \*See Items to check before beginning flow verification procedure contained at the beginning of this document.
2. Command open pressure independent characterized control valve to maximum design flow position.
3. Reference approved engineering document containing design coil water pressure drop (usually expressed in ft. of H2O) for design flow. This value will be for the heating/cooling coil associated with corresponding pressure independent characterized control valve.
4. Measure coil dP by using PT ports #1 & #2 as referenced in Fig. A. Adjust the angle of the actuator so the differential pressure across the orifice matches the flow required on the table located on page 3.
5. Formula to calculate flow is:

$$\text{Actual GPM} = \sqrt{\frac{\text{Measured Coil dP}}{\text{Design Coil dP}}} \times \text{Design GPM}$$

Note: Coil dP and Design dP expressed in feet of H2O.

## Procedure #5 (Terminal Level Verification) – Coil Flow for PICCV-F Models with Factory Provided Flow Orifice

1. Verify that System is in proper working order. \*See Items to check before beginning flow verification procedure contained at the beginning of this document.
2. Command open pressure independent characterized control valve to maximum design flow position.
3. Connect differential pressure gauge to the flow orifice device's high and low pressure PT ports. Reference the gauge reading in the field to the provided published chart to determine the flow rate.
4. All PICCV assemblies with flow orifice are motorized with proportional control LRB24-SA or floating point control KRB24-3 actuators. They are shipped from the Belimo factory with default flow setting equal to the maximum Gallons Per Minute (GPM) rating of the valve body. When the coil design GPM is less than the PICCV factory default, the user must manually set the actuator travel limit to match the flow rate of the coil. The travel limit of the LRB24-SA is set with a simple electronic push button and the KRB24-3 is set mechanically with a fine tooth gear travel limit mechanism. The new "field set" PICCV maximum flow rate is validated with the flow orifice methodology.

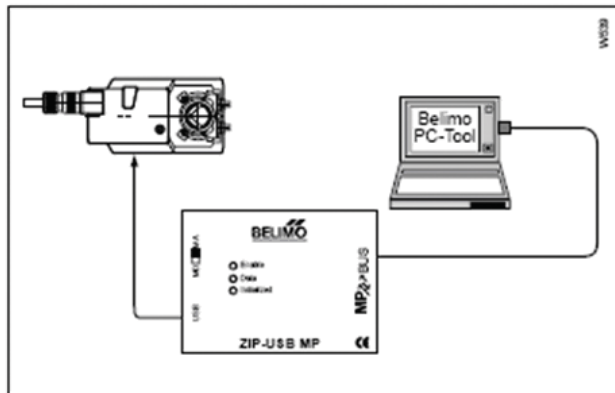


**Field adjustment of maximum flow and /or flow accuracy.**

(This function is not a requirement. This procedure is purely optional and is not a mandatory procedure for proper operation of PICCV valves.)

Flow Accuracy of the PICCV valve body is +/-5%. However, actuator hysteresis and installation can have an effect on measured accuracy of the PICCV assembly (actuator/valve) in the field. The accuracy of the PICCV assembly can be improved in the application.

The maximum flow setting and/or flow accuracy can be adjusted in the field using the Belimo PC-Tool or ZTH-GEN US (shown on next page). Please contact your local Belimo representative to obtain/purchase this tool or arrange to have a Belimo representative visit the project site to make adjustments.



For additional information pertaining to the flow verification and commissioning industry, please visit the website of these organizations that promote the certification and continuing education of industry professionals in the Test and Balance discipline.

NEBB - National Environmental Balancing Bureau, <http://www.nebb.org/>  
 TABB - Testing Adjusting Balancing Bureau, <http://www.tabbcertified.org/>

# Flow Setting and Verification for Field Set Actuators

## KRB24-3, LRB24-SA



### KRB24-3 Field Setting Coil Maximum Flow Procedure

The KRB24-3 actuator factory defaults flow setting is equal to the maximum GPM of the valve body it motorizes. If coil design maximum flow is less than the factory default, follow “field set” procedures below.

To field set or adjust the desired maximum flow:

**Step 1:** With Actuator powered by 24VAC place factory provided magnet on actuator magnetic gear release area to release internal lock mechanism, allowing the indicator wheel to rotate freely. A click will be heard when it is released.



**Step 2:** Access the locking tab by rotating the actuator and associated flow indicator away from the locking tab.



**Step 3:** Using a small flat head screwdriver remove the locking tab by prying out from the bottom. Replace after new position is set according to step 4.



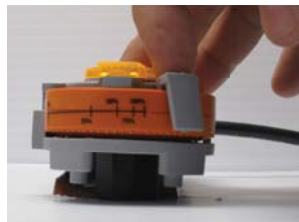
**Step 4a:** Select the valve body and desired flow on the flow table attached to the power cable of the actuator; rotate the flow indicator on the top of the actuator to the desired position on the equal percentage scale. Manually position the actuator travel limit (right side edge with scale facing your view) to equal coil maximum flow.



	25%	50%	100%
P2050B010	0.5	1	1.5
P2050B025	1.5	2.5	3.5
P2050B055	3	5.5	7
P2075B100	7	10	14

**Step 4b:** For –F models with flow orifice manually rotate the actuator until the measured flow matches the coil differential pressure gauge reading (inches w.c.) and flow reference from provided chart below. Manually position the actuators locking tab to make contact with the right side of the travel limit.

**Step 5:** Reattach the locking tab to the actuator by first engaging at the top with a slight approach angle, and then push down to engage the bottom. A click will be heard when the locking tab is fully seated.



**Step 6:** Remove the magnet from the actuator and retain for future use. Replacement magnets are available with part number 10861-0001.

### LRB24-SA Field Setting Coil Maximum Flow Procedure

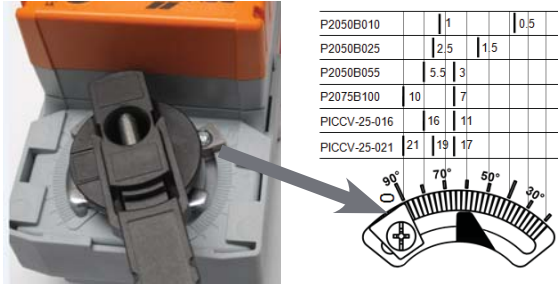
The LRB24-SA actuator factory defaults flow setting is equal to the maximum GPM of the valve body it motorizes. If coil design maximum flow is less than the factory default, follow “field set” procedures below.

To set or adjust the desired maximum flow:

**Step 1:** With the actuator powered by 24VAC depress the black gear release mechanism on the actuator and press down until the locking tab engages to the side of the actuator. If done correctly a click will be heard and gear release will stay depressed.



**Step 2:** Select the valve body and desired flow on the flow table attached to the power cable of the actuator, rotate the actuator to the desired position to the maximum coil flow.



**Step 3a:** With the desired flow achieved press the translucent button for 3 seconds with tool (e.g. pen tip) to load the position setting in the actuator. The translucent button will glow yellow when the position setting is loaded in the actuator. (Note: During normal operation the translucent button will only be illuminated when the actuator handle is throttled to the field set maximum flow setting.)



### Field Set Flow Verification Procedure with LRB24-SA and KRB24-3 actuators – tools and chart

- Belimo provided flow orifice has two pressure ports for field Delta P measurement with a manometer gauge.
- Connect monometer high pressure line to flow orifice red PT port; connect low pressure line to green PT port. Follow gauge instructions to verify connections.
- Take  $\Delta P$  reading in inches of water (w.c.) and transpose to the PICCV line of the Flow Chart. From that point follow the corresponding chart line to the flow scale and determine the actual flow.



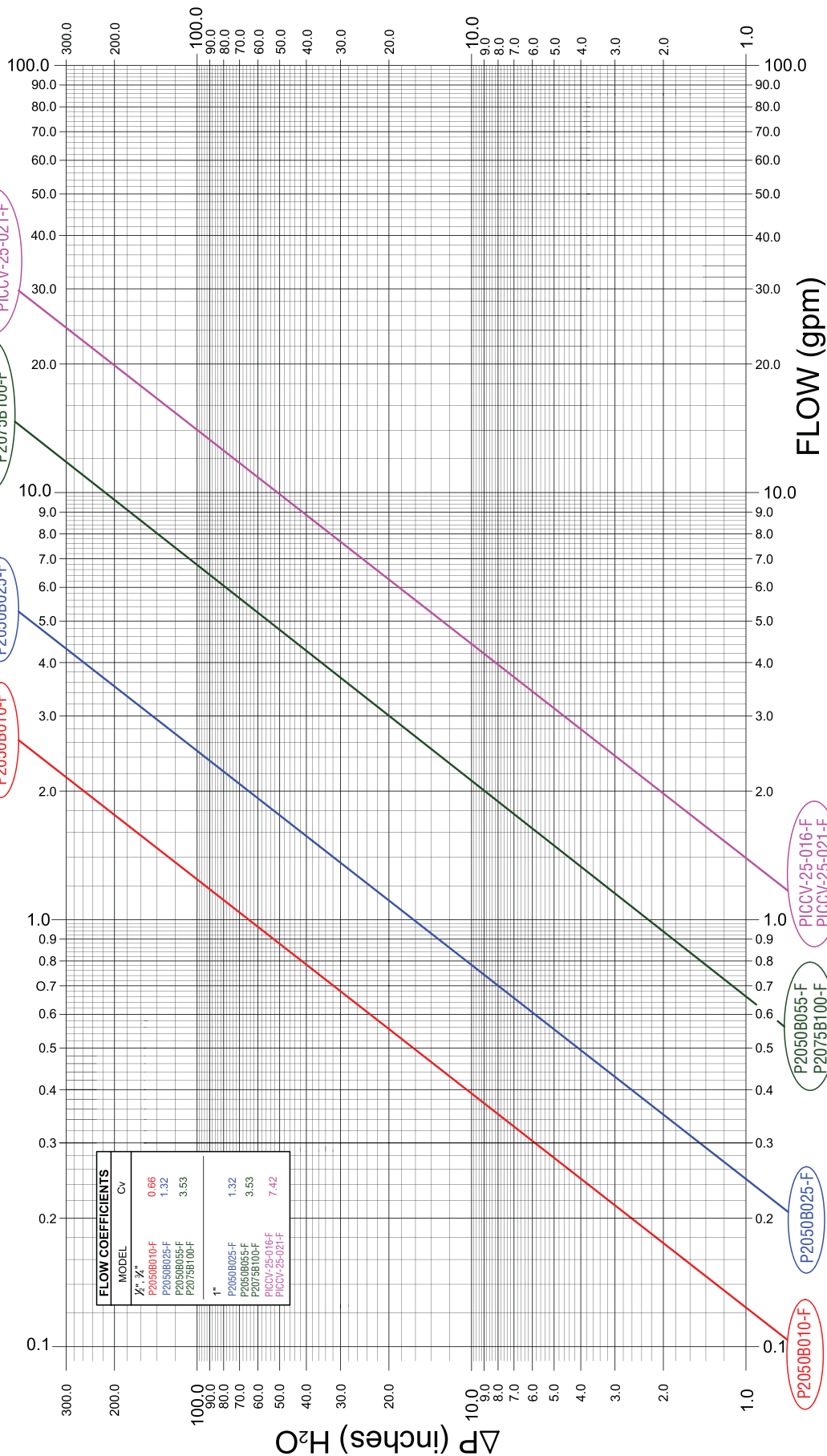
**Step 3b:** For –F models with flow orifice manually rotate the actuator until the measured flow matches the coil differential pressure gauge reading (inches w.c.) and flow reference from provided chart. With the desired flow achieved press the translucent button for 3 seconds with tool (e.g. pen tip) to load the position setting in the actuator. The translucent button will glow yellow when the position setting is loaded in the actuator. (Note: During normal operation the translucent button will only be illuminated when the actuator handle is throttled to the field set maximum flow setting.)

**Step 4:** Depress the black gear release mechanism on the side of the actuator to release locking tab.



# Flow Chart

Meter Readings, Water @ 70°F / 21°C



- How to Determine Flow:**
1. Enter the chart with the  $\Delta P$  (differential pressure) reading.
  2. Go horizontally across to the size of the valve.
  3. Go vertically up or down to read the GPM (flow).

**Temperature Correction Factor:**  
 155°F / 68°C = 1.01 x GPM  
 205°F / 96°C = 1.02 x GPM

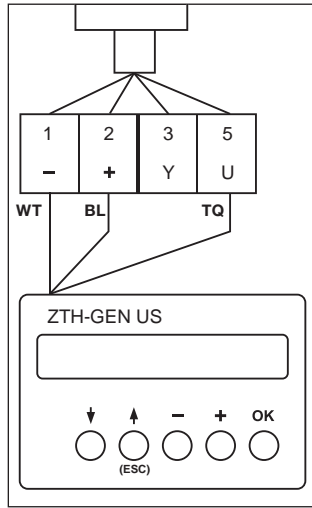
**For Exact GPM or  $\Delta P$**   
 $GPM = \sqrt{\Delta P \times (Cv / 5.3)}$   
 $\Delta P = (GPM \times 5.3 / Cv)^2$

The ZTH-GEN US is a tool created to easily adapt the flow settings for the PICCV in the field. It directly connects to the Belimo actuator.



**IMPORTANT:**

There are two ways to connect the tool to the actuators



**LR, AR, GM Series**

Use the interface on the top of the actuator. (Leave all of the wires of the actuator installed.)

**TFRX, LF, AFRX Series**

Connect to the installed wires of the actuator.



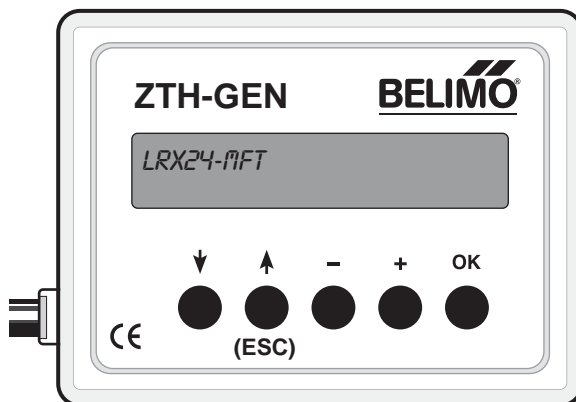
**Technical Information**

Supply	24 VAC/DC
Communication	PP
Used with actuator types	LRX24-MFT TFRX24-MFT LF24-MFT US ARX24-MFT AFRX24-MFT GMX24-MFT

**RE-PROGRAMMING PROCESS:**

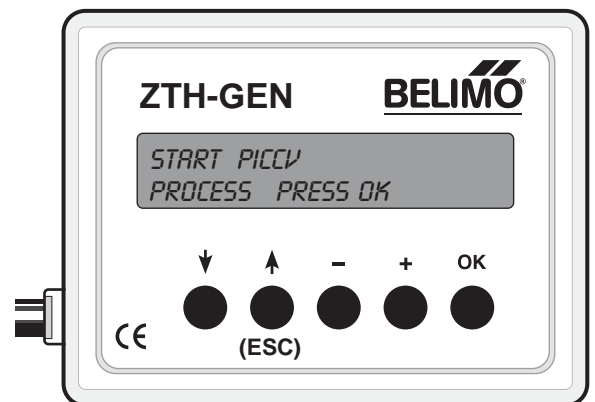
**Step 1**

Connect cable to actuator port, twist to lock in place (or wire as above). Will display actuator for 5 seconds – note this and compare to actuator being connected.



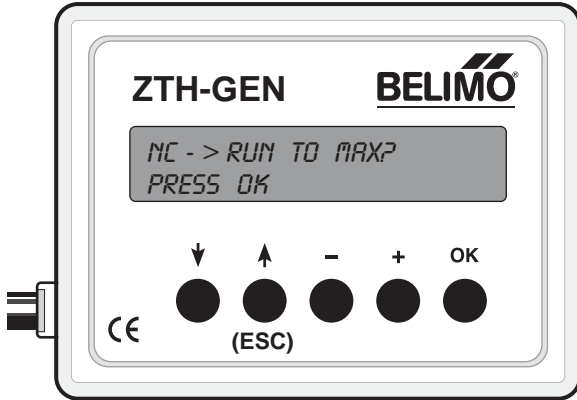
**Step 2**

**Start PICCV PROCESS press OK** will be displayed. Press OK.



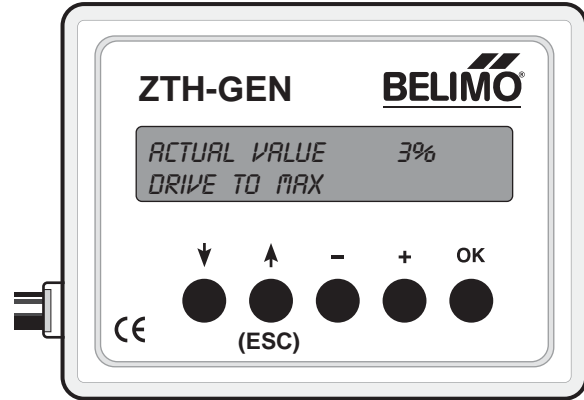
**Step 3**

**NC (or NO) – run to MAX?** Press OK will be displayed. Press OK.  
**NOTE:** if you need to change the NO/NC action for the actuator, then you must use the PC-Tool. Changing the switch will not accomplish this. Do not change the Y1/Y2 switch.



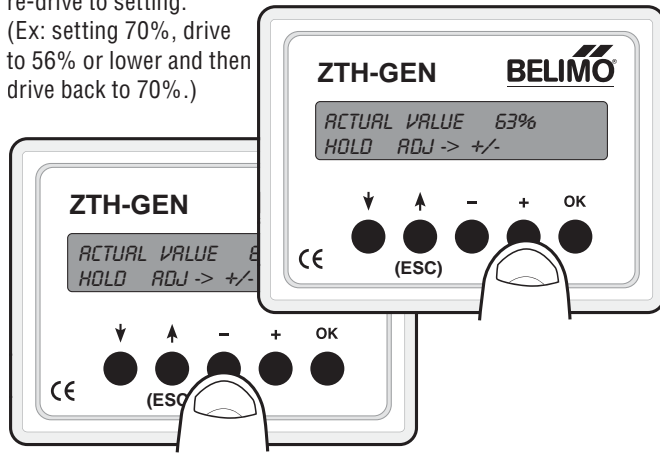
**Step 4**

Actuator will drive to current setting (MAX for NC, Min for NO). When it stops, adjust using + and – buttons. As it is running, it will show actual value as the actuator moves.



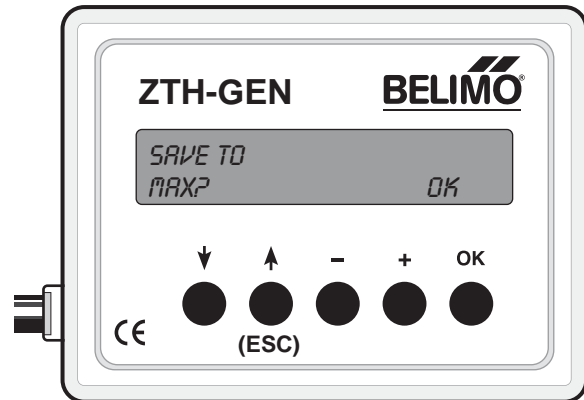
**Step 5**

HOLD DOWN the – or + button down to adjust setting. If you disengage the button, then the word “stop” appears and will change to “hold”. When setting is changed as needed, press OK.  
To re-test flow, drive actuator to 80% of current setting and then re-drive to setting.  
(Ex: setting 70%, drive to 56% or lower and then drive back to 70%.)



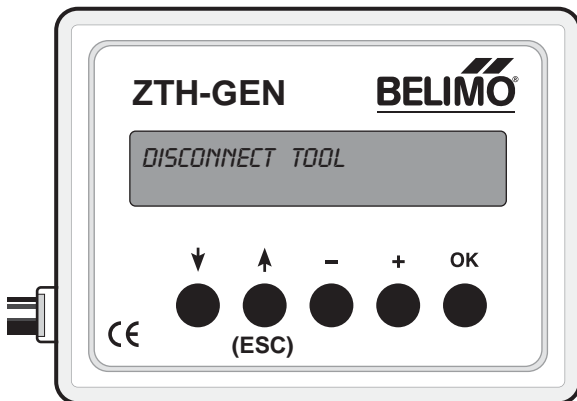
**Step 6**

Display will state – **SAVE to MAX** (if NC) or **SAVE to MIN** (if NO). Press OK.



**Step 7**

Disconnect tool by twisting and re-cover connection port (or un-wire actuator). You do not need to wait until actuator stops running to disconnect.



**Advanced Mode**

- Enter the configuration menu by pressing “OK” (hold button) while connecting the ZTH-GEN US to the actuator.
- Step through with arrow key to “Advanced Mode” menu
- Change mode from 0 to 1
- Unplug the ZTH-GEN US
- With advanced mode, change runtime, control signal (2-10 VDC, 0-10 VDC).