



FLUID SYSTEMS

TERMINAL
UNIT
RANGE

PRESSURE INDEPENDENT CONTROL VALVES

EXCELLENCE IN ENERGY EFFICIENCY



OUR GENIUS IS VALVES

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PRESSURE INDEPENDENT CONTROL VALVES

In modern Building Services projects, the desire for energy efficiency is a primary consideration for designers, installers, manufacturers, and end users.

HVAC systems offer an excellent opportunity for energy savings if the correct products are specified, selected and installed and the use of these products is clearly understood.

For installations incorporating fan coil units (FCU) or chilled beams, the Crane PICV offers an excellent solution for control of water flow rates, and therefore comfort control and energy savings when used as part of a variable volume system design.

For the installer, we offer a range of solutions which are easy to select, install and commission.

Why choose the Crane D991 PICV?

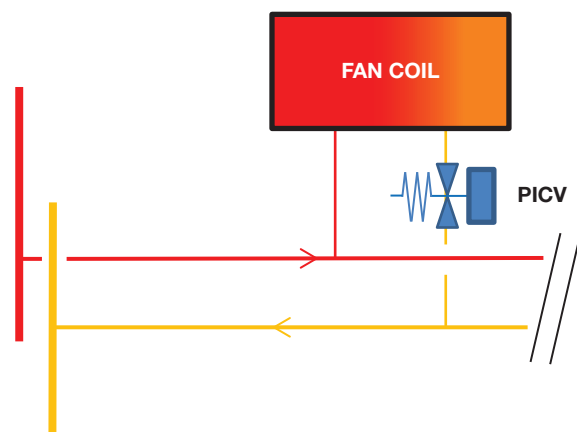
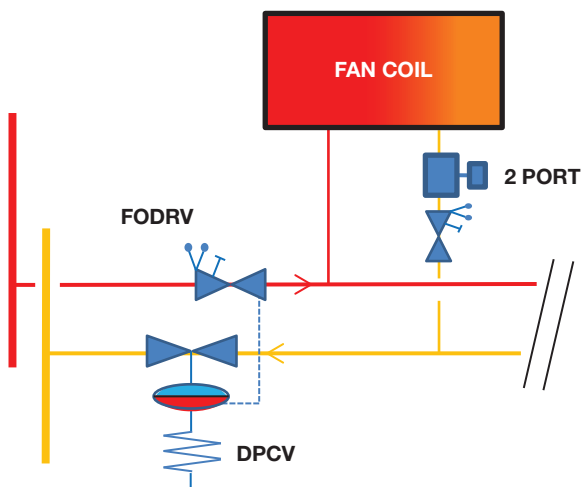
Variable speed pumps allow the flow rate in the system to fluctuate in response to system demand, by responding to information from the BMS system, which gathers information from thermostats and pressure sensors.

For a traditional variable volume system to work efficiently:

- 1. DPCVs (Differential Pressure Control Valves)** - remove fluctuating system pressures.
- 2. Flow Regulation valves** - enable system balancing.
- 3. Comfort Control using 2 Port Control Valves** - react to room thermostats.

The Crane D991 PICV combines the functions of the DPCV, Flow regulation, and 2 Port Control valves, into a single valve which:

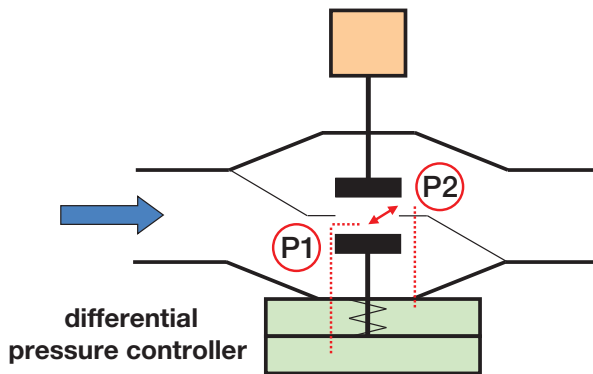
- Reduces the number of valves
- Reduces installation time
- Reduces number of joints / potential leaks
- Simplifies selection
- Simplifies Commissioning



1. Differential Pressure Control

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.

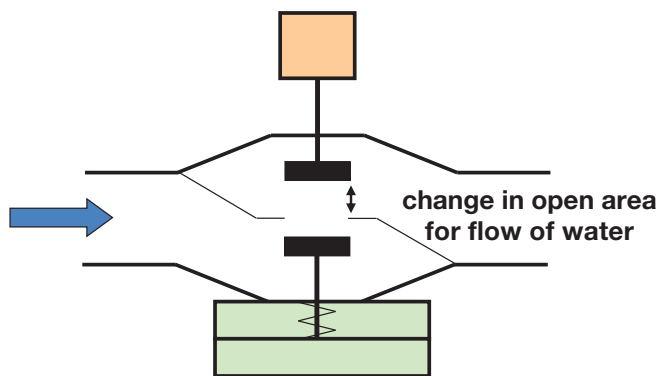
To negate these fluctuating pressures, the PICV maintains a constant pressure drop across its seat P1 to P2, therefore maintaining a constant flow rate to the terminal.



2. Flow regulation

By changing the open space through which the water flows within the valve, the flow rate can be adjusted and set.

The pressure across the seat of the PICV is held constant by the differential pressure controller. Whilst setting, the open area around the disk will change resulting in a change to the flow rate. The new set flow rate recreates the constant seat differential pressure P1 to P2. Having set a new flow rate, it will stay constant at the new set value.

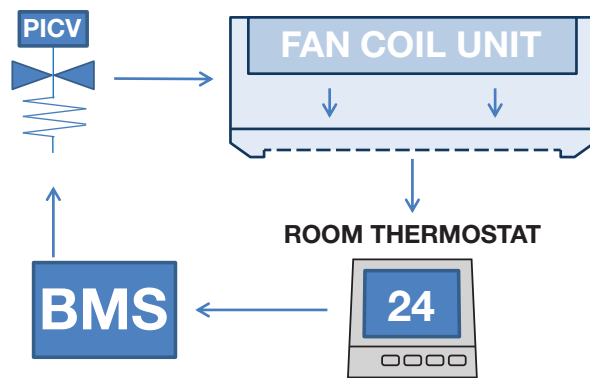


3. Comfort Control

The use of a PICV, as with all 2 port control valves, allows for the variation of the flow rate to vary the heat 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 heat output of the terminal. For PICVs with an equal percentage characteristic, (see page 5) there is a direct relationship between valve position and heat output, i.e. half open = half heat output.



Features & Benefits

Maintains a constant flow up to 350 kPa differential pressure

Simple setting of flow rate

Integral test points for verification of differential pressure

DZR Brass construction

Compact Design

Can be used as a constant flow regulator

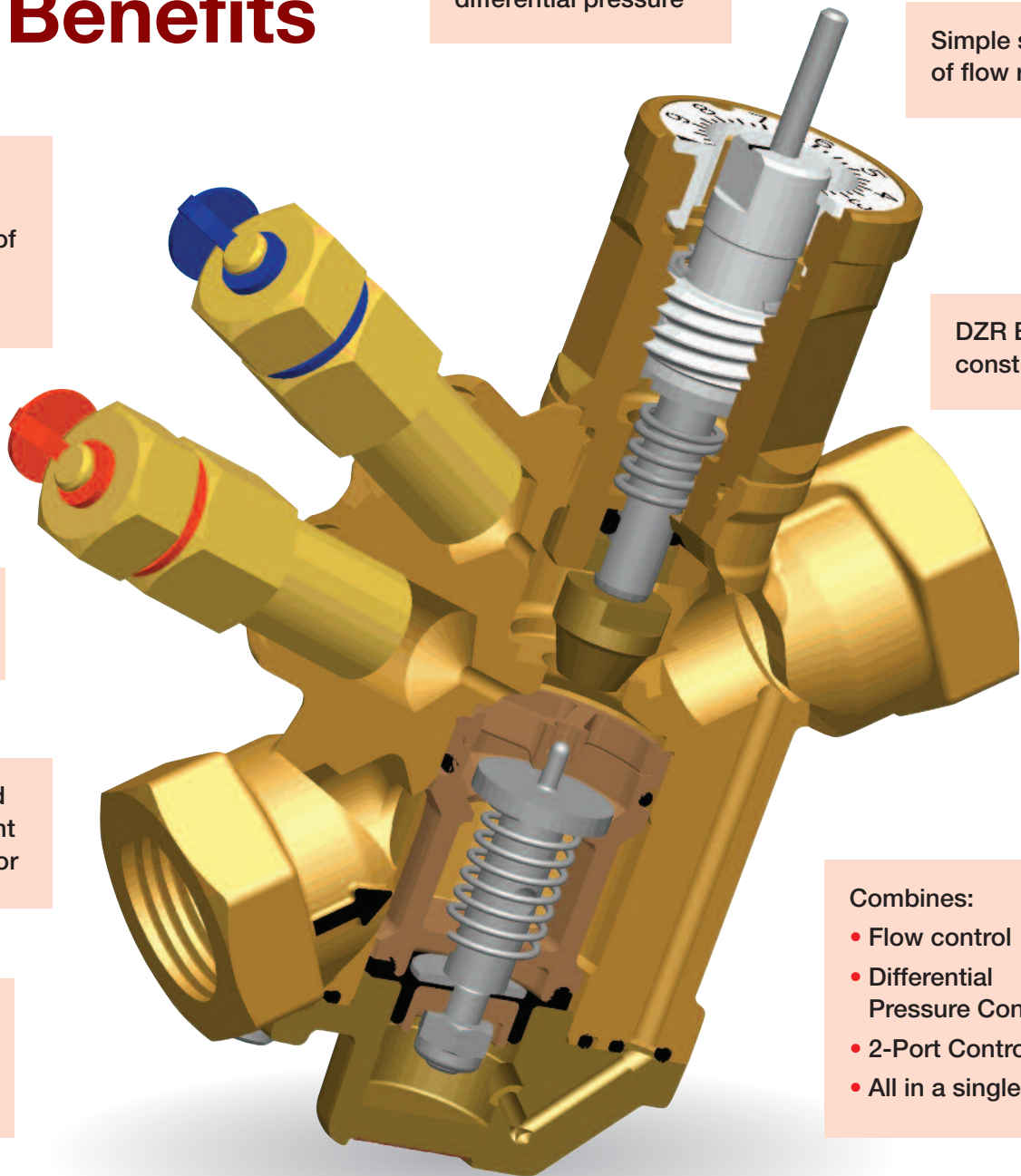
Combines:

- Flow control
- Differential Pressure Control
- 2-Port Control
- All in a single unit

Made in



the UK



Options



Stand Alone



Dominator with PICV



Dominator Mini with PICV for direct mounting on FCU

PICV

Performance Characteristics

Equal percentage characteristic (= %)

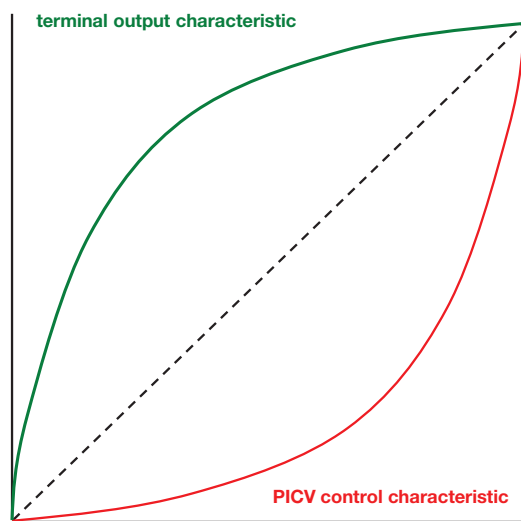
The Crane D991 PICV / actuator combination, has an equal percentage control characteristic at all pre-set flow rate positions and under all part load conditions, maximising energy saving and effective room temperature control.

The control characteristic of a PICV is the relationship between flow rate and open position. When considering PICVs, the combined PICV and matched actuator must be considered.

For terminal units using 'forced air', typically FCUs and active chilled beams, an equal percentage control characteristic is considered to be the best solution to maximise energy saving.

For the PICV to achieve good modulating control over the flow rate, and subsequently the heat output from the terminal, the control characteristic should be a 'mirror image' of the heat output characteristic of the terminal unit. An equal percentage characteristic does this.

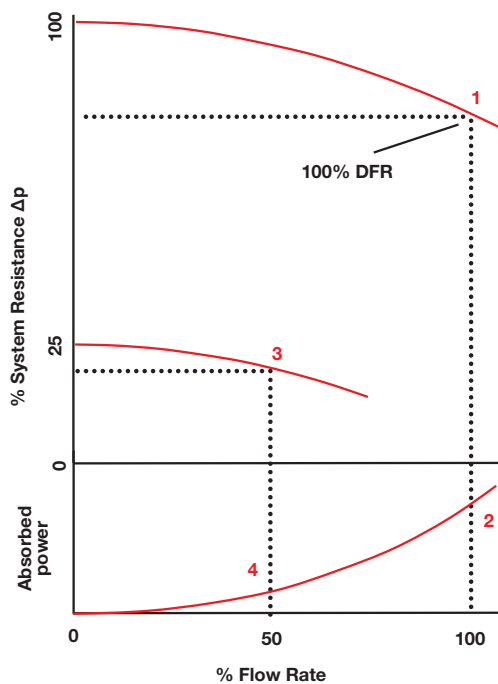
The equal percentage characteristic establishes the relationship between terminal unit heat output and valve open position, i.e. 50% valve open position produces 50% heat output from the terminal, whereas the flow rate may only be 30% of full design flow rate.



Maximising Energy Savings

To maximise energy saving the pump should be set to run at a speed to ensure sufficient pressure is available across the least favoured (index) PICV. Any additional pump pressure available at the least favoured PICV will be absorbed by the PICV, therefore is excess for the PICV to control.

- As system demand changes, required flow rate changes.
- Direct relationship between pump speed and flow rate.
- 50% Pump speed = 50% Flow rate
- Direct relationship between pump speed and power absorbed.
- 50% Pump speed = 12.5% Power absorbed.
- Using variable speed pumps allows flow rate to match system requirements, and maximise energy savings.



1. 100% flow rate
2. 100% absorbed power
3. 50% flow rate
4. 50% absorbed power

PICV

Actuator Options

Electro-Mechanical Actuators – Modulating

Forced convection (active) terminal units, i.e. FCU (Fan Coil Units) and active Chilled Beams are designed to be very responsive to changes in room temperature.

Modulating actuators enable flow rate changes, and consequently heat output changes, to quickly match demand requirements, therefore, modulating actuators should be chosen for forced convection terminal units.

Modulating actuators allow all intermediate flow rates between full flow and no flow.



Thermal Actuators – On/Off

Natural convection (passive) terminal units, i.e. passive Chilled Beams and underfloor heating are designed to be less responsive to changes in room temperature than forced convection terminal units.

Therefore, thermal on/off actuators should be chosen for natural convection terminal units.

On/off actuators only allow for full flow or no flow.



APPLICATION	FIG NO.	PART NO	FUNCTION	VOLTAGE	CABLE LENGTH	IP RATING
Fan Coil Unit	ACT991M	0EA08732W	Modulating	24VAC/DC (0-10V Control Signal)	1.5m	IP43
Active Chilled Beams						
Passive Chilled Beams	ACT991TH	0EA08733X	On/Off (Normally Closed)	24VAC/DC	2.0m	IP54

PICV

Selection & Setting of Valves

Differential Pressure Requirements

Each valve size (DN 15-25) at each % setting option requires a specific Δp (Differential pressure) to ensure the PICV is within its working range;

PICV Fig No. D991

DN15 LF			DN15 STD FLOW			DN20			DN25		
POS	Δp	FLOW	POS	Δp	FLOW	POS	Δp	FLOW	POS	Δp	FLOW
2	15	0.008	2	15	0.040	2	15	0.056	2	20	0.096
3	15	0.017	3	15	0.060	3	20	0.084	3	20	0.144
4	15	0.026	4	20	0.080	4	20	0.112	4	20	0.192
5	15	0.035	5	20	0.100	5	20	0.140	5	20	0.240
6	20	0.044	6	20	0.120	6	25	0.168	6	20	0.288
7	20	0.053	7	20	0.140	7	25	0.196	7	20	0.336
8	20	0.062	8	25	0.160	8	25	0.224	8	25	0.384
9	20	0.071	9	25	0.180	9	25	0.252	9	25	0.432
10	20	0.080	10	25	0.200	10	25	0.280	10	25	0.480

Flow rates in l/sec. Intermediate flow rates / set positions can be extrapolated. Δp is total loss across valve

Example Selection

Flow rate required: 0.04 l/sec

Selection could be either: DN15 Low Flow - Setting 6 or DN15 Standard Flow - Setting 2.

Recommended selection is: DN15 Low Flow - Setting 6.

Where a choice of valves is available for any required flow rate, use smallest valve at higher setting.

Setting

Fit setting key and turn clockwise to ensure that valve is fully closed.

Turn setting key anti-clockwise and line up arrow on key to required position; 6 on dial as example.

Remove key. The valve is now set, and ready for the actuator to be fitted.



D991

Pressure Independent Control Valve - PN16

Features & Benefits

- Maintains equal percentage control characteristic at all flow rate settings
- Pressure independent control of flow
- Simple flow rate setting
- Adjustable over wide range of flow rates
- Compact design
- Integral test points for Dp verification

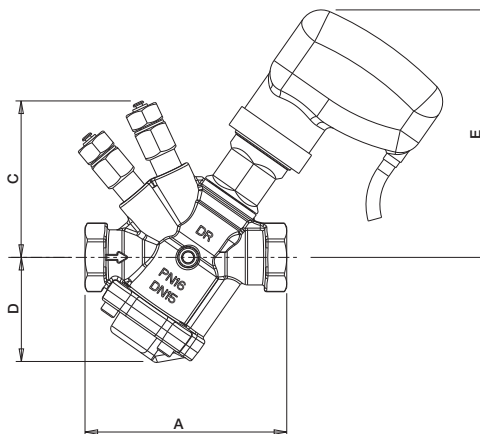
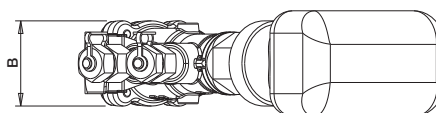
Materials

PART	MATERIAL	SPECIFICATION
Body	DZR Brass	BS EN 12165 (CW602N)
Bonnet	DZR Brass	BS EN 12165 (CW602N)
Bottom Cover	DZR Brass	BS EN 12165 (CW602N)
Test Points	DZR Brass	BS EN 12165 (CW602N)
Setting Key	Nylon	Grade PA 6
Cartridge	PPS	40% GF
Diaphragm	EPDM	
O Ring Seals	EPDM	
Springs	Stainless Steel	



D991 PICV + Modulating Actuator

Dimensional Drawings



Dimensions & Weights

FIG. NO	Size (DN)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	VALVE WEIGHT (kg)	ACTUATOR WEIGHT (kg)
D991LF	15	90	38	70	47	115	0.77	0.25
D991	15	90	38	70	47	115	0.77	0.25
D991	20	105	38	70	47	115	0.85	0.25
D991	25	121	59	74	66	120	1.49	0.25

Pressure/Temperature Ratings

TEMPERATURE RANGE (°C)	-10°C to 100°C
PRESSURE (BAR)	16 Bar (Max Operating Differential Pressure 3.5 bar)

Actuator Options

APPLICATION	FIG NO.	PART NO	FUNCTION	VOLTAGE	CABLE LENGTH	IP RATING
Fan Coil Unit	ACT991M	0EA08732W	Modulating	24VAC/DC	1.5m	IP43
Active Chilled Beams						
Passive Chilled Beams	ACT991TH	0EA08733X	On/Off	24VAC/DC	2.0m	IP54

Accessories: Setting key 0EA08736B
Isolating Cap 0EA08735A

SPECIFICATION: The PICV shall have a constant control characteristic at all flow settings and control flow rates at differential pressures up to 350 kPa. Flow rates will be externally adjustable, and set point recordable. Integral test points will be fitted to verify setting pressure allowing pumps to be set at optimum speed to maximise energy savings. Shall be manufactured from DZR Brass, with Stainless Steel springs, and an EPDM diaphragm. Shall be rated to PN16 and operate at temperatures to 100°C. As Crane Fig D991.

PRESSURE RATING: PN16 **MEDIUM:** Group 2 Liquids **END CONNECTIONS:** BSP Female to BS EN 10226

D991

Constant Flow Regulator - PN16

Features & Benefits

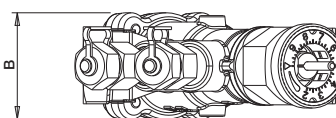
- Maintains a constant flow rate
- Pressure independent control of flow
- Simple flow rate setting
- Adjustable over wide range of flow rates
- Compact design
- Integral test points for DP verification

Materials

PART	MATERIAL	SPECIFICATION
Body	DZR Brass	BS EN 12165 (CW602N)
Bonnet	DZR Brass	BS EN 12164 (CW602N)
Bottom Cover	DZR Brass	BS EN 12165 (CW602N)
Test Points	DZR Brass	BS EN 12164 (CW602N)
Setting Key	Nylon	Grade PA 6
Cartridge	PPS	40% GF
Diaphragm	EPDM	
O Ring Seals	EPDM	
Springs	Stainless Steel	

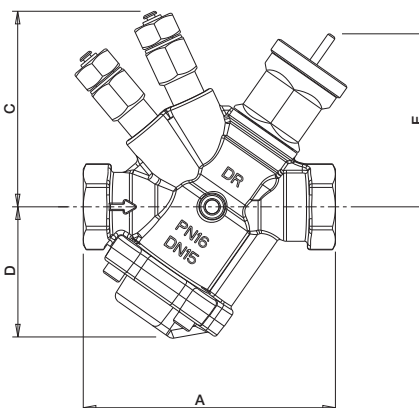


Dimensional Drawings



Dimensions & Weights

FIG. NO	Size (DN)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	VALVE WEIGHT (kg)
D991LF	15	90	38	70	47	62	0.77
D991	15	90	38	70	47	62	0.77
D991	20	105	38	70	47	64	0.85
D991	25	121	59	74	66	66	1.49



Pressure/Temperature Ratings

TEMPERATURE RANGE (°C)	-10°C to 100°C
PRESSURE (BAR)	16 Bar (Max Operating Differential Pressure 3.5 bar)

Although PICVs are generally fitted with actuators to control the flow rate, they can be used without an actuator as a constant flow device (CFD) / constant flow regulator (CFR).

PRESSURE RATING: PN16 **MEDIUM:** Group 2 Liquids **END CONNECTIONS:** BSP Female to BS EN 10226

SPEC. CLAUSE: The PICV shall have a constant control characteristic at all flow settings and control flow rates at differential pressures up to 350 kPa. Flow rates will be externally adjustable, and set point recordable. Integral test points will be fitted to verify setting pressure allowing pumps to be set at optimum speed to maximise energy savings. Shall be manufactured from DZR Brass, with Stainless Steel springs, and an EPDM diaphragm. Shall be rated to PN16 and operate at temperatures to 100°C. As Crane Fig D991.

Introduction to Dominator

On projects where a large number of fan coils or chilled beams are used, the installer has to provide:

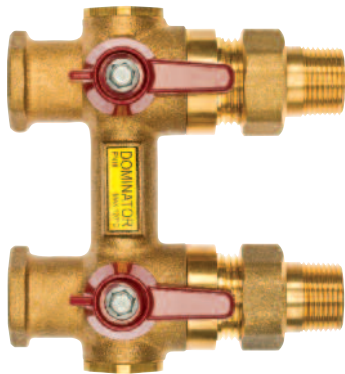
As standard: Flushing by-pass, Isolation valves, Flow control valves, drain valves.

As options: Strainers and flow measurement devices on each terminal unit.

Purchasing the individual components and making assemblies on site is time-consuming, repetitive work that

requires considerable labour time. The correct flow control valve must be selected for each terminal unit, and the number of pipe joints can be significant, all of which carry risks of leakage, re-work and delays in project time plans.

The Crane Dominator is a pre-assembled and tested unit supplied complete and ready for installation. All flow control valves are sized by Crane to suit each fan coil flow rate, and every unit is supplied tagged with fan coil reference for ease of installation.



H-Body for LTHW
(No Extension Stems)

Using our unique H-Body flushing by-pass arrangement as the cornerstone of each assembly, a variety of valves are then connected on the flow and return sides of the H-Body to suit specification.



H-Body for chilled water.
Extension stems fitted to accommodate lagging.

On the flow side

Options include:

- A combined strainer and drain assembly D299P
- If no strainer is required, a drain valve is included D342



D299P



D342

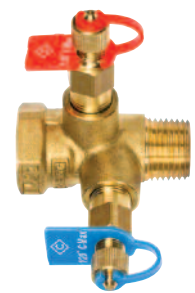
On the return side

Options include:

- Pressure Independent Control Valves (PICV). D991 + Actuator
- Constant Flow regulators. D991
- Flow measurement devices to verify flow. D901/D902



D991 with Actuator



D901/D902

The Crane Dominator can be manufactured as a bespoke assembly to suit individual project requirements, including:

Z9901P - Dominator with PICV, Strainer and Drain.

Z9901PF - Dominator with PICV, Strainer and Drain, including Flow Measurement Device.

Z9901P & Z9901PF

Dominator & PICV (with Strainer & Drain)

Features & Benefits

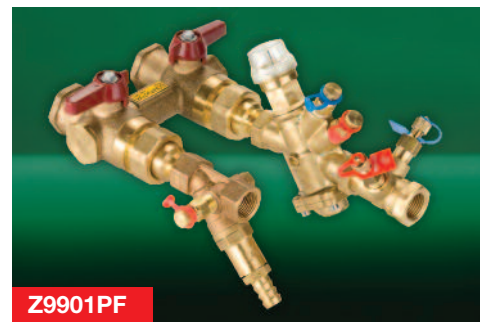
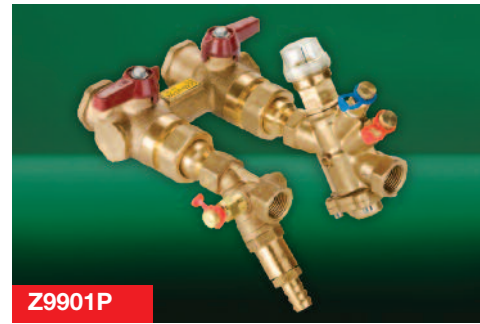
- Compact, pre-fabricated unit - now available with Pressure Independent Control Valve
- Provides accurate flow rates & differential pressure control as well as flow measurement (Z9901PF), system flushing and isolation
- Fully assembled & factory tested unit reduces installation time, costs and specification risks
- Can be tailored to suit customer's specification:
 - available with extension stems (Z9901PEXT) or without (Z9901P)
 - add an extra Flow Measurement device for verification of flow rates (Z9901PF & Z9901PFEXT)
- On/Off or modulating actuators are available separately to match specification

Materials

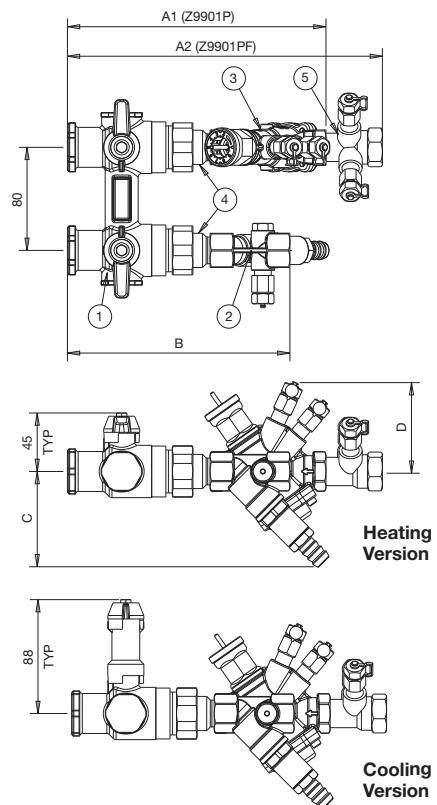
NO.	PART	MATERIAL	SPECIFICATION
1	Bypass H-Body	Bronze	BS EN 1982 CC491K
2	D299P Strainer	Bronze	BS EN 1982 CC491K
3	D991 PICV	DZR Brass	BS EN 12165 (CW602N)
4	Tailpiece	DZR Brass	BS EN 12164 (CW602N)
5	D901/D902 FMD	DZR Brass	BS EN 12164 (CW602N)

Dimensions & Weights

FIG. NO	Size (DN)	A1 (mm)	A2 (mm)	B (mm)	C (mm)	D (mm)	WEIGHT (kg)
Z9901P	15/15	205	-	175	75	70	2.65
Z9901P	20/15	205	-	175	75	70	2.65
Z9901P	20/20	215	-	180	80	70	2.77
Z9901P	25/20	240	-	205	80	70	2.77
Z9901P	25/25	265	-	220	85	73	3.70
Z9901PF	15/15	-	245	175	75	70	2.94
Z9901PF	20/15	-	245	175	75	70	2.94
Z9901PF	20/20	-	260	180	80	70	3.07
Z9901PF	25/20	-	285	205	80	70	3.07
Z9901PF	25/25	-	315	220	85	73	4.12



Dimensional Drawings



PRESSURE RATING: PN16 **TEMPERATURE RATING:** -10 to 100°C

END CONNECTIONS: Flushing By-pass body - BSP Parallel, Strainers & Tailpieces - BSP Taper

SPECIFICATION CLAUSE: Bronze (BS EN 1982 CC491K) fan-coil valve / terminal unit valve assembly. Pre-assembled to the requirements of each individual terminal unit to include a flushing by-pass with integral isolation valves, Pressure Independent Control Valve (PICV), with options for low flow, flow measurement device, strainer, drain and pressure test points as and where specified. Extended handles will be fitted for Chilled Water applications. On/Off or modulating actuator is required to control the PICV. Valve assembly will be labelled to include the terminal unit reference number and flow rate. Generally as Crane Fluid Systems Z9901P Dominator system

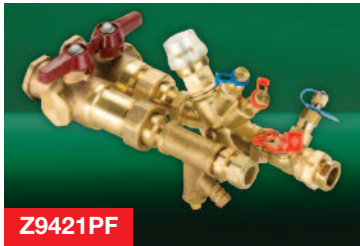
Introduction to Dominator Mini

The Dominator Mini takes pre-fabrication of these valve sets to the next stage.

From a fan coil schedule, Crane will select the correct PICV, manufacture and test the full assembly, and tag each unit with the fan coil reference. These units can then be supplied to the chosen fan coil manufacturer to fit onto the fan coil prior to despatch to site.

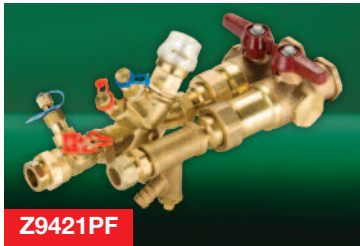
The benefits to the contractor include:

- Reduced installation time.
- Reduced risk of joint leaks (all units pre-tested)
- The knowledge that the correct PICV has been fitted to the correct fan coil.



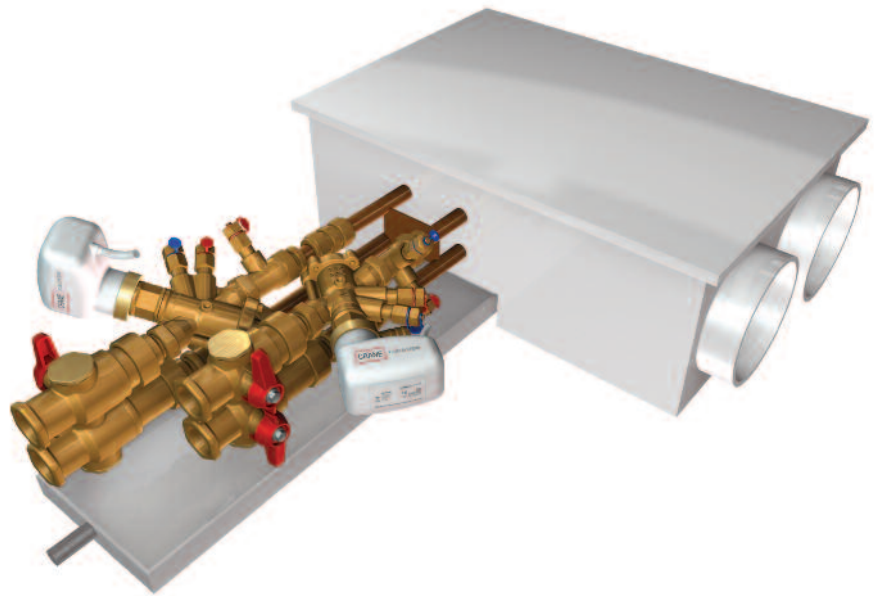
Z9421PF

Standard

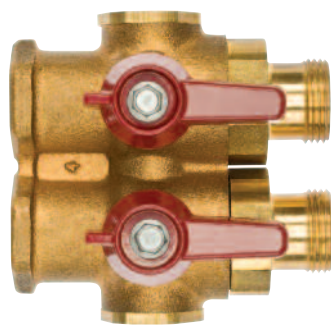


Z9421PF

Reverse Handed



On the flow side

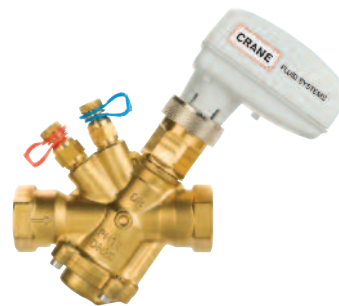


H-Body with 40mm Centres

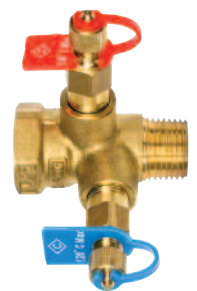


D342

On the return side



D991 with Acuator



D901/D902

Dominator Mini - Models available:

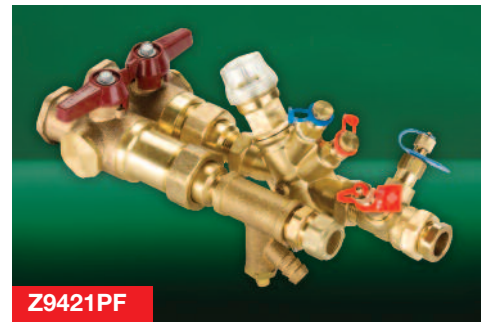
Z9421PF: Includes PICV and Flow Measurement as standard.
Standard and reverse handing enables direct mounting onto fan coil units.

Z9421PF

Dominator Mini & PICV (with Drain)

Features & Benefits

- Designed with 40mm centres to fit directly onto terminal unit, reducing installation time and cost
- Ultra compact design which can be mounted over extended drip tray on fan coil unit, thus eliminating requirement for lagging
- Fully assembled and factory tested
- Integral flushing by-pass included on every unit
- Flow measurement device fitted as standard on all units
- On/off or modulating actuators are available and should be ordered separately



Materials

NO.	PART	MATERIAL	SPECIFICATION	QUANTITY
1	Bypass H-Body	Bronze	BS EN 1982 CC491K	1
2	Tailpiece	DZR Brass	BS EN 12164 CW602N	2
3	D342 Drain	Bronze	BS EN 1982 CC491K	1
4	D991 PICV	DZR Brass	BS EN 12164 CW602N	1
5	D901/902 FMD	DZR Brass	BS EN 12164 CW602N	1
6	R Thread x Comp Coupling	DZR Brass	BS EN 12164 CW602N	1† or 2‡
7	Compression Adaptor	DZR Brass	BS EN 12165 CW602N	1† or 0‡

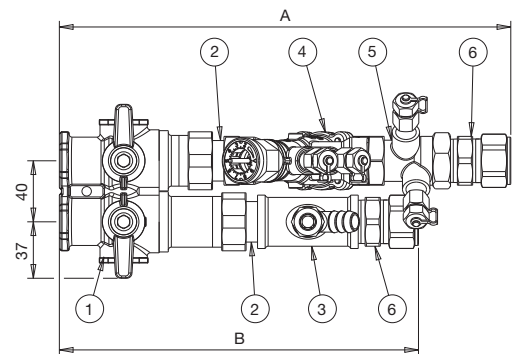
† Quantities for DN15/15 & DN20/15 Valve Assembly Arrangements

‡ Quantities for DN20/20 Valve Assembly Arrangement

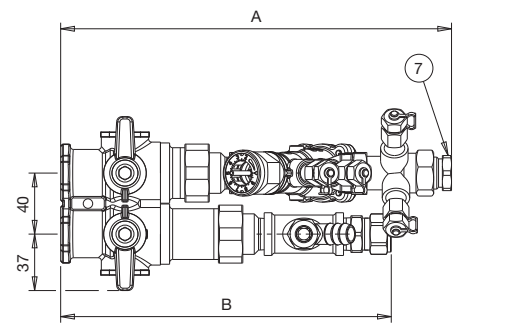
Dimensions & Weights

SIZE (DN)	A (mm)	B (mm)	C (mm)	D (mm)	WEIGHT (kg)
Z9421PF 15/15	256	217	70	47	2.93
Z9421PF 20/15	256	217	70	47	2.93
Z9421PF 20/20	256	235	70	47	2.93
Z9423PF 15/15	256	217	70	47	2.93
Z9423PF 20/15	256	217	70	47	2.93
Z9423PF 20/20	256	235	70	47	2.93

Dimensional Drawings



Z9421PF DN20



Z9421PF DN15

PRESSURE RATING: PN16 **TEMPERATURE OPERATING RANGE:** -10 to 100°C

END CONNECTIONS: Flushing bypass body - BSP Parallel, FCU Connections - Compression EN 1254-2

SPECIFICATION: Z9421PF has tailor made pipe connections which can be mounted directly onto the fan coil unit. Bronze (BS EN 1982 CC491K) fan-coil valve/terminal unit valve assembly. Pre-assembled to the requirements of each individual terminal unit to include a flushing bypass with integral isolation valves, Pressure Independent Control Valve (PICV), with options for low flow, flow measurement device, drain and pressure test points as and where specified. On/Off or modulating actuator is required to control the PICV. Valve assembly will be labeled to include the terminal unit reference number and flow rate.

PICV

Frequently Asked Questions

01. Q. Can I measure flow rate?

A. No. Flow rate cannot be measured directly from the PICV. Other means of flow verification such as orifice plates/ flow measurement devices should be installed as part of the system. However, the flow rate can be established from valve set position, and our published chart on Page 7.

02. Q. What are the test points used for?

A. They are used to verify the pressure drop across the seat to check that the valve is operating at the correct pressure drop. Please refer to the IOM.

03. Q. How do I know if the PICV is working correctly?

A. This can be verified by measuring the pressure drop across the seat using the test points and then comparing against the detail provided in FAQ 2.

04. Q. Can I install the PICV upside down?

A. The PICV can be mounted in any orientation. However consideration needs to be given to choice of actuator. Thermal actuators can be installed in any orientation, but Electro-Mechanical actuators should not be installed upside down as this can allow moisture to enter the actuator. However, a PICV with an electro-mechanical actuator can be orientated anywhere between 0-90° from the vertical.

05. Q. Can I install the PICV on flow or return?

A. The PICV can be installed on either flow and return. Please ensure that the valve is installed with the flow direction arrow in the correct direction.

06. Q. Does it matter which way around the PICV is installed?

A. The PICV must be installed with the flow direction arrow in the correct direction.

07. Q. How accurate is the pre-setting?

A. With careful alignment of the setting dial to desired flow rate position, a pre-set accuracy of +/- 10% can be achieved.

08. Q. Can I flush through the PICV?

A. It is not recommended to flush through PICVs. The PICV is a control valve with close tolerance flow paths. Flushing through these valves may introduce debris which could block the flow paths.

09. Q. Are the valves able to isolate?

A. Control valves are not designed to be isolating valves, and it is always recommended to fit separate isolating valves. However for routine maintenance purposes, i.e. strainer cleaning, the actuator can be removed, and a manual cap fitted which can be used to close the valve.

10. Q. How do I commission using PICVs?

A. BSRIA Guide to Commissioning Water Systems BG2 / 2010 and CIBSE Commissioning Code W: 2010 give details of commissioning procedures using PICVs.



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