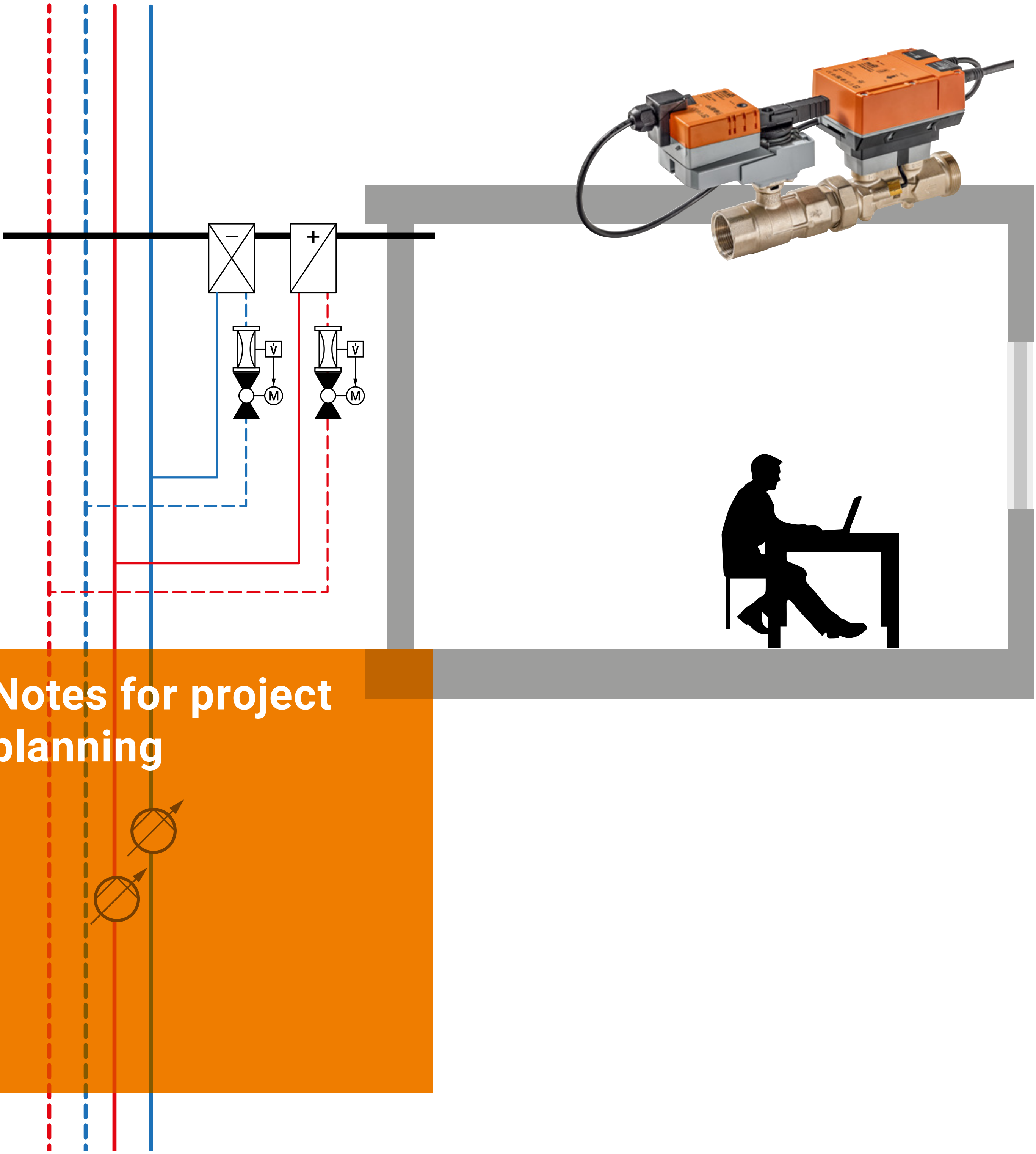
Notes for project planning



Electronic pressure-independent characterised control valve EPIV

Edition 2022-09/A

BELIMO®

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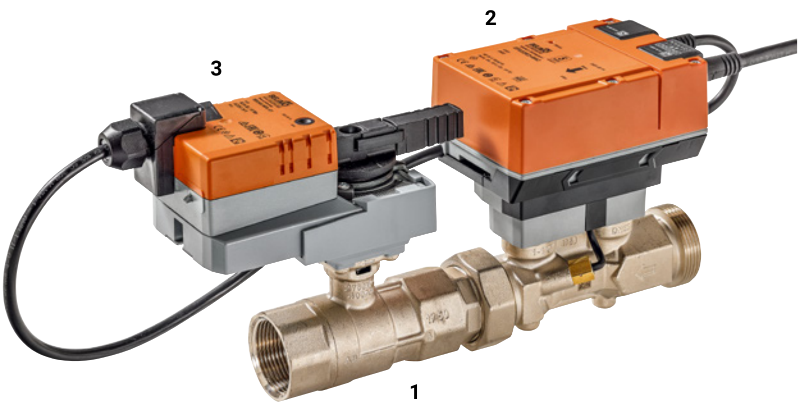
Electronic pressure-independent characterised control valve (EPIV)

Structure

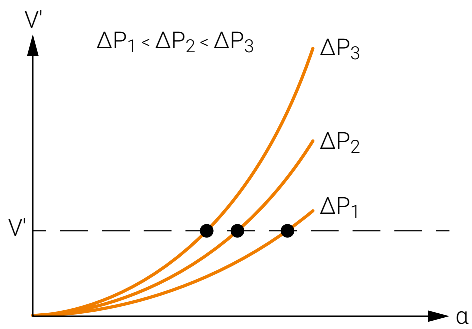
Nominal diameter DN 15...50



1. **Characterised control valve**
   (Leakage rate A in accordance with EN 12266-1)
   Air-bubble tight sealing regulating device ensures absolutely sealed shut-off at zero load and thus reliably prevents activation losses
2. **Measuring pipe with flow sensor**
   Ultrasonic flow measurement optimally adapted to the requirements of the application
3. **Actuator**
   Actuator specially optimised for pressure-independent flow control

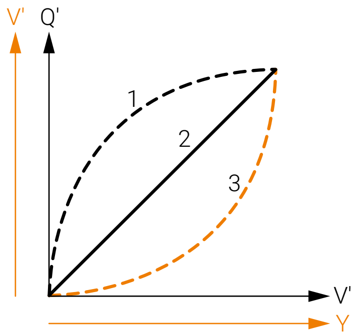
Principle of operation

The control device consists of three components: characterised control valve, measuring pipe with flow sensor and the actuator itself. The set maximum flow rate (V'_{max}) is assigned to the maximum control signal (typically 10 V/100%). The control device can be communicative or analogue controlled. The fluid is recorded by the sensor in the measuring pipe and is applied as the flow rate value. The measured value is compared with the setpoint (analogue control signal or request via bus communication). The drive corrects the deviation by changing the valve position. The angle of rotation α varies according to the differential pressure through the actuation element.



Transfer response of the heat exchanger

Depending on the construction, temperature spread, fluid and hydronic circuit, the power Q' is not proportional to the flow rate V' (curve 1). With the classical type of temperature control, an attempt is made to maintain the positional signal Y proportional to the power Q' (curve 2). This is achieved by means of an equal-percentage valve characteristic curve (Graph 3).



For applications with linear transfer behaviour (a-value ~1) the flow characteristic of the EPIV™ can be changed from equal percentage to linear.

Control functions

In the measuring section (sensor electronics) the medium velocity is measured and converted to a flow signal. The control signal Y corresponds to the power Q' via the exchanger. In the EPIV, the flow rate is regulated. The control signal Y is converted into an equal-percentage flow characteristic and provided with the V'_{max} value as the new reference variable w. The momentary control deviation forms the actuation signal Y1 for the drive.
The specially configured control parameters in connection with the precise flow sensor ensures stable control quality. It is however not suitable for rapid control processes, i.e. for domestic water control. The feedback signal (U5) displays the measured flow rate as a voltage (factory setting). Alternatively, U5 can be used for displaying the valve opening angle.

Project planning

Relevant information

Please note the data, information and limit values in the data sheets of the electronic pressure-independent characterised control valves (EPIV).
– EP..R2+BAC: DN 15...50 with standard actuator
– EP..R2+KBAC: DN 15...50 with electrical fail-safe

Dimensions

The dimensions of the actuator combination used depend on the design and nominal diameter used. The dimensions can be found in the associated data sheets.

Pipeline clearances

The minimum clearances between the pipelines and the walls and ceilings required for project planning depend not only on the valve dimensions but also on the design. The dimensions can be found in the associated data sheets.

Pressure-independent characterised control valves

Characterised control valves must be provided as throttling devices in the return. This leads to lower thermal loads on the sealing elements in the valve. The prescribed direction of flow must be observed.

Flow direction

Observe the specified direction of flow.

Water quality

Adhere to the water quality requirements specified in VDI 2035.

Strainer

The electronic pressure-independent characterised control valve is a regulating device. To ensure that it can also fulfil the control task in the long term, central strainers are recommended.

Design water system

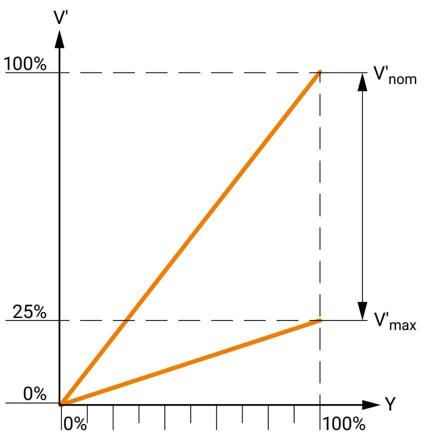
Application is permitted only in closed water circuits.

Open/close valve

Make sure that sufficient open/close valves are installed.

Definitions

V'_{nom} is the maximum possible flow.
V'_{max} is the maximum flow which has been set with the greatest control signal, e.g. 10 V.
V'_{min} 0% is not variable.
V'_{max} can be set between 25% and 100% of V'_{nom}.

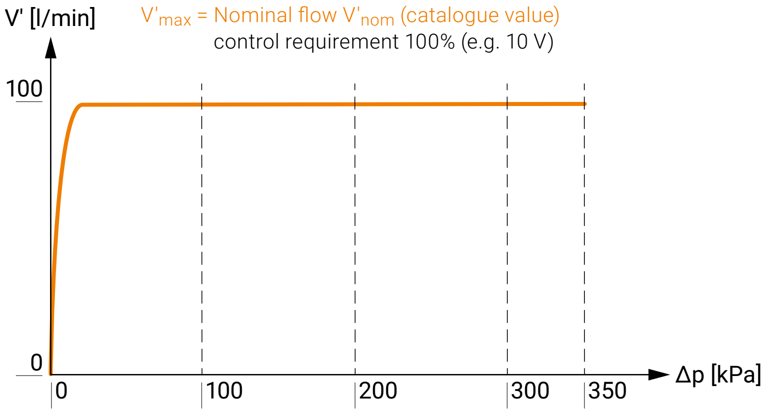


Design and dimensioning

A conventional (pressure-dependent) valve is designed based on the k_V value. For a given nominal flow, this is dependent on the differential pressure present across the valve. In order to obtain a sufficient quality of control, the valve authority P_V must also be taken into account for pressure-dependent valves.
With a pressure-independent solution, such as the electronic pressure-independent characterised control valve, the design is greatly simplified. Due to dynamic balancing, the device provides the required water quantity at any time, even in the event of differential pressure fluctuations and in partial load operation. Due to dynamic balancing, the valve authority amounts to 1.

Constant flow rate V'

Thanks to the permanent balancing of the flow value in the event of differential pressure changes in the system, constant pressure-independent water flow is ensured over a large differential pressure range.

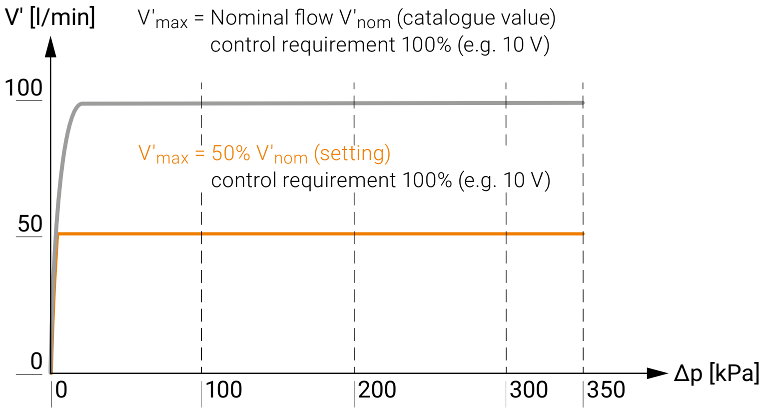


Pressure-independent flow rate over a large differential pressure range due to dynamic balancing (example EP032R2+BAC).

Valve design

The valve is determined using the maximum flow required V'_{max}. Calculation of the k_{vs} value is not required. The required system-specific maximum flow V'_{max} must lie within the permissible setting range.
DN 15...50: V'_{max} = 25...100% of V'_{nom} (catalogue value)
During commissioning, the desired system-specific flow rate value V'_{max} is set on the valve using the Belimo Assistant App (NFC) or via bus.

Plant-specific setting of the maximum flow V'_{max} (Example EP032R2+BAC)



Verification of the differential pressure

For proper operation, the differential pressure across the valve must lie within a defined range.

Minimum differential pressure (minimum pressure drop)

The minimum required differential pressure (pressure drop across the valve) to reach the desired flow rate V'_{max} can be calculated using the theoretical k_{vs} value (see data sheet) and the formula below. The calculated value depends on the required maximum flow rate V'_{max}. Higher differential pressures are compensated for automatically by the valve.

Formula Δp_{min}

$$\Delta p_{min} = 100 \cdot \left(\frac{V'_{max}}{k_{vs}}\right)^2 + 16$$

Δp_{min} : [kPa]
V'_{max} : [m^3/h]
k_{vs} : [m^3/h]

Example:

(DN 25 with desired maximum flow = 58% V'_{nom})
EP025R2+BAC
k_{vs} theor. = 8.6 m^3/h
V'_{nom} = 58.3 l/min
58% * 33.8 l/min = 2.0 m^3/h

$$\Delta p_{min} = 100 \cdot \left(\frac{V'_{max}}{k_{vs\ theor.}}\right)^2 = 100 \cdot \left(\frac{2\ m^3/h}{8.6\ m^3/h}\right)^2 = \mathbf{5.4\ kPa}$$

Maximum differential pressure

The valve automatically compensates for higher differential pressures. Motion of the closing element in the direction of the closing point causes an increase in the pressure drop across the valve. This ensures a constant water quantity The permitted maximum differential pressure is specified in the data sheet.

Sizing with missing hydronic data

If no hydronic data are available, the nominal diameter of the valve can be selected equal to the nominal diameter of the heat exchanger.

Flow characteristics

In the case of an electronic pressure-independent characterised control valve, the control signal request corresponds directly to a flow value.
The electronic pressure-independent characterised control valve offers various setting options with which the characteristic curve can be influenced:

Characteristics of the characteristic curve
- Equal percentage with a characteristic curve factor n(gl) = 3.2, optimised in the opening range * (factory setting)
- Linear

Operating range Y
- DC 2...10 V (factory setting)
- Starting point DC 0.5...24 V/end point DC 8.5...32 V

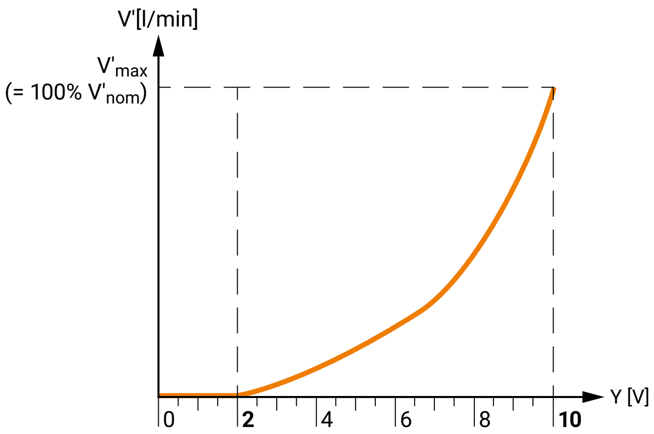
Adjustable flow rate V'_{max}
- DN 15...50: 25...100% of V'_{nom}
- Factory setting $V`_{max}$ = 100% of V'_{nom}

Invert signal
- No (factory setting)
- Yes

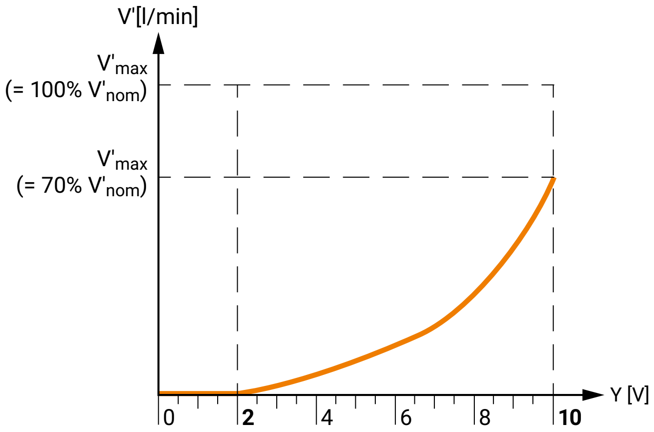
* The course is linear in the lower flow range between 0...35% stroke. This ensures outstanding control characteristics, including in the lower partial load range.

Flow rate curves

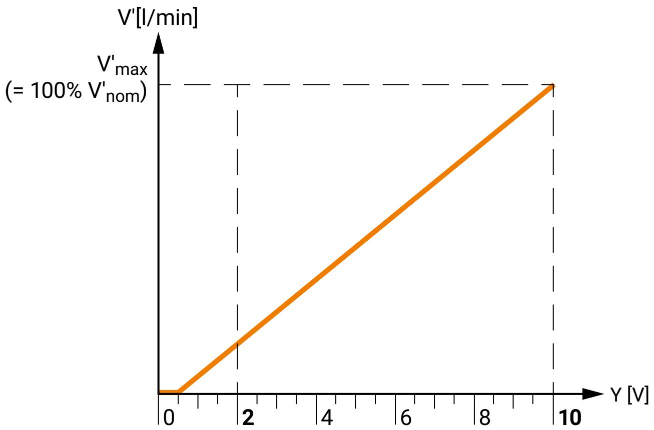
Factory setting:



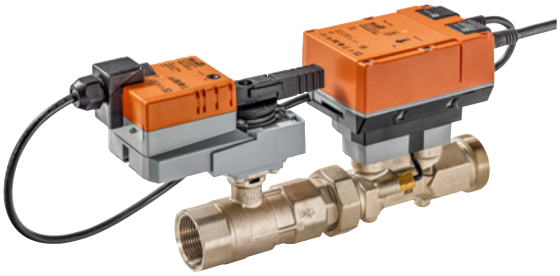
Setting:
– V'_{max} reduced



Setting:
– Linear characteristic
– Operating range 0.5...10 V



Dimensional diagram electronic pressure-independent characterised control valve (EPIV)



Application

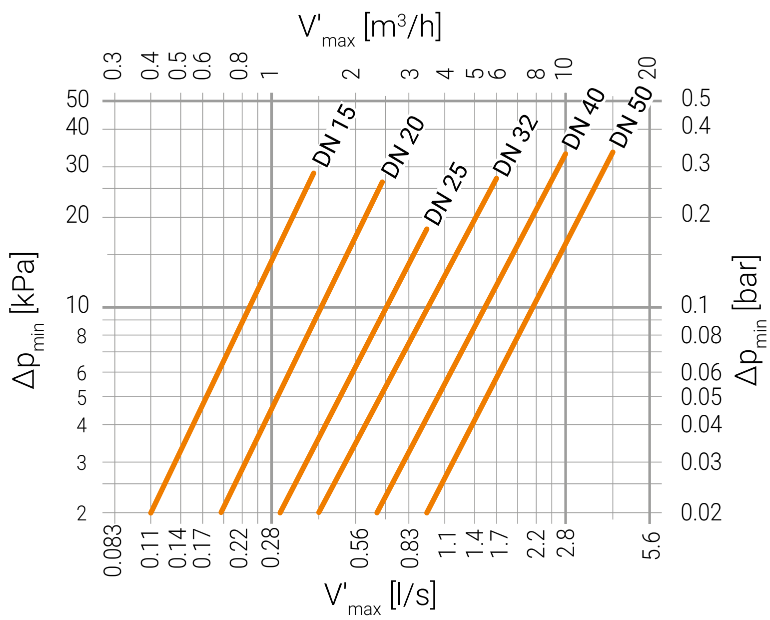
This control device is used in closed cold and warm water systems for modulating water-side control of ventilation and heating systems.

Media

Cold and hot water, water with glycol up to max. 60% vol.

Fluid temperatures

The permissible fluid temperatures can be found in the corresponding data sheet.



Δp_{min} Minimum required differential pressure (pressure drop across the valve) to reach the desired flow rate V'_{max}

V'_{max} Desired flow rate should be achieved at full load. Flow at greatest control signal, e.g. 10 V

Formula Δp_{v100}

$$\Delta p_{min} = 100 \cdot \left(\frac{V'_{max}}{k_{vs}}\right)^2$$

Δp_{min} : [kPa]
V'_{max} : [m^3/h]
k_{vs} : [m^3/h]

Definitions

Formula symbol

k_v	Flow rate factor or flow coefficient (catalogue value). The k_v value corresponds to the volumetric flow of water through a valve (in m^3/h or l/min) with a differential pressure of 100 kPa (1 bar), a water temperature of 5...40°C and at a fixed opening angle
k_{vs}	The kv value in reference to the nominal delay angle is referred to as the k_{VS} value. The manufacturer specifies the maximum valve opening of the nominal delay angle. Characterised control valves (CCV): Flow coefficient at 100% valve opening (90° angle of rotation)
Δp_S	Closing pressure at which the actuator can still seal the butterfly valve tightly allowing for the appropriate leakage rate
Δp_{v0}	Differential pressure at closing element opening
Δp_{v100}	Differential pressure across the completely opened valve at V'_{100}
V'_{max}	Set maximum flow rate of a pressure-independent valve with the greatest control signal, e.g. 10 V
V'_{nom}	Maximum possible flow rate of a pressure-independent valve, catalogue value, delivery condition

Further documentation

- Data sheets of the electronic pressure-independent characterised control valve EPIV
- Installation instructions
- General notes for project planning

All inclusive.

Belimo as a global market leader develops innovative solutions for the controlling of heating, ventilation and air-conditioning systems. Damper actuators, control valves, sensors and meters represent our core business.

Always focusing on customer value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

The “small” Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

In short: Small devices, big impact.

- 5-year warranty
- On site around the globe
- Complete product range
- Tested quality
- Short delivery times
- Comprehensive support

EN – 2022-09/A – Subject to technical modifications

BELIMO Automation AG
Brunnenbachstrasse 1, 8340 Hinwil, Switzerland
+41 43 843 61 11, info@belimo.ch, www.belimo.com

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