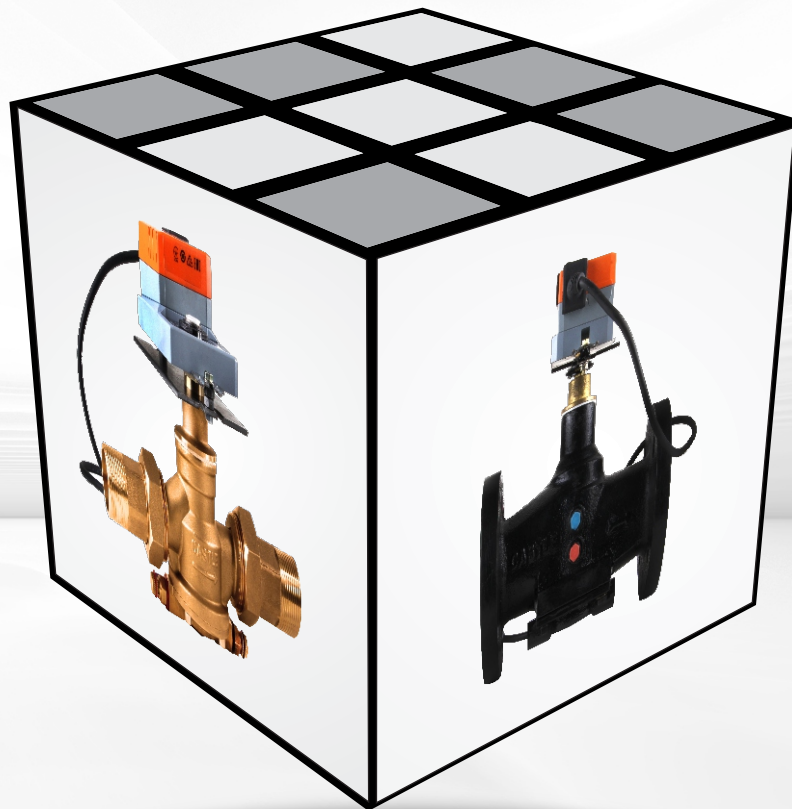


CASTLE

PRESSURE INDEPENDENT CONTROL VALVES



**MORE THAN
25 YEARS**



CASTLE PRESSURE INDEPENDENT CONTROL VALVE

Castle Pressure Independent Control Valve is a multifunctional valve as it is used in heating and chilled water systems to control and regulate the flow. It is also a differential pressure control valve. This implies that the PICV acts as a replacement to three different valves that is a two-way valve, a balancing valve and a valve to control differential pressure.

WHY PICV?

A balanced system is a necessity for saving on energy costs and material costs in a chilled water system. For a manual-balancing valve, it requires to be balanced and for that it requires to manually balance each valve and thus is a time-consuming job. On the other hand, the PICV responds to the changes in pressure that results in maintaining the desired flow. Being a multifunctional valve, it reduces the number of valves purchased by the consumer. The overall cost of the system is reduced as the piping size required is smaller and they eliminate the requirement of the complexed return piping. Thus, the PICV results in reduction in energy consumption and saves costs as well.

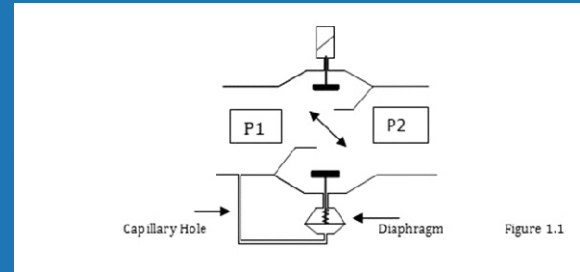


The Castle PICV goes beyond simple shutoff or isolation (on/off) and actually allows precise control of the flow rate. The actuators on these valves use feedback and control signals to accurately open and close the valve according to the flow requirement. A control signal is sent from thermostat to the actuator to instruct it on how far to raise or turn the stem. The control signal may be in the form of electrical voltage. A 0-10 VDC electric signal will cause the actuator to completely closed the valve at 0 VDC, 2-8VDC for intermediate positions and completely open it at 10 VDC.

How Does the Castle PICV Work?

Differential Pressure Control

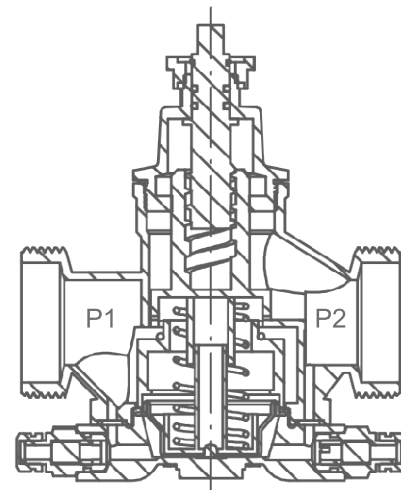
PICV are used to address the inevitable pressure fluctuations in hydronic systems. As the flow rates in the distribution pipework fluctuate to match demand, the available pressure at individual terminal units varies. This variation in available pressure has the effect of changing the flow rate through the terminal sub-circuit, i.e. an increase in pressure gives an increased flow rate. To negate these fluctuating pressures, the PICV maintains a constant pressure drop across its seat P1 to P2, therefore maintaining a constant flow rate to the terminal.



FLOW REGULATION

The diaphragm reacts to the system & regulates the pressure differential across the actuated control valve orifice to maintain its flow rate. The diaphragm acts against a spring in order to balance the pressure control and stop the diaphragm oscillating.

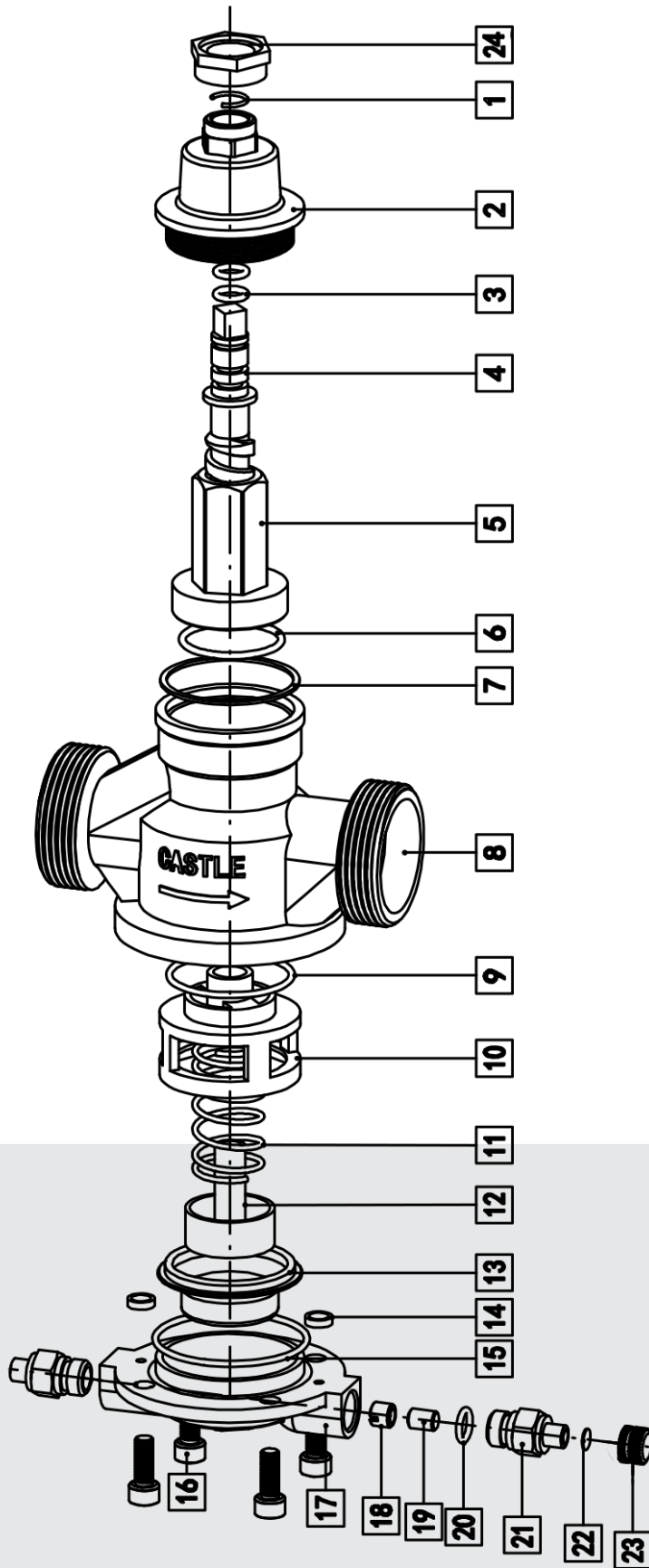
As long as the pressure differential across the valve is within the operating range, the Kv of the valve is variable, being continuously regulated to keep the control valve in constant authority.



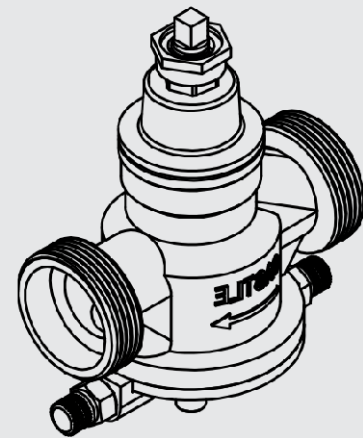
PRE-SETTING

Castle PICV offers flow rate pre-setting of the maximum flow. Castle introduces pre-setting of the actuator by using the auto-recognition stroke feature, requiring only a simple mechanical stop giving a guaranteed maximum flow as per the requirement of design flow, remaining valve travel will be used for modulating control. Since PICV are equal percentage valves with near 100% control authority, limiting the valve opening on the actuator is simplest & assured method of adjusting the valve to maximum flow requirement. The conventional method of pre-setting the valves with a screw or with the help of dial or other methods exerts undue pressure on the diaphragm and its springs, which reduces the life of the components. This method has no impact on any of the internal parts.

GENERAL ASSEMBLY DRAWING



S.No	Part Name	Material	Quantity
1	Lock Ring	AISI 304	1
2	Bonnet	Forged Brass	1
3	O-ring	Nitrile	2
4	Stem	Forged Brass	1
5	Cartridge	Forged Brass	1
6	O-ring	Nitrile	1
7	Valve Seat	PTFE	1
8	Body	Forged Brass	1
9	Seal	Nitrile	1
10	Filter Cartridge	AISI 304	1
11	Spring	AISI 304	1
12	Spring Holder	Poly Amide	1
13	Diaphragm	Nitrile	1
14	O-ring	Nitrile	2
15	O-ring	Nitrile	1
16	Bolt	AISI 304	4
17	Bottom Plate	Forged Brass	1
18	Bush	Forged Brass	2
19	Rubber Bush	Nitrile	2
20	O-ring	Nitrile	2
21	Nozzle	Forged Brass	2
22	O-ring	Nitrile	2
23	Nozzle Cap	Forged Brass	2
24	Actuator Cap	Forged Brass	1



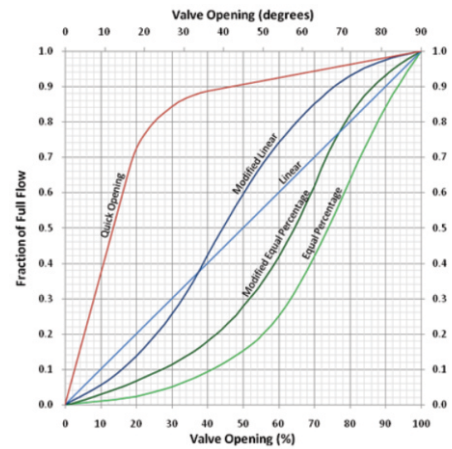
TECHNICAL DATA

Size	DN	25	32	40	50	65	80	100	125	150
Flow Rate	m ³ /hr	0.3-1.6	0.7-3.1	1.0-7.7	2.0-12.1	3.0-20.4	13.7-35	18-47	15-70.7	20-101.8
Differential Pressure Range	kPa	25-400		30-600						40-700
Maximum Close Off Pressure	6-7 bar									
Body MOC	Brass Forged				Cast Iron					
End Connection	Screwed End, Union Type				Double Flanged Connection					
Pressure Rating	PN 16									
Control Characteristic	Linear flow (may be converted to equal %, linear rotation or linear signal on actuator)									
Control Range	1:1000 / IEC 60534									
Body Taps	1/4" ISO									
Duty	Chilled water/ hot water/ condenser water									

VALVE AUTHORITY

The Castle PICV is a 100% authority valve that instantaneously self balances at every point while operating even when there is inconsistency in differential pressure. Till the time the differential pressure across the valve is in the operational range, the K value of the valve is controlled non-stop to ensure that the valve is under full authority.

Valve Authority ensures a linear curve for the Percentage Flow Rate v/s Percentage Flow Opening. 100% Valve Authority is the main purpose of the PICV as this 100% Valve Authority is the reason for its superiority over equal percentage valves.

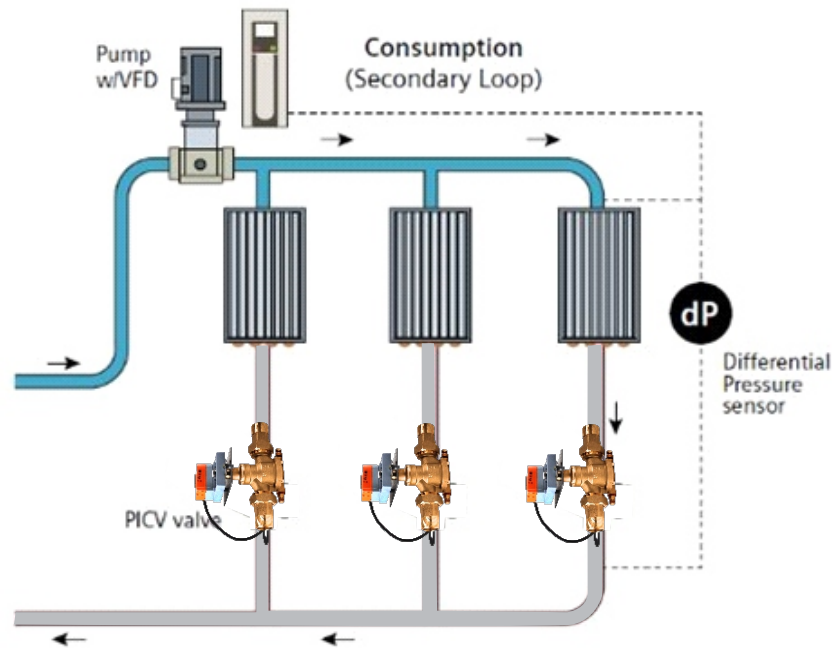


MATERIAL SPECIFICATIONS:

S.No	Description	Material of Construction	
		25mm to 40mm	50mm to 150mm
1.	Body	Forged Brass to IS 6912 Gr. FLB	Cast Iron IS : 210 FG: 260
2.	Bonnet	Forged Brass to IS 6912 Gr. FLB	Cast Iron IS : 210 FG: 260
3.	Spindle	Forged Brass to IS 6912 GrFLB	AISI 410
4.	O-rings	Nitrile rubber	Nitrile rubber
5.	Seal	PTFE	Nitrile rubber
6.	Cartridge	AISI 304	AISI 304
7.	Springs	AISI 304	AISI 304
8.	Diaphragm	Nitrile Rubber	Nitrile Rubber
9.	Nozzles	Forged Brass	Forged Brass

THE HYDRONIC SYSTEM: DIFFERENTIAL PRESSURE CONTROL

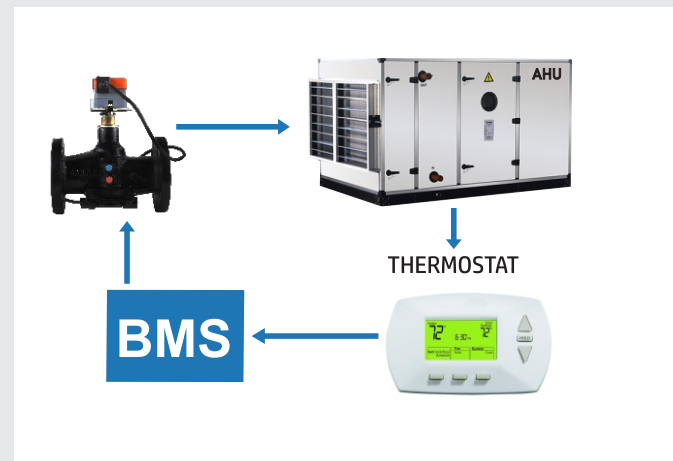
As Hydronic systems continue to evolve from constant volume systems to constant volume primary, variable volume secondary, to variable primary systems it is important to ensure we maintain flow across all of our heat transfer circuits. Since a VFD is connected to either the primary pumps or secondary pumps in variable hydronic flow systems, the control loop will need an input to monitor and control. A differential pressure sensor located on the circuit most likely to be starved, also known as the critical circuit, is a common and reliable input configuration. The differential pressure sensor will allow the hydronic system to set a minimum pressure across the critical circuit ensuring flow availability across all circuits. The pump and variable frequency drive will take the differential pressure measurement across the critical circuit and control via the VFD's onboard proportional-integral-derivative (PID) controller, allowing the pump speed to be optimally reduced and energy savings maximized.



Variable Flow secondary with PICVs

COMFORT CONTROL

The use of a PICV, as with all 2 port control valves, allows for the variation of the flow rate to vary the chilled water output of the terminal unit. The PICV is an integral part of the control loop. Thermostat, BMS, PICV & terminal unit. By varying the flow rate we can control the chilled water output of the terminal. For PICVs with an equal percentage characteristic, there is a direct relationship between valve position and flow output, i.e. half open = half flow output.



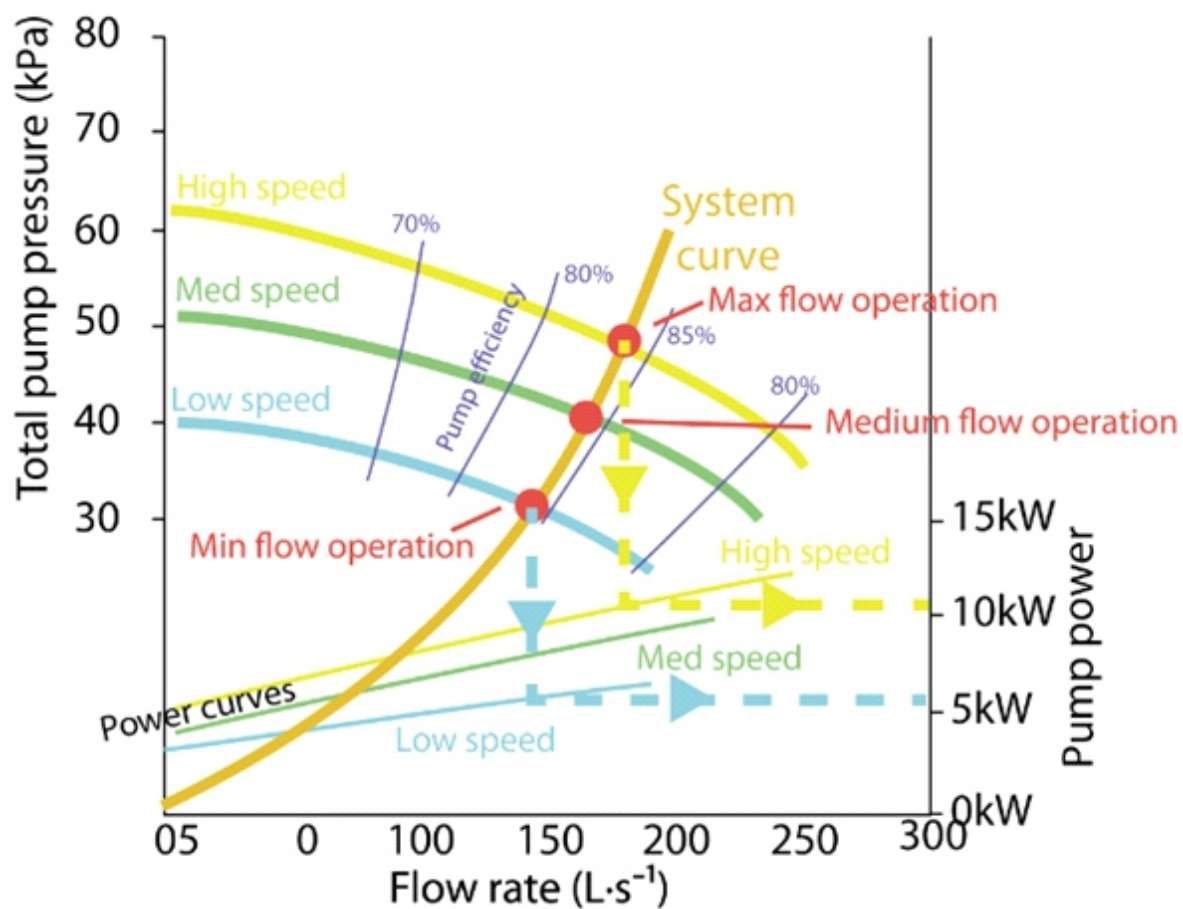
Hydronic flow optimization

Whether used separately or in combination, PICVs and VFDs contribute to a high level of hydronic flow optimization:

- PICVs combine the functions of a control valve, automatic pressure regulator, and flow limiter ensuring the flow changes only when and where you want it to change, as well as simplifying the basic hydronic system.
- VFDs reduce pump speed to optimize flow and lower energy consumption. Together they optimize hydronic flow, maximize energy savings and provide comfort throughout the building.

The nonlinear relationship between power and speed can be exploited for significant energy savings if the speed of the motor can be changed.

The example pump performance, as shown in Figure 1, indicates a system where – as the system requires less flow – the pump speed can be gradually reduced to provide the operating points. Three example operating points are shown at nominal maximum, medium and low speeds. Pump power is clearly significantly lower as the flow reduces.



CASTLE PICV SILENT FEATURES

Pressure independent sizing	Eliminates need for calculating Cv using flow and pressure drop.	Simplified valve sizing.
Mechanism for maximum flow setting is independent of valve stroke (Pre-setting)	Requiring only a simple mechanical stop on the actuator giving a guaranteed maximum flow.	Greater control resolution and precision. Excellent control accuracy. Remaining valve travel will be used for modulating control.
Stroke valve design	Linear valve shaft, higher stroke length always maintains maximum valve authority.	Greater control over the whole stroke of the valve and actuator.
Automatic pressure regulator	Automatic balancing and pressure	Make this ideal for retrofit projects.
	Maintains constant flow through the valve at any given control setting regardless of the pressure fluctuations in the system.	Easier balancing and shorter commissioning times. Commissioning cost savings.
	Avoid over- and under-flow.	Greater comfort due to better control.
Close-Off Pressure	PICV acts as control and shut off valve with close off pressure 100PSI.	Valve that holds pressure, give more energy saving.
Nozzles / Test points	Measure differential pressure across the device.	Easily validate that the device is operating in the design range for pressure independent functionality.
Proven Actuators	Familiar, rugged and reliable belimo actuators from Switzerland are used.	Ensure highest levels of customer satisfaction as they have service centers all over the world.
Experienced valves manufacturer	Castle Valves has more than 25 yrs of experience in manufacturing balancing Valves and water balancing in HVAC.	Gives the best combination of Castle Valve & Belimo Actuator.
Easy and economical maintenance	Castle is the only manufacture of PICV in India, all other companies imports complete Chinese valves.	Easy replacement of the parts of PICV, no need to change the complete valve during maintenance.

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