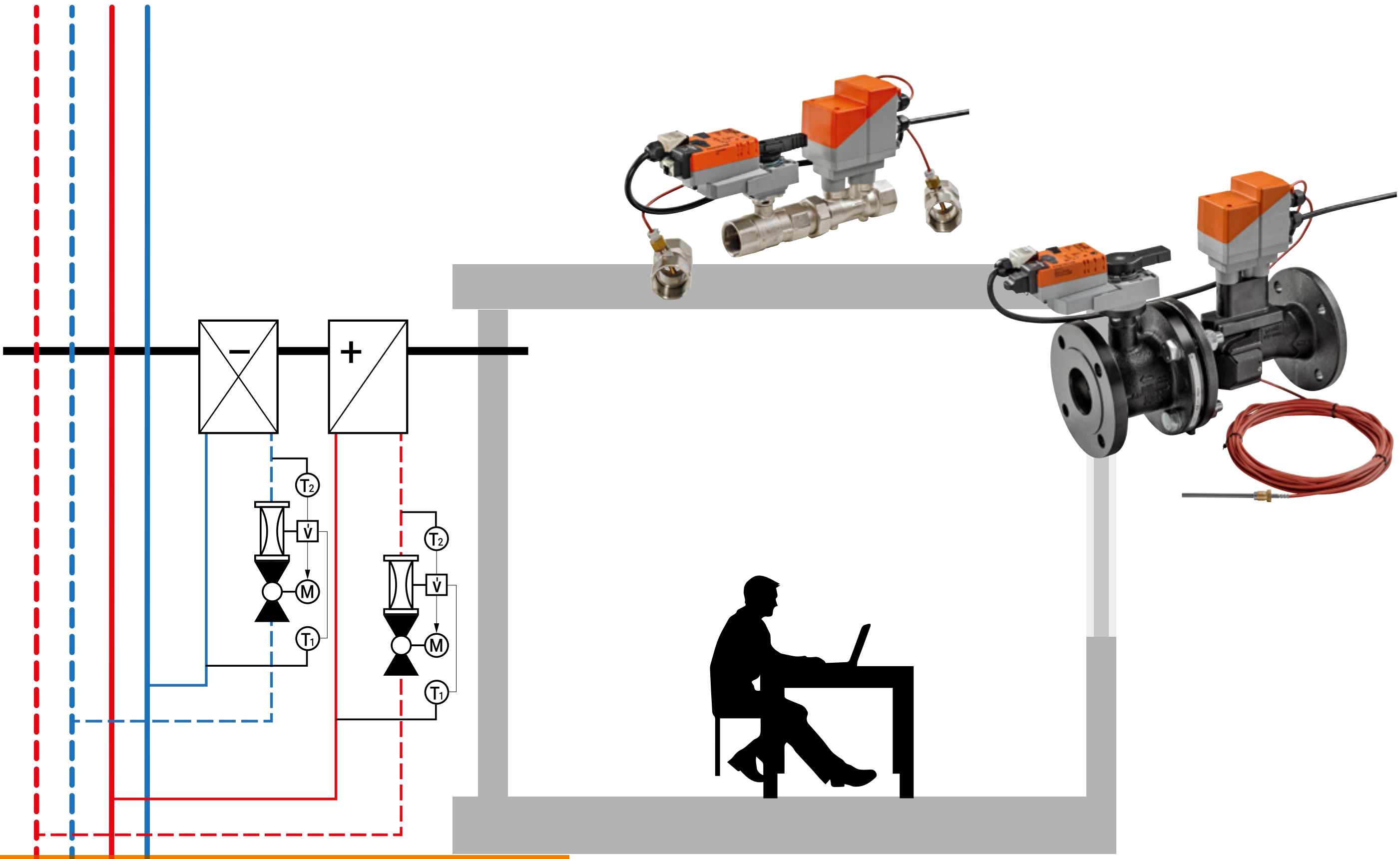

Notes for project planning

Electronic pressure-independent characterised control valve with energy monitoring
Belimo Energy Valve™

Edition 2021-10/A

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BELIMO

General

Version information

These instructions apply to products listed below with a production date on or after 31 March 2017:

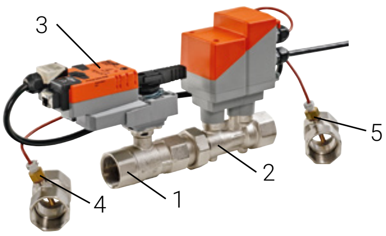
Belimo Energy Valve™ DN 15...50
– EV0..R+(K)BAC
– Belimo Energy Valve™ DN 65...150
– P6..W..EV-(K)BAC or EV..F+(K)BAC
– Earlier versions may have different representations and functions. If in doubt, please contact your Belimo representative.

Belimo Energy Valve™

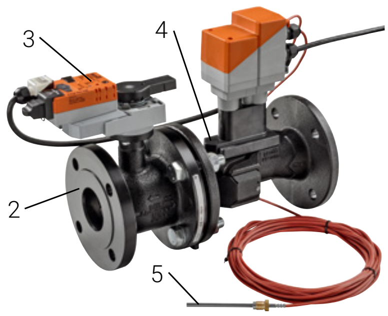
Structure

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 volumetric flow sensor**
   Ultrasonic flow measurement optimally adapted to the requirements of the application
3. **Actuator with integrated web server**
   Actuator specially optimised for pressure-independent flow control with energy monitoring function, data logging, delta T manager, power control, and much more
4. **Temperature sensor T1**
   • DN 15...50: cable length 3 m
   • DN 65...150: cable length 10 m
5. **Temperature sensor T2**
   • DN 15...50: cable length 0.8 m
   • DN 65...150: installed in valve unit

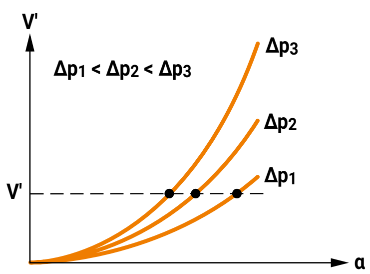
Nominal diameter DN 15...50



Nominal diameter DN 65...150

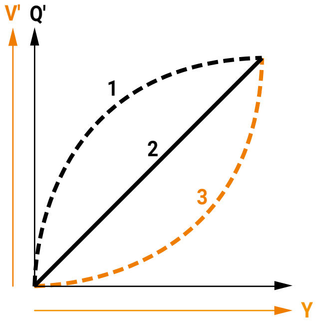


Mode of operation



The actuator is comprised of four components: control ball valve, measuring pipe with volumetric flow sensor, temperature sensors and the drive. The set maximum flow (V'_{max}) is allocated to the maximum positioning signal (typically 10 V / 100%). Alternatively, the positioning signal can be assigned to the valve opening angle or to the power required at the heat exchanger. The fluid is recorded in the measuring pipe by the sensor and is applied as the flow rate value. The measured value is compared with the setpoint (analogue positioning signal or request via bus communication). The drive corrects the deviation by chaning the valve position. The angle of rotation α varies, depending on the differential pressure across the HVAC performance device.

Transfer response of the heat exchanger



Depending on the design, temperature spread, fluid and hydronic circuit, the power Q' is not proportional to the water volumetric flow V' (curve 1). With the traditional 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 Belimo Energy Valve™ can be changed from equal percentage to linear.

Control functions

With the Belimo Energy Valve™, various control variables can be allocated to the positioning signal, depending on the respective requirements.

1. **Position control**
   In this setting, the positioning signal is assigned to the opening angle of the valve (e.g. Y = 10 V <–> α = 90°). This results in pressure-dependent operation similar to that of a conventional valve.
2. **Flow control**
   The positioning signal directly requires a defined water quantity (e.g. Y = 10 V <–> V' = 80 l/min). The valve unit selects the opening angle automatically so that the requested water quantity is available. Differential pressure fluctuations are thus automatically compensated for by the Belimo Energy Valve™ –> pressure-independent operation.
3. **Power control**
   In this setting, the power output at the heat exchanger is used as a control variable (e.g. Y = 10 V' <–> Q' = 20 kW). The valve unit selects the opening angle automatically so that the requested power is provided to the heat exchanger. Influences of differential pressure and temperature fluctuations are automatically compensated for –> pressure and temperature-independent operation.

Project planning

Relevant information

The data, information and limit values on the data sheets of the electronic pressure-independent characterised control valves Belimo Energy Valve™ must be taken into account.

- EV..R+BAC (DN 15...50 with standard actuator)
- EV..R+KBAC (DN 15...50 with electrical fail-safe)
- P6..W..EV-BAC (DN 65...150 with standard actuator)
- P6..W..EV-KBAC (DN 65...150 with electrical fail-safe)
- EV..F+BAC (DN 65...150 with standard actuator)
- EV..F+KBAC (DN 65...150 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.

2-way version

2-way Belimo Energy Valves™ are throttling devices. The installation in the return flow is recommended. This leads to lower thermal loads on the sealing elements of the valve.

Flow direction

Observe the specified direction of flow.

Water quality

Adhere to the water quality requirements specified in VDI 2035.

Strainer

The Belimo Energy Valve™ is a regulating device. Central strainers are recommended to ensure the control task in the long term.

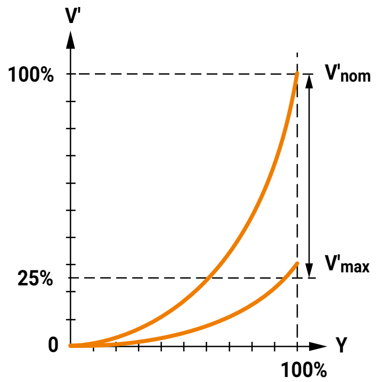
Design water system

Application is permitted only in closed water circuits.

Open/close valves

Make sure that a sufficient number of open/close valves are installed.

Definitions



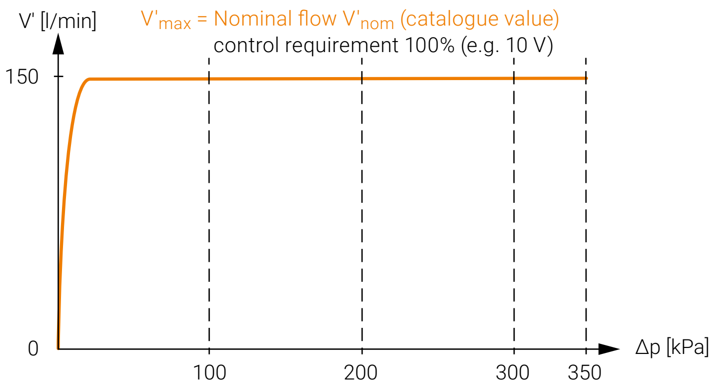
V'_{nom} is the maximum possible flow.
V'_{max} is the maximum flow rate which has been set with the greatest positioning signal, e.g. 10 V.
V'_{max} can be set between 30% and 100% of V'_{nom} (DN 15...50).
V'_{max} can be set between (30%) 45% and 100% of V'_{nom} (DN 65...150).
V'_{min} 0% is not variable.

Design and dimensioning

A conventional (pressure-dependent) valve is designed based on the k_V value. For a given nominal flow rate, this depends on the differential pressure across the valve. In order to obtain sufficient quality of control, the valve authority P_V must also be taken into account for pressure-dependent valves.
For a pressure-independent solution, such as the Belimo Energy Valve™, the design is greatly simplified. Due to the automatic adjustment of flow deviations, the Energy Valve always provides the required water quantity even with differential pressure fluctuations and during partial load operation. Due to dynamic balancing, the valve authority amounts to 1.

Constant flow volume V'

Due to permanent balancing of the measured flow value with the setpoint and corresponding automatic re-adjustment of the valve opening position, a constant, pressure-independent water quantity is ensured over a large differential pressure range.

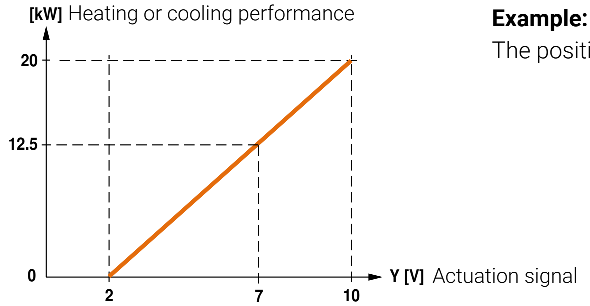


Pressure-independent flow over a large differential pressure range due to dynamic balancing (example: EP040R+MP).

Constant power output Q'

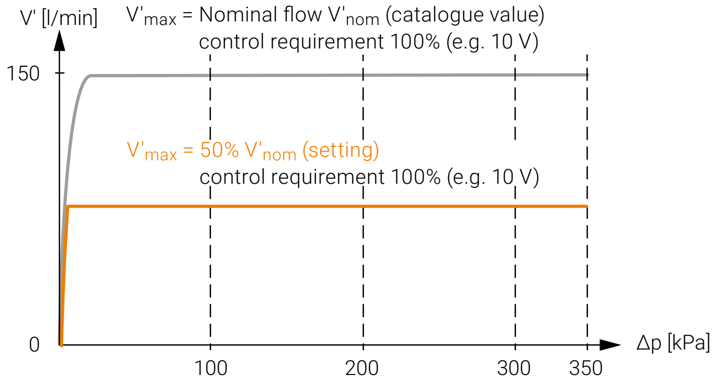
The power output at the heat exchanger is influenced not only by the flow volume but also by the water temperature. A changed supply temperature, for example, can adversely affect the power output and thus comfort. In the power control function, the Energy Valve automatically compensates for the influence of the differential pressure in addition to the influence of the temperature. Due to the pressure and temperature-independent operating mode, optimum comfort is always ensured.

Example: power control with set Q'_{max} = 20 kW
The positioning signal directly requires a power output at the heat exchanger.



Valve design

The valve is determined using the maximum flow required V'_{max}. Calculation of the k_{vs} value is not required. The required plant-specific maximum flow V'_{max} must be within the permissible setting range.
DN 15...50: V'_{max}= 30...100% of V'_{nom} (data sheet value)
DN 65...150: V'_{max} = (30) 45...100% of V'_{nom} (data sheet value)
If the Belimo Energy Valve™ is to be operated in the control function power control, the maximum controllable power according to the data sheet must also be observed.
During commissioning, the desired plant-specific flow value V'_{max} is set on the valve using the ZTH EU service tool, the integrated web server or via bus.



Plant-specific setting of the maximum flow V'_{max}
(Example: EP040R+MP)

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 volumetric flow 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 volumetric flow V'_{max}. Higher differential pressures are compensated for automatically by the valve.

Formula:

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

Δp_{min}:	kPa
V'_{max}:	m^3/h
$k_{vs\,theor}$:	m^3/h

Example:
(DN 25 with desired maximum flow = 58% V'_{nom})
EP025R+MP
k_{vs} theor. = 8.6 m^3/h
V'_{nom} = 69 l/min
58% * 69 l/min = 40 l/min = 2.4 m^3/h

$$\Delta p_{min} = 100 \times \left(\frac{V'_{max}}{k_{vs\,theor.}}\right)^2 = 100 \times \left(\frac{2.4\ m^3/h}{8.6\ m^3/h}\right)^2 = 8\ kPa$$

Maximum differential pressure
Higher differential pressures across the valve are compensated for automatically by this. 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, then the same valve DN can be selected as the nominal diameter of the heat exchanger.

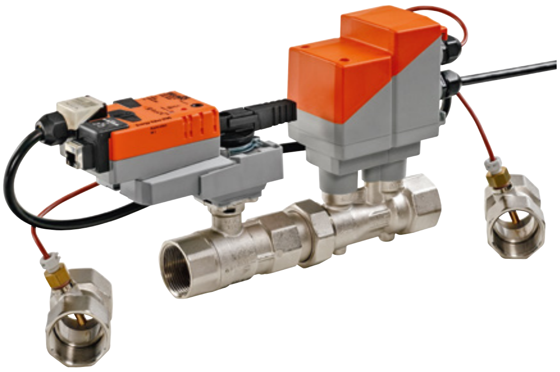
Flow characteristics

In the case of an electronic pressure-independent characterised control valve, the actuation signal requirement corresponds directly to a flow value. Alternatively, the control functions power control and position control are available.

Settings

The Belimo Energy Valve™ offers diverse setting possibilities. Please refer to the separate document for a detailed description:
Web server 4.0 manual – Belimo Energy Valve™.

Dimensional diagram for EV DN 15...50



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. 50% vol.

Fluid temperatures

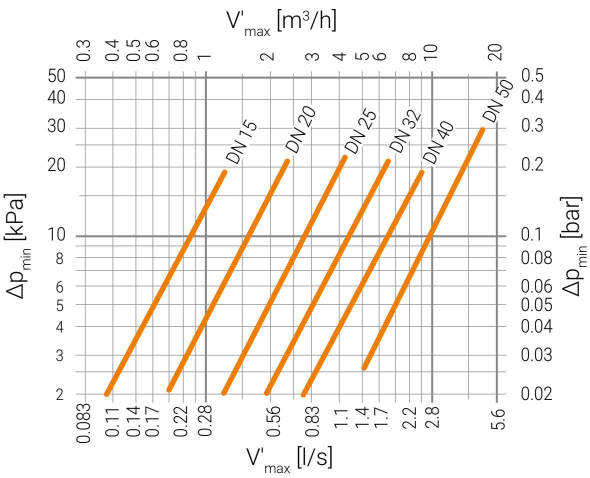
The permissible fluid temperatures can be found in the corresponding data sheet.

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

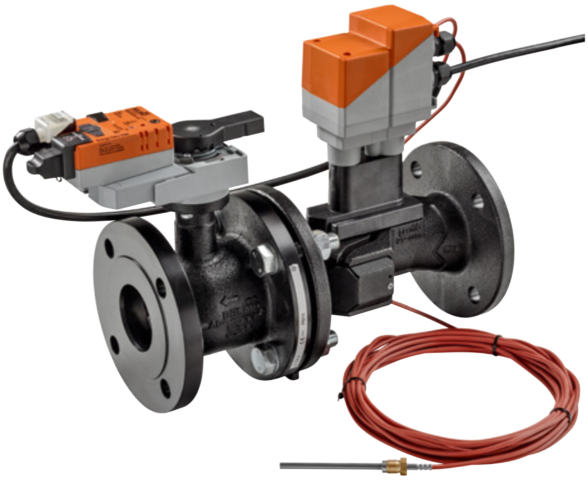
V'_{max}
Desired volumetric flow that should be achieved at full load. Flow at greatest positioning signal, e.g. 10 V

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

Δp_{min}:	kPa
V'_{max}:	m^3/h
$k_{vs\ theor}$:	m^3/h



Dimensional diagram for EV DN 65...150



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. 50% vol.

Fluid temperatures

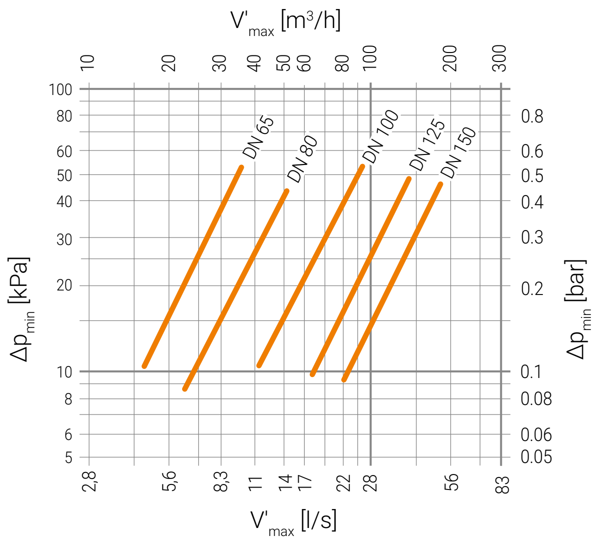
The permissible fluid temperatures can be found in the corresponding data sheet.

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

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

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

Δp_{min}:	kPa
V'_{max}:	m^3/h
$k_{vs\ theor}$:	m^3/h



All inclusive.

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

Always focusing on customer added 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

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

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