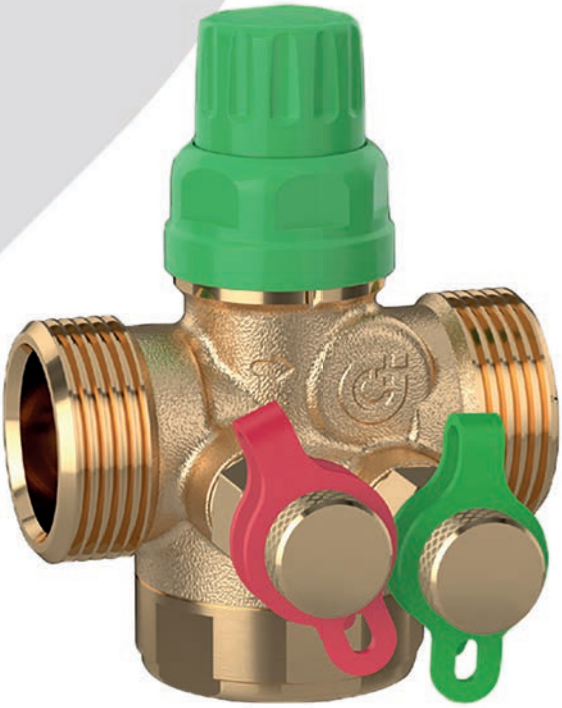
145 PICV

pressure independent
control valve



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145 PICV pressure independent control valve

Application

The pressure independent control valve (PICV) is a valve comprising an automatic flow rate regulator and a control valve with actuator.

The valve can adjust the flow rate and keep it constant in the presence of changing differential pressure conditions of the circuit.

Flow rate is adjusted in two different ways:

- manually on the automatic flow rate regulator, to restrict the maximum value
- automatically by the control valve in combination with a proportional (0 to 10 V) or ON/OFF actuator, in accordance with the thermal load requirements of the circuit of the system to be controlled.

The pressure independent control valve (PICV) is supplied complete with connections for upstream and downstream pressure test ports for checking of operating conditions.

The valve can be used in heating and air-conditioning systems.

Technical Specification

Material

Body:		dezincification resistant alloy BS EN 12165 CW602N
Headworks:		dezincification resistant alloy BS EN 12164 CW602N
Control stem & piston:		stainless steel BS EN 10088-3 (AISI 303)
Body seat:	H20	BS EN 12165 CW602N
	H40, H80 and 1H2	PTFE
	1H8, 3H0 and 3H7	BS EN 10088-3 (AISI 303)
Disc facing:		EPDM
Pressure regulating diaphragm:		EPDM
Springs:		stainless steel BS EN 10270-3 (AISI 320)
Seals:		EPDM
Gasket:		non-asbestos fibre
Pre-adjustment indicator:		nylon 6 - PA6G30
Knob:		nylon 6 - PA6

Technical Specification

Performance

Medium:		water, glycol solution
Max. percentage of glycol:		50%
Max. working pressure:		25 bar
Max. differential pressure with code 145013 actuator and 6565 series thermo-electric actuators:		4 bar
Working temperature range:		-20 to 120°C
Nominal Δp control range:	H20	0.02 to 0.2 m^3/h
	H40	0.08 to 0.4 m^3/h
	H80	0.08 to 0.8 m^3/h
	1H2	0.12 to 1.2 m^3/h
	1H8	0.18 to 1.8 m^3/h
	3H0	0.30 to 3.0 m^3/h
	3H7	0.37 to 3.7 m^3/h
Accuracy:		±5%
Leakage:		Class V in accordance with BE EN 60534-4
Type:		diaphragm
Max. flow rate with 656 series thermo-electric actuator fitted reduced by:		20%

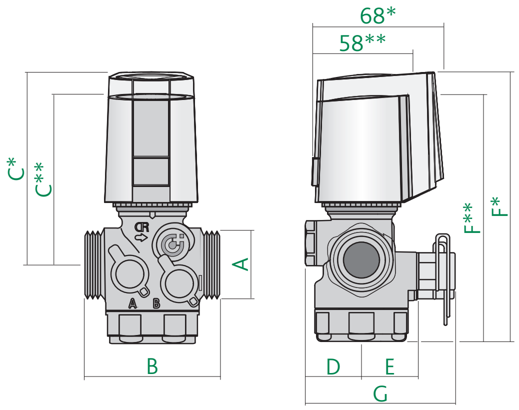
Connections

Main	½", ¾", 1" and 1¼" male BS EN 10226-1 with union
	¾" male BS EN ISO 228-1 Euro-connection
For electro-thermal actuators:	M30 x 1.5
For pressure test ports:	¼" female BS EN ISO 228-1 with plug

Actuators - thermo-electric actuators compatible with the 145 series

				
* auto stroke detection	145013	656524	656502	656504
	-	Normally closed	Normally closed	
Type	Actuator	Thermo-electric actuator	Thermo-electric actuator	
Electric supply	24 V	24 V	230 V	24 V
Power consumption	2.5 V(ac) - 1.5 W (dc)	1.2 W	1 W	
Control signal	0 (2) - 10V / 0(4) -20 mA	0 to 10 V	ON/OFF	
Opening and closing time*	approx. 35 seconds *	approx. 200 seconds	approx. 240 seconds	
Protection class	IP54	IP54	IP54	
Ambient temperature range	0 to 50°C	0 to 60°C	0 to 60°C	
Feedback signal	0 to 10 V	0 to 10 V	-	
Supply cable length	2 m	1 m	1 m	
Connection	M30 x 1.5	M30 x 1.5 - quick coupling	M30 x 1.5 - quick coupling	
Force	160 N	125 N	100 N	
Max. differential pressure	4 bar	4 bar	4 bar	
Starting current	1.54 A	320 mA	550 mA	300 mA

Dimensions

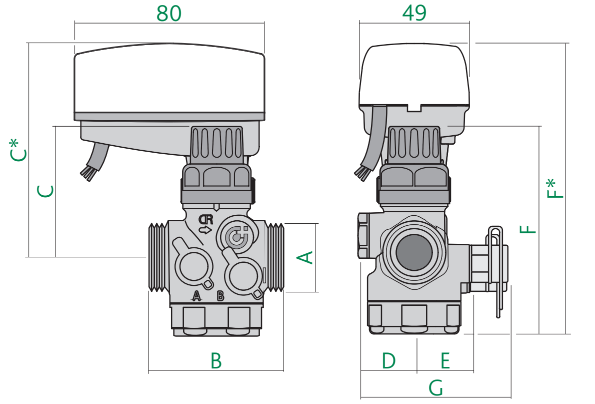


Ref. No	DN	A	B	C**	C*	D	E	F**	F*	G***	kg
14543. H20	15	½"	70	81	91	25	26	117	127	76	0.60
14544. H40	15	¾"	70	81	91	25	26	117	127	76	0.60
14544. H80	15	¾"	70	81	91	25	26	117	127	76	0.60
14555. H40	20	1"	72	81	91	25	26	117	127	76	0.62
14555. H80	20	1"	72	81	91	25	26	117	127	76	0.62
14555. 1H2	20	1"	72	81	91	25	26	117	127	76	0.62
14566. 1H8	25	1¼"	90	85	95	30	36	136	146	86	1.14
14566. 3H0	25	1¼"	90	85	95	30	36	136	146	86	1.14
14566. 3H7	25	1¼"	90	85	95	30	36	136	146	86	1.14

* Actuator code 656524 ** Actuator code 656502 to 656504 *** Only for code 145..7

145 PICV pressure independent control valve

Dimensions Continued



Ref. No	DN	A	B	C**	C*	D	E	F	F*	G***	kg
14543. H20	15	½"	70	59	96	25	26	95	132	76	0.60
14544. H40	15	¾"	70	59	96	25	26	95	132	76	0.60
14544. H80	15	¾"	70	59	96	25	26	95	132	76	0.60
14555. H40	20	1"	72	59	96	25	26	95	132	76	0.62
14555. H80	20	1"	72	59	96	25	26	95	132	76	0.62
14555. 1H2	20	1"	72	59	96	25	26	95	132	76	0.62
14566. 1H8	25	1¼"	90	63	100	30	36	114	151	86	1.14
14566. 3H0	25	1¼"	90	63	100	30	36	114	151	86	1.14
14566. 3H7	25	1¼"	90	63	100	30	36	114	151	86	1.14

* Actuator code 145013 *** Only for code 145..7

Product Range

With pressure test ports

Ref. No	DN	Connections	Flowrate Range - m³/hr
145437 H20	15	½"	0.02 to 0.20
145447 H40	15	¾"	0.08 to 0.40
145447 H80	15	¾"	0.08 to 0.80
145557 H40	20	1"	0.08 to 0.40
145557 H80	20	1"	0.08 to 0.80
145557 1H2	20	1"	0.12 to 1.20
145667 1H8	25	1¼"	0.18 to 1.80
145667 3H0	25	1¼"	0.30 to 3.00
145667 3H7	25	1¼"	0.37 to 3.70

With pressure test ports

Ref. No	DN	Connections	Flowrate Range - m³/hr
145434 H20	15	½"	0.02 to 0.20
145444 H40	15	¾"	0.08 to 0.40
145444 H80	15	¾"	0.08 to 0.80
145554 H40	20	1"	0.08 to 0.40
145554 H80	20	1"	0.08 to 0.80
145554 1H2	20	1"	0.12 to 1.20
145664 1H8	25	1¼"	0.18 to 1.80
145664 3H0	25	1¼"	0.30 to 3.00
145664 3H7	25	1¼"	0.37 to 3.70

Union End with Seal

Threads BS EN 10226-1

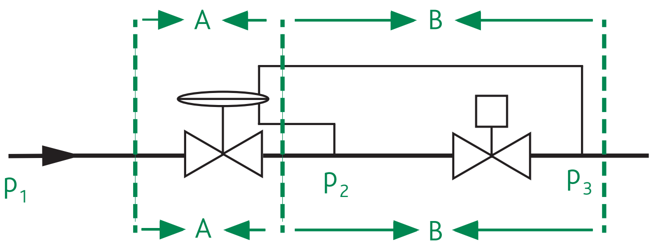
Ref. No	Connections
145001	¾"F x ³/₈"M
145003	¾"F x ¾"M
145005	1"F x ¾"M
145006	1"F x 1"M
145007	1¼"F x 1"M
145008	1¼"F x1¼"M

Operating Principle

The pressure independent control valve (PICV) is designed to regulate a flow of fluid by:

- an actuated 2-port control valve that varies the flow through a terminal unit.
- a differential pressure control regulator that maintains a constant differential pressure across the control valve thereby ensuring the maximum set design flow rate cannot be exceeded.

The valve construction is shown in the schematic diagram.



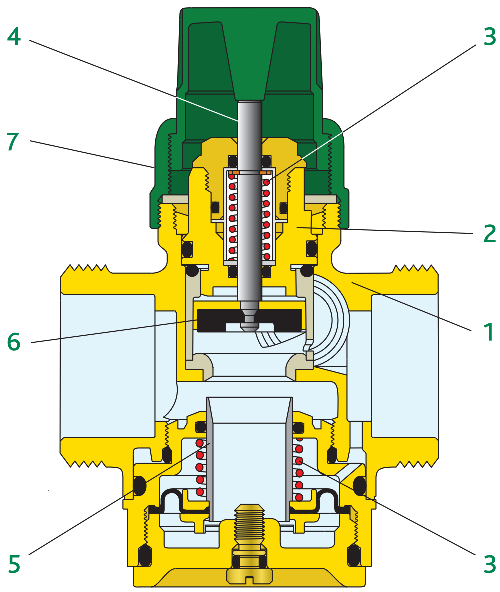
Where:

p_1 = upstream pressure

p_2 = intermediate pressure

p_3 = downstream pressure

Δp total valve = $p_1 - p_2$

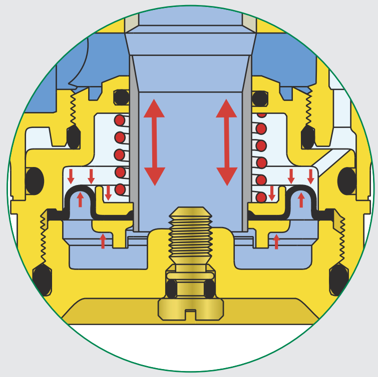


Operating Principle

Device **A** regulates Δp_i (p_2-p_3) and keeps it constant across the valve **B** by means of an automatic action (balancing between the force generated by the differential pressure and the internal opposing spring).

If (p_2-p_3) increases, the internal Δp regulator reacts to close the valve and maintains (p_2-p_3) constant.

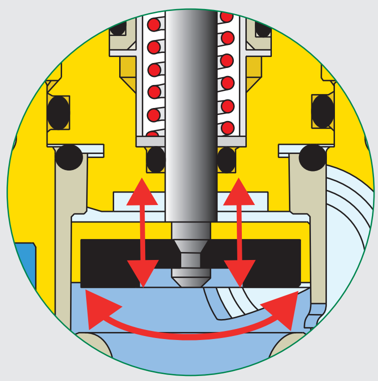
In these conditions the flow rate will remain constant.



Valve **B** regulates flow rate G by changing the flow path cross section.

The change in flow path cross section determines the hydraulic coefficient value Kv of the regulating valve **B**, which remains constantly at:

- a manually pre-set value
- the value determined by the actuator's regulating action.



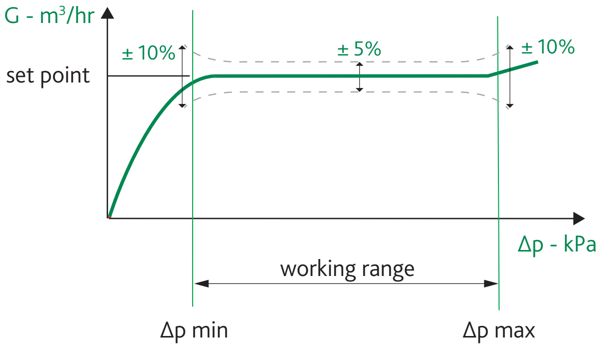
Constant Flow Rate

G = required flow rate

Since G = Kv x √Δp

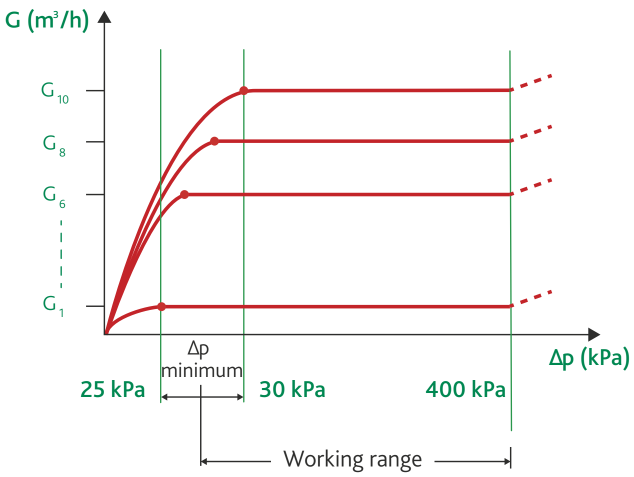
- by manually or automatically adjusting valve **B**, the Kv value and consequently the flow rate G can be set.
- once the flow rate G has been set, it remains constant as a result of device **A** in response to circuit pressure changes.

Flow Rate Accuracy



Working Range

For the device to keep the flow rate constant independently from the circuit's differential pressure conditions, total valve Δp (p1-p3) must be in the range from the minimum Δp value (see "Flow rate adjustment tables") and the maximum value of 400 kPa.



Construction Details

Materials in dezincification resistant alloy and stainless steel

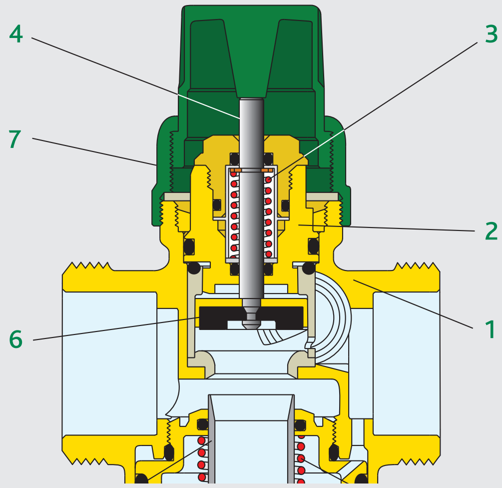
Valve body (1) and headwork (2) are made of dezincification resistant alloy while springs (3), control stem (4) and piston (5) are in stainless steel.

These materials prevent corrosion, guarantee accuracy, reliable performance over time and are compatible with glycols and additives, which are often used in the circuits of air conditioning systems.

EPDM obturator

EPDM obturator (6) provides a perfect seal in the case of complete closing of the valve for circuit shut-off.

Construction Details



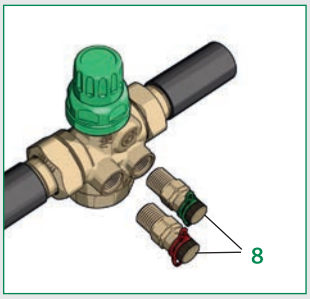
Compact design

The valve is of compact design with reduced dimensions and is easy to install.

Protective knob (7) can be removed by hand easily for flow rate regulation and when fitting the actuator.

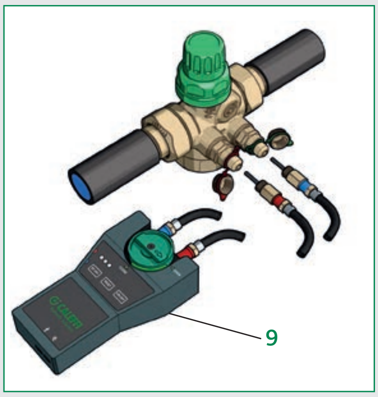
Pressure test ports

The valve is supplied with upstream and downstream connections for fast-plug pressure test ports (8), to be fitted in the connections with the system cold and not under pressure.



During operation the valve Δp generated by the fluid flow can be measured with a differential pressure meter (9).

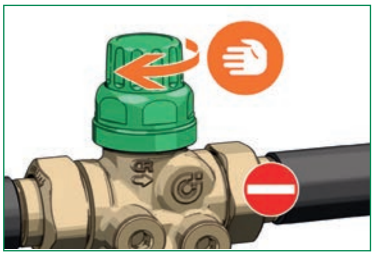
By comparing this value with the selected Δp range, the corresponding actual flow rate can be determined.



Construction Details Continued

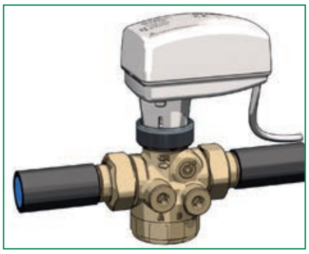
Shut-off

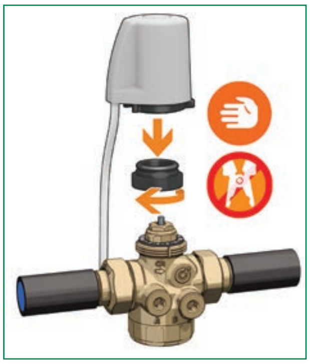
The knob can be used to shut-off the circuit zone controlled by the valve.



When Fitted with an Actuator

The valve is designed to accept a proportional linear actuator (code 145013 and 656524). When controlled by an actuator, the valve can modulate the flow rate in accordance with the system thermal load. As alternative to a proportional linear actuator, the valve can also be controlled with an ON/OFF type thermo-electric actuator 6565 series, for simpler temperature control logic.

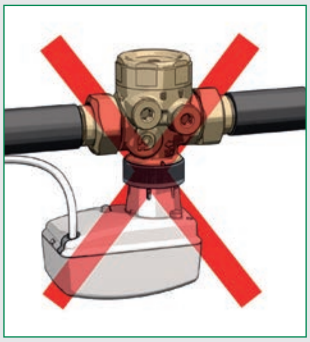


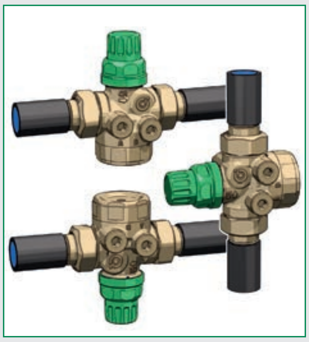


Installation versatility

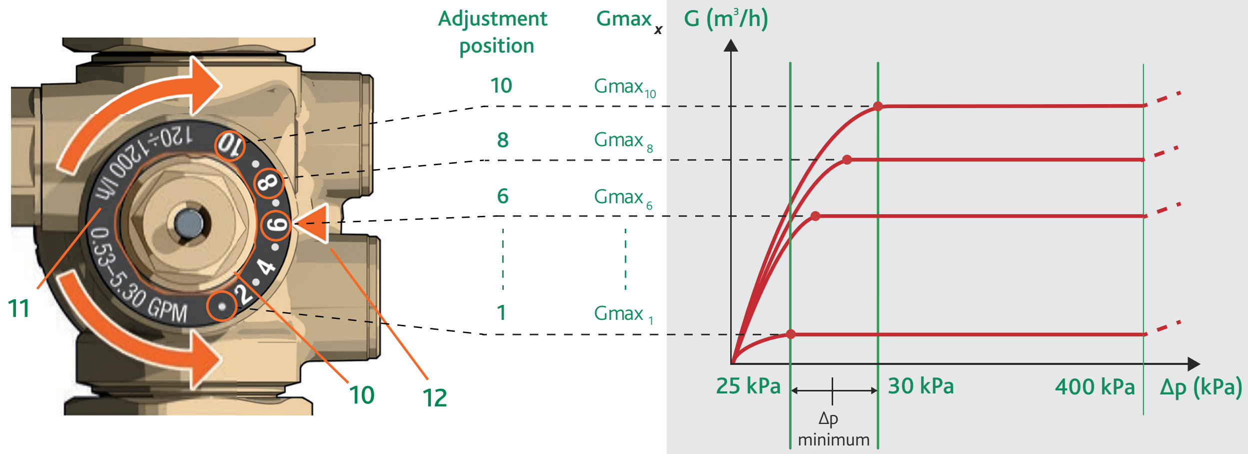
Without an actuator the valve can be installed in any position.

With an actuator the valve can be installed in any position except upside down.





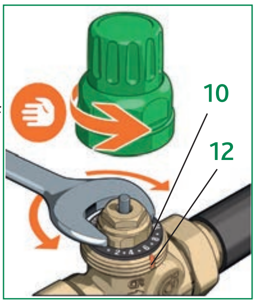
Adjustment Procedure



Adjustment Procedure Continued

Maximum flow rate adjustment

Unscrew the protective plug by hand to gain access to the maximum flow rate adjustment nut (10), which can be turned with a hexagonal wrench.



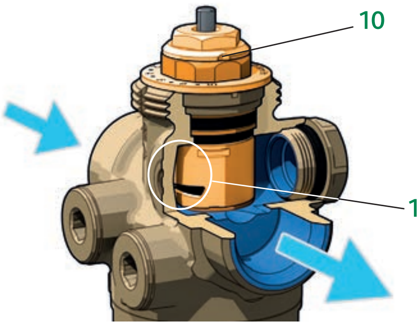
The adjustment nut is fixed to a 10-position graduated scale,

divided into steps corresponding to 1/10 of the maximum available flow rate, which is also shown on the scale (11).

Turn the adjustment nut to the numerical position corresponding to the required flow rate (design flow rate), referring to the "Flow rate adjustment table".

The notch (12) on the valve body is the physical positioning reference.

Such operation does not reduce obturator total stroke (full stroke modulation)



Turning adjustment nut (10), which determines the number associated with the "Adjustment position", results in opening/closing of the bore cross section in the external obturator (13). Hence, each bore cross section set on the adjustment nut corresponds to a specific Gmax value.

Automatic flow rate adjustment with actuator and external regulator

After adjusting the maximum flow rate, fit the actuator (0–10 V) code 145013 (14) to the valve.

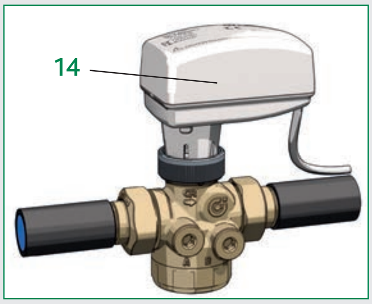
When connected to an electronic controller the actuator can automatically adjust the flow rate from the maximum set value eg. $Gmax_8$ to the minimum value in accordance to the demand for heating or cooling.

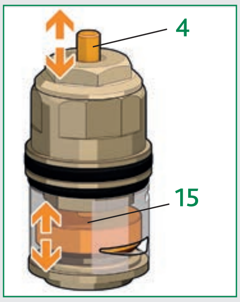
The actuator acts on the vertical displacement of control stem (4).

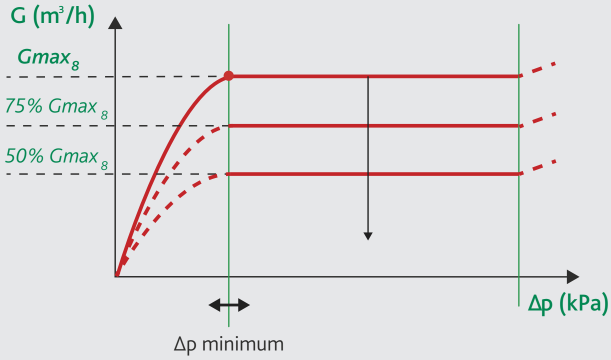
This results in additional opening/closing, on the maximum flow path cross section, by the internal obturator (15).

For example, if the maximum flow rate has been set to position 8, the flow rate can be adjusted automatically by the actuator from $Gmax_8$ to completely closed (zero flow rate).

Automatic flow rate adjustment with actuator and external regulator







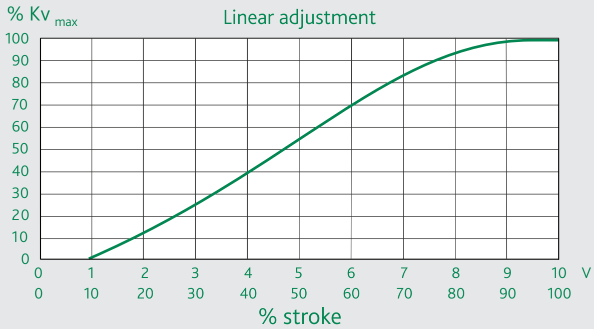
Flow rate adjustment curve

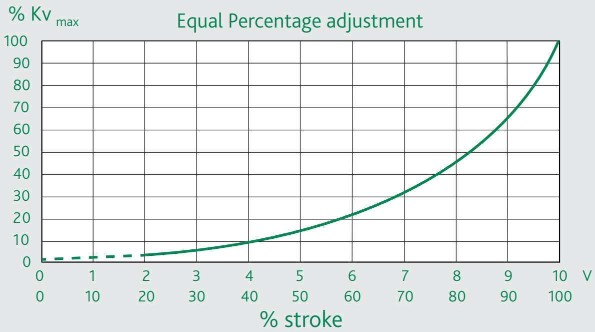
The valve adjustment curve is of the linear type.

An increase or decrease in the valve opening cross section corresponds to a directly proportional increase or decrease of the device's hydraulic coefficient Kv.

The motor is factory configured with linear adjustment.

It is possible to obtain an equal-percentage adjustment (see diagram below) setting the actuator (code 145013) for this operation by means of the dedicated switch inside it (see specific instruction sheet). In this way the control signal is managed to obtain an equal percentage adjustment.





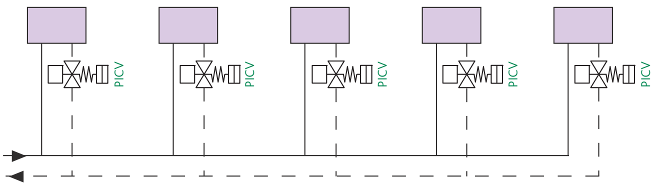
Flow Rate Adjustment Table

Code locking nut colour	Flow range G Δp min	Adjustment positions									
		1	2	3	4	5	6	7	8	9	10
145... H20	0.02 to 0.2 m^3/h	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20
	Δp min kPa	25	25	25	25	25	25	25.5	25.5	26	26
145... H40	0.08 to 0.4 m^3/h	-	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.40
	Δp min kPa	-	25	25.5	26	26	26.5	26.5	27	27	27
145... H80	0.08 to 0.8 m^3/h	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72	0.80
	Δp min kPa	25	25	25.5	26	26	27	27.5	28	28.5	29
145... 1H2	0.12 to 1.2 m^3/h	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96	1.08	1.20
	Δp min kPa	25	25	25.5	26	26	26.5	26.5	27	27.5	28
145...1H8	0.18 to 1.8 m^3/h	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.62	1,80
	Δp min kPa	35	35	35	35	35	28	25	25	25	25
145... 3H0	0.30 to 3.0 m^3/h	0.30	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00
	Δp min kPa	35	35	35	35	35	35	35	35	35	35
145... 3H7	0.37 to 3.7 m^3/h	0.37	0.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70
	Δp min kPa	48	48	48	48	45	45	43	43	43	43

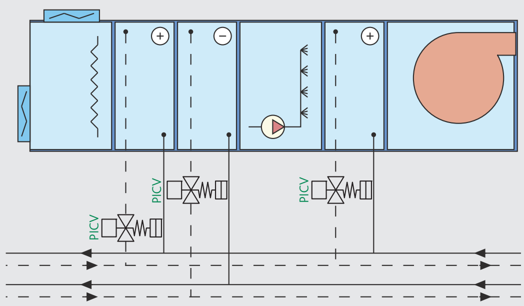
Minimum differential pressure required

To choose the pump you need, add the minimum pressure difference required by the valve to the fixed head losses of the most disadvantaged circuit. This value corresponds to working range starting Δp_{min} value shown in the table ($H_{pump} = \Delta p_{circuit} + \Delta p_{min}$).

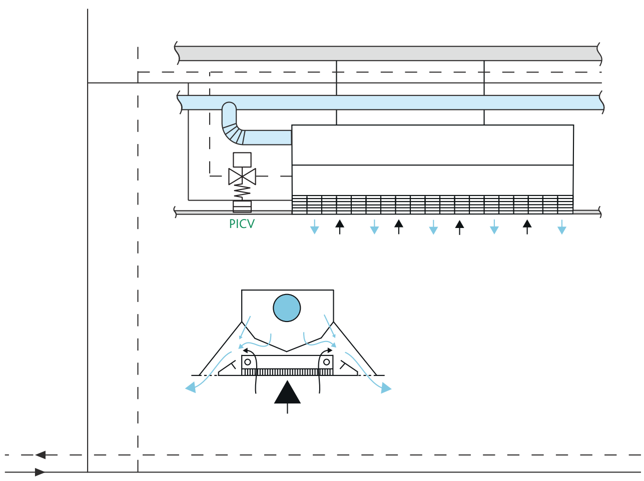
Typical Applications



For use with various types of heat emitter, radiators, convectors, fan convectors, perimeter heating etc



To balance circuits that serve air conditioning units



To adjust the flow rate to chilled beams

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