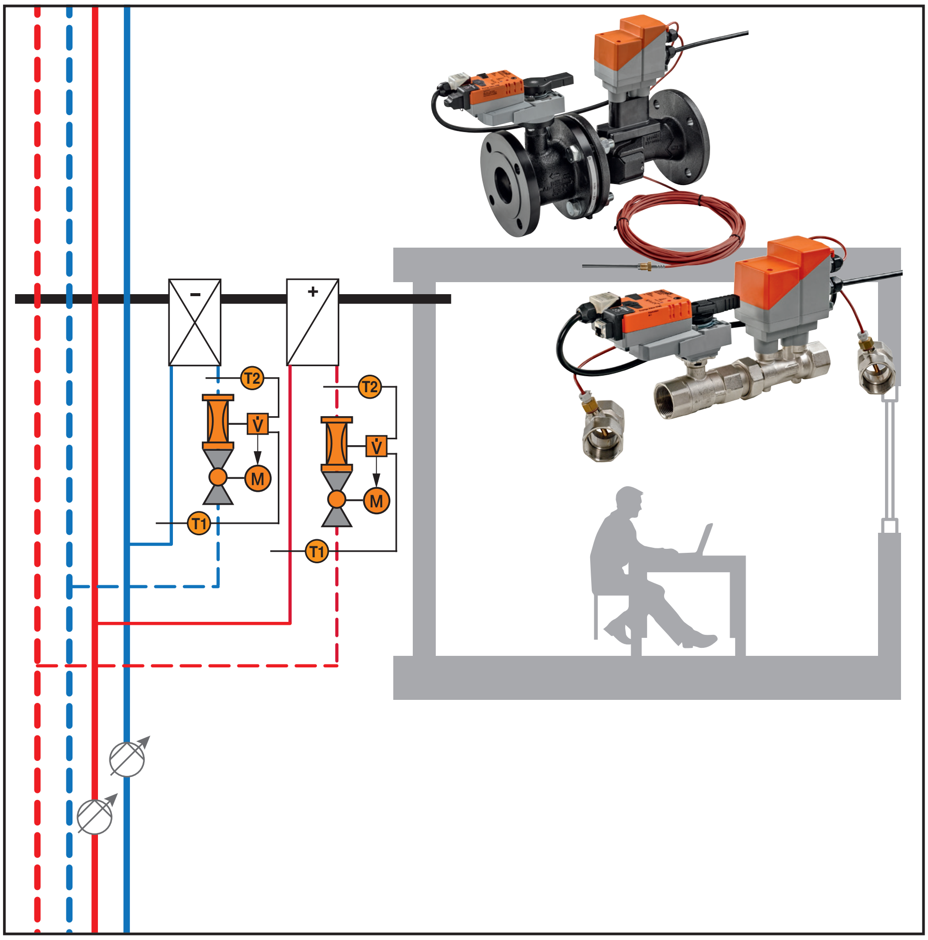

Electronic pressure-independent characterised control valve with energy monitoring
Belimo Energy Valve™

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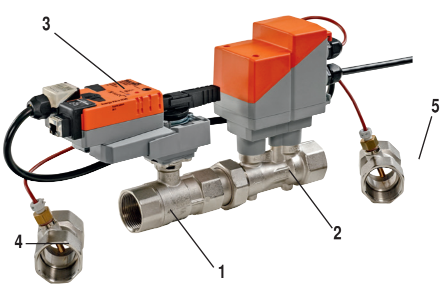
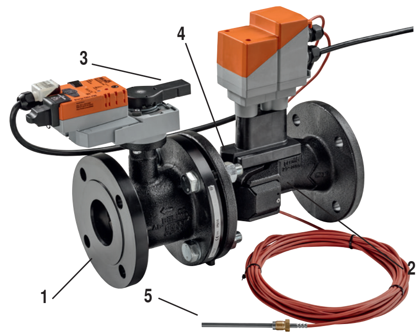
The Belimo Energy Valve™

Structure

Nominal diameter DN 15-50



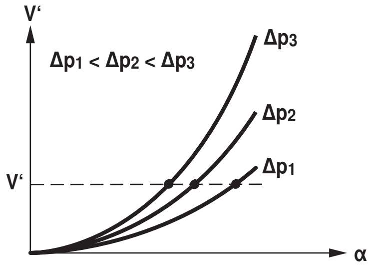
Nominal diameter DN 65-150



1. Characterised control valve (leakage rate A according to EN 12266-1)
   Air bubble-tight sealing regulating device ensures absolutely sealed shutting 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 field of 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: Built into valve unit

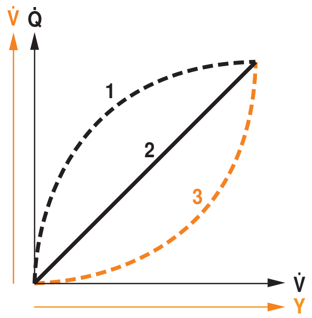
Mode of operation

The control device is comprised of four components: characterised control valve, measuring pipe with volumetric flow sensor, temperature sensors and the actuator. The set maximum flow ($\dot{V}_{max}$) is assigned to the maximum positioning signal (typically 10 V/100%). Alternatively, the positioning signal can be assigned to the valve opening angle or the power required at the heat exchanger. The medium 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 requirement via bus communication) . The actuator corrects the deviation by changing the valve position. The angle of rotation α varies according to the differential pressure through the control element.



Transfer response of the heat exchanger

Depending on the construction type, temperature spread, medium and hydraulic circuit, the power Q' is not proportional to the water volumetric flow V' (Graph 1). In classical temperature control, it is attempted to keep the positioning signal Y proportional to the power Q' (Graph 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 Energy Valve ™ can be changed from equal percentage to linear.

The Belimo Energy Valve™ (continued)

Control functions

With the Energy Valve ™, the positioning signal can be assigned to different actuation variables 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°) The result is a pressure-dependent operation as in 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 automatically compensated for by the Energy Valve ™→ pressure-independent operation
3. Power control
   In this setting, the power output at the heat exchanger is used as an actuation 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 Belimo Energy Valve ™ must be observed or complied with.
– EV..R+BAC (DN 15-50 with standard actuator)
– EV..R+KBAC (DN 15-50 with electrical emergency control function)
– P6..W..EV-BAC (DN 65-150 with standard actuator)
– P6..W..EV-KBAC (DN 65-150 with electrical emergency control function)
– EV..F+BAC (DN 65-150 with standard actuator)
– EV..F+KBAC (DN 65-150 with electrical emergency control function)

Dimensions

The dimensions of the actuator combination used depend on the design and nominal diameter used. The dimensions are listed on the 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 version. The dimensions can be found on the corresponding data sheet.

2-way version

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

Direction of flow

The specified direction of flow must be observed.

Water quality

The water quality requirements specified in VDI 2035 must be adhered to.

Strainer

The Energy Valve ™ is a regulating device. So that the control task can be taken over in the long term, central strainers are recommended in the system.

Design water system

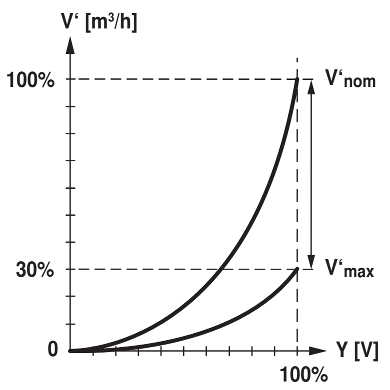
Application is permissible only in closed water circuits.

Shut-off devices

Care must be taken to ensure that sufficient numbers of shut-off devices 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} (DN15-50).
V'_{max} can be set between (30)45% and 100% of V'_{nom} (DN 65-150).
V'_{min} 0% non-variable.



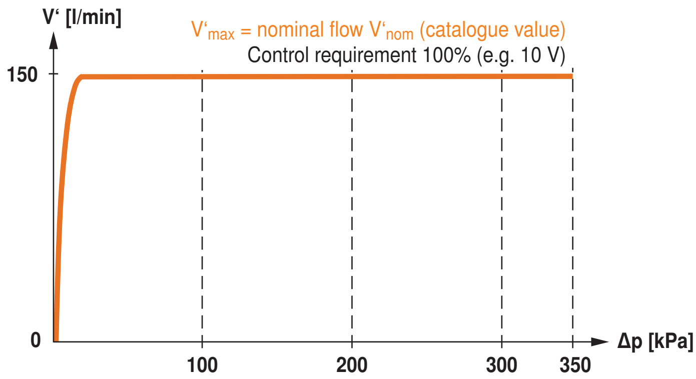
Design and dimensioning

A conventional (pressure-dependent) valve is designed based on the kv value. For a given nominal flow, this is dependent on the differential pressure which is present across the valve. In order to obtain a sufficient quality of control, the valve authority Pv 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 this dynamic balancing, the valve authority amounts to 1.

Constant flow volume V' (control function flow control)

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

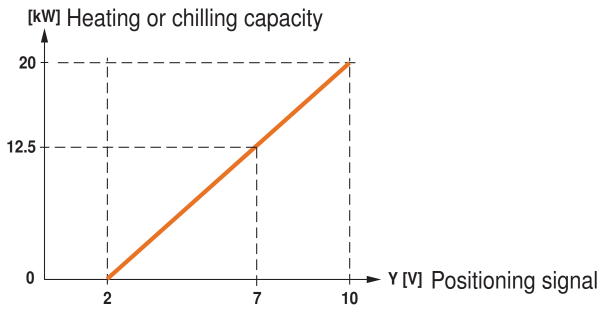


Pressure-independent flow over a large differential pressure range due to dynamic balancing (Example EP040R+MP)

Constant power output Q' (control function power control)

The power output on 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 the comfort. In the control function power control, in addition to the influence of the differential pressure, the influence of temperature is also automatically compensated for by Energy Valve ™ . Due to the pressure and temperature-independent mode of operation, optimum comfort is always ensured.

The positioning signal requires directly a power output at the heat exchanger.



Example power control with set Q'_{max} = 20 kW

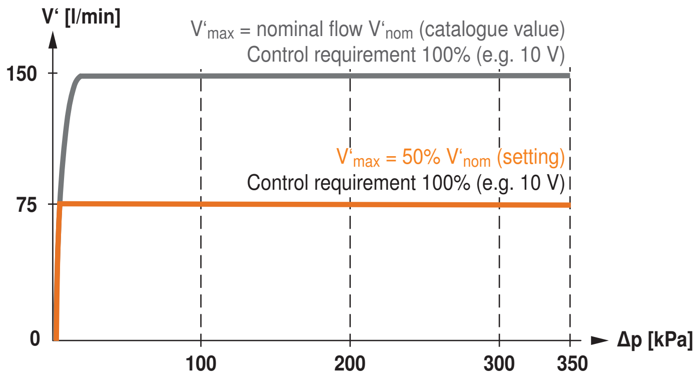
Valve design

The valve is determined using the maximum flow rate required V'_{max}. A calculation of the kvs value is not required. The required system specific maximum flow V'_{max} must lie within the permissible setting ranges.

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 power control operating mode, the maximum controllable power according to the data sheet must be observed.
During commissioning, the desired system-specific flow rate value V'_{max} is set on the valve using the ZTH EU adjustment tool, integrated web server or via bus.

Design and dimensioning (continued)



System 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 kvs 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 the desired maximum flow = 58% V'_{nom})
EP025R+MP
kvs 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. A movement 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 permissible maximum differential pressure is specified on the data sheet.

Design on missing hydraulic data

If no hydraulic data are available, then the same valve DN can be selected as the heat exchanger nominal diameter.

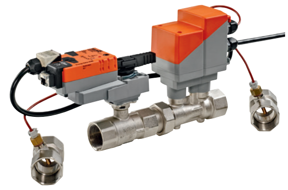
Flow characteristics

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

Settings

The Belimo Energy Valve™ offers diverse setting possibilities. The detailed description can be found in the separate document *Instructions Web server Belimo Energy Valve™*.

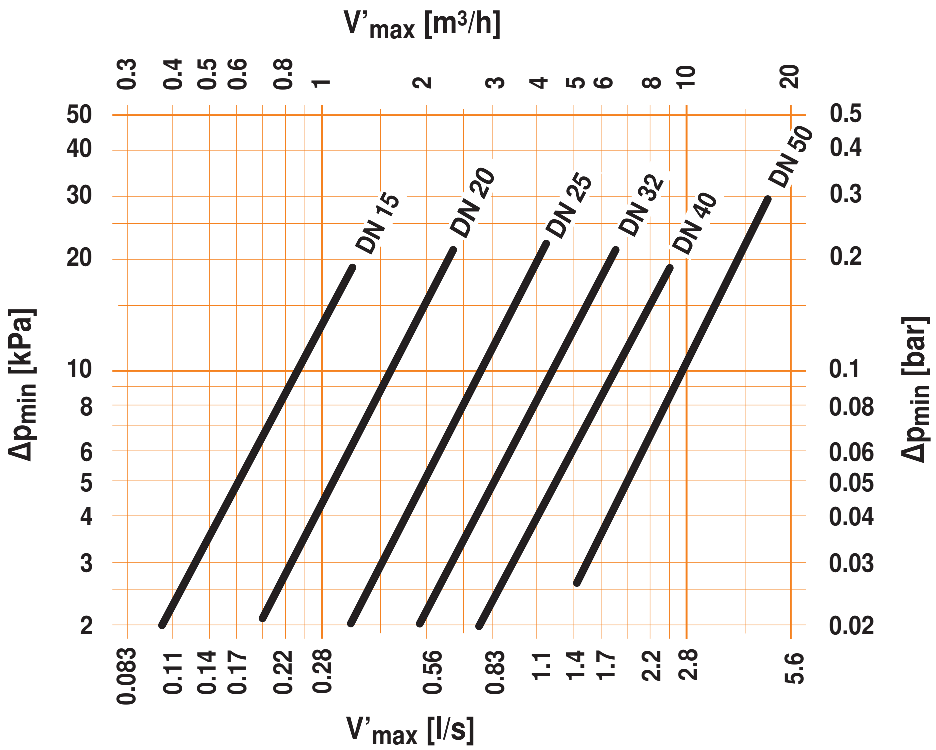
Dimensional diagram for EV DN 15-50



Application This control device is used in closed cold and warm water systems for continuous water-side control of air handling units and heating systems.

Media Cold and warm water, water with glycol up to max. 50% vol.

Medium temperatures The permissible medium temperatures can be found in the corresponding data sheets.



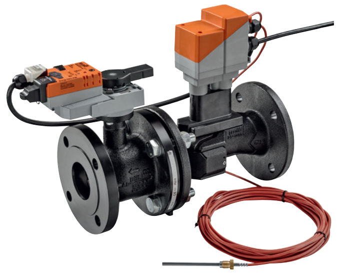
—— Δp_{min}
The minimum required differential pressure (pressure drop across the valve) to reach the desired volumetric flow $\dot{V}_{max}$

—— $\dot{V}_{max}$
Desired volumetric flow 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

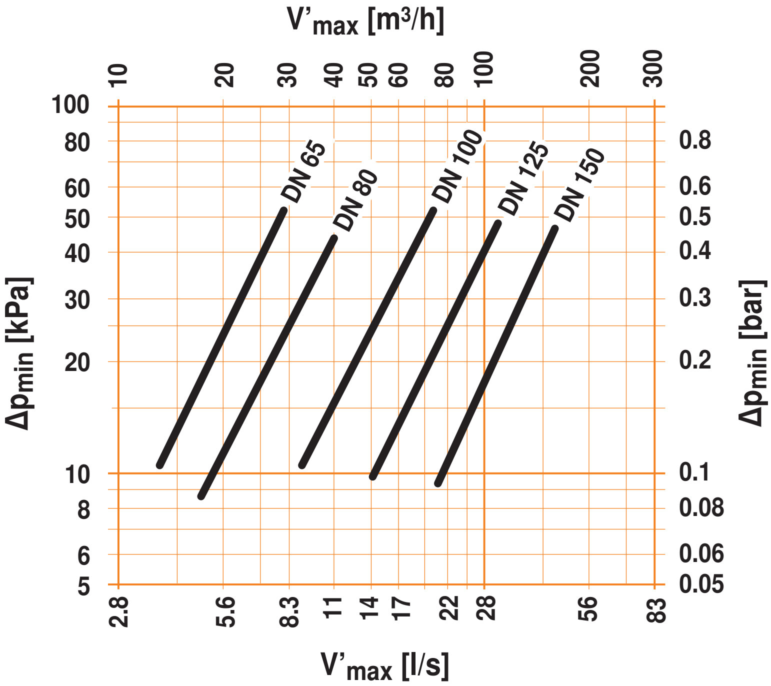
Dimensional diagram for EV DN 65-150



Application This control device is used in closed cold and warm water systems for continuous water-side control of air handling units and heating systems.

Media Cold and warm water, water with glycol up to max. 50% vol.

Medium temperatures The permissible medium temperatures can be found in the corresponding data sheets.



—— Δp_{min}
The minimum required differential pressure (pressure drop across the valve) to reach the desired volumetric flow $\dot{V}_{max}$

—— $\dot{V}_{max}$
Desired volumetric flow 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}: m³/h
$k_{vs\ theor.}$: m³/h

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