

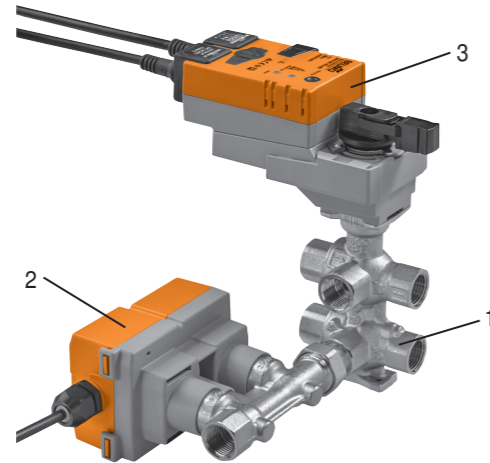
## Electronic pressure-independent 6-way characterised control valve

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## The electronic characterised control valves (EPIV)

Structure Nominal diameter DN 15/20



1. 6-way characterised control valve (Leakage rate A according to EN 12266-1)  
Air-bubble tight sealing regulating device ensures absolute tight isolation at zero load and thus reliably prevents activation losses
2. Measuring pipe with volumetric flow sensor  
Optimally adapted to the requirements of the ultrasonic flow measurement field of application
3. Actuator  
Actuator specially optimised for pressure-independent flow control

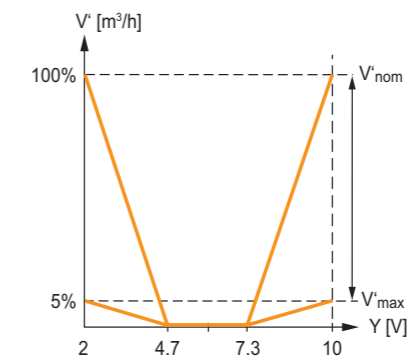
**Mode of operation** The actuator consists of three components: 6-way characterised control valve, measuring pipe with volumetric flow sensor and actuator. The set maximum flow for sequence 1 ( $V'_{max1}$ ) and sequence 2 ( $V'_{max2}$ ) are allocated to the positioning signal (2 V for sequence 1, 10 V for sequence 2).  
The actuator is under analogue control. The fluid is detected by the sensor in the measuring pipe and is applied as the flow value. The measured value is balanced with the setpoint. The drive corrects the deviation by changing the valve position.

**Control behaviour** The velocity of the medium is measured in the measuring component (sensor electronics) and converted to a flow rate signal.  
The actuation signal Y corresponds to the power Q via the exchanger. The volumetric flow is controlled in the 6-way EPIV. The actuation signal Y is converted into a linear volumetric flow characteristic curve and provided with the 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 rate sensor ensure a stable quality of control. It is however not suitable for rapid control processes, i.e. for domestic water control.

U5 displays the measured volumetric flow  $V'_{max1}$  or  $V'_{max2}$  as voltage (factory setting).

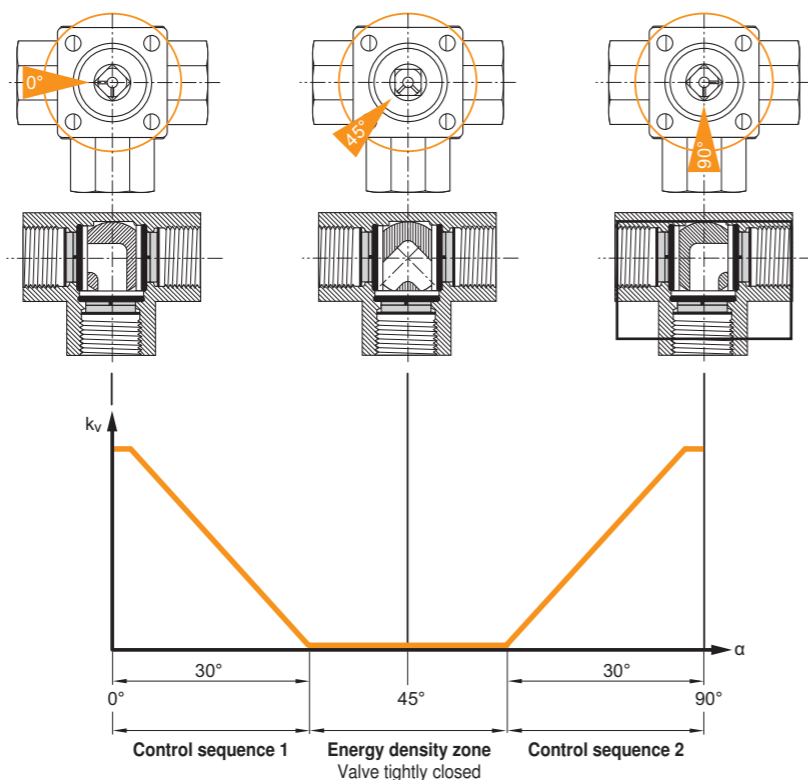
## Project planning

- Relevant information** The data, information and limit values listed on the data sheets of the (electronic pressure independent) 6-way characterised control valves are to be taken into account and/or complied with, respectively.  
EP..R-R6+BAC (Electrical pressure independent 6-way RKH DN 15/20)  
- R30...-...-B2 (6-way RKH DN15/20)
- Dimensions** The dimensions of the drive 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.
- Flow direction** The specified flow direction must be observed
- Water quality** The water quality requirements specified in VDI 2035 must be adhered to.
- Dirt filter** The 6-way EPIV is a regulating device. So that the control tasks can be taken over in the long term, central dirt filters are recommended in the system.
- Water systems version** Application is permitted only in closed water circuits.
- Isolation valves** Care must be taken to ensure that sufficient numbers of isolation valves are installed.
- Definitions**  $V'_{nom}$  is the maximum possible flow. ( $V'_{nom}=V'_{nom1}=V'_{nom2}$ )  
 $V'_{max1}$  is the maximum flow which has been set with the smallest positioning signal, for example, 2 V.  
 $V'_{max2}$  is the maximum flow rate which has been set with the greatest actuation signal, for example, 10 V.  
 $V'_{max1}$  and  $V'_{max2}$  can be set between 5% and 100% of  $V'_{nom}$ .  
 $V'_{min}$  0% (non-variable).



Project planning (continuation)

**Valve characteristic curve** When the valve is rotated by 90°, these 3 sequences are run through.



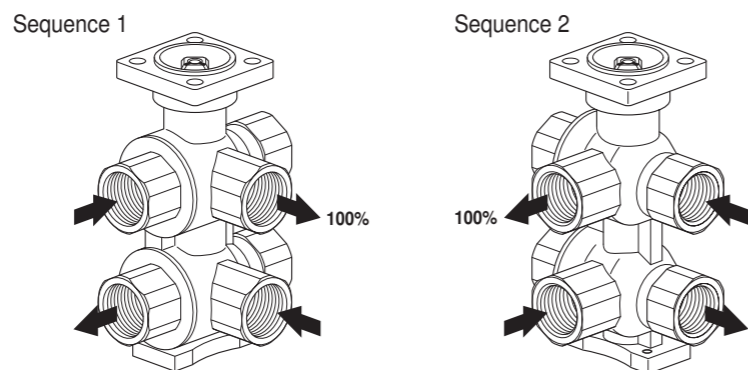
**Allocation of the sequences** Allocation to hot and chilled water is in principle, freely selectable. However, due to installation safety, the definition of an equal allocation for all valves is recommended.



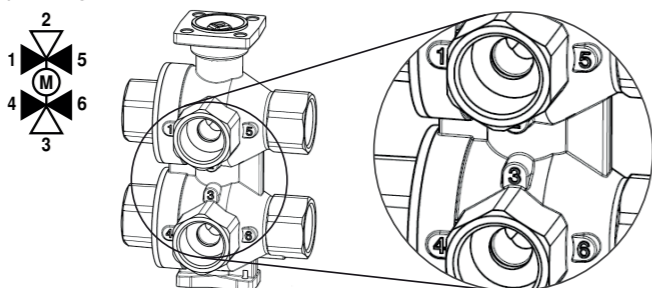
Due to the control characteristics of the room temperature controller CRK24-B1 from Belimo, the following mandatory allocation is to be selected when used:

- Sequence 1 = cooling
- Sequence 2 = heating

**Flow direction** The direction of flow must be observed.



**Marking of the connection gates** These are numbered from 1 to 6 for the purpose of secure allocation of the connections during planning and installation.

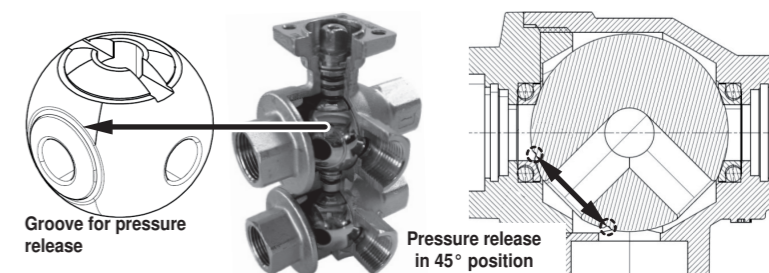


Protection of the heating/cooling element (pressure release function)

In cases of combined heating/cooling control elements, the fluid remains in the control element when in the closed position (no heating or cooling). The pressure of the enclosed fluid can rise or fall due to changes in fluid temperature caused by the ambient temperature. The 6-way characterised control valves have an integrated pressure release function for the purpose of compensating for such pressure changes.

**Design for pressure release**

The upper ball of the characterised control valves is equipped with a groove that establishes a connection between the "Supply Sequence 1" (Gate 1) connection point and the heating/cooling element connected to Gate 2 when in the closed position.



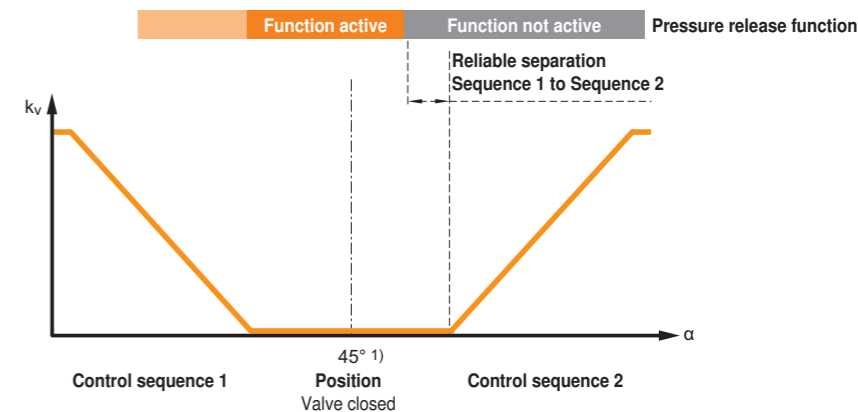
**Function**

**Pressure change in the heating/cooling element with closed valve**

The corresponding differential pressure in the heating/cooling element is compensated for by means of the connection to the 'Sequence 1' circuit. After pressure compensation, there is no further water flow due to the same absolute pressures in Sequence 1 and in the heating/cooling element and the air-bubble tight closing lower closing element.

**Behaviour in hot or cold operation**

The pressure relief function has no influence on the hot or cold operation. When operating sequence 1, the function is on the same side as the desired water flow. When operating sequence 2, the pressure relief function is not active. A direct mixing of water of the sequences of 1 and 2 is not possible duration operation.

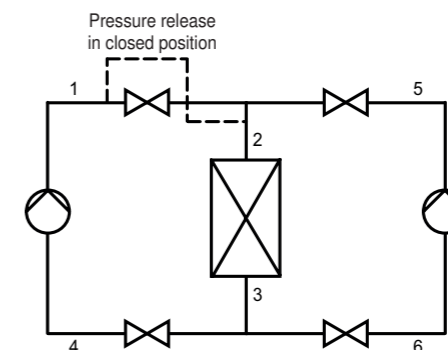


<sup>1</sup>Positioning signal for closed position:  
Operating range drive 2...10 V: Y = 6 Volt  
Operating range drive 0.5...10 V: Y = 5.25 Volt

**Valve leakage rate**

Each water circuit is channeled through two valve cones (series circuit). As a result of the continued air-bubble tight closing of the lower closing element 2, the valve continues to exhibit Leakage rate A in accordance with EN 12266-1, even for Sequence 1.

**Equivalent circuit diagram**

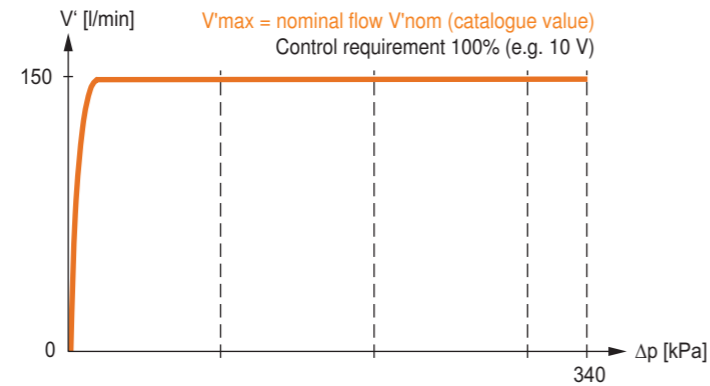


## Design and dimensioning

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 6-way EPIV, the design is greatly simplified. Due to the automatic adjustment of flow deviations, the 6-way EPIV provides the required water quantity at any time, even with differential pressure fluctuations and in partial load operation. Due to this dynamic adjustment, the valve authority amounts to 1.

**Constant flow volume V'** Due to the permanent comparison of the measured flow value with the target value and the 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)

**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 permitted setting ranges  
 DN 15/20:  $V'_{max} = 5 \dots 100\%$  of  $V'_{nom}$  (data sheet value)  
 During commissioning, the desired system-specific flow rate value  $V'_{max}$  is set on the valve using the ZTH EU actuator, NFC (Belimo Assistand App) or via bus.

## Design and dimensioning (Continued)

**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 automatically compensated by the valve.

Formula:

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

$\Delta p_{min}: \text{kPa}$   
 $V'_{max}: \text{m}^3/\text{h}$   
 $k_{vs \text{ theor.}}: \text{m}^3/\text{h}$

Example (DN 25 with desired maximum flow = 50%  $V'_{nom}$ )

EP025R+MP

$k_{vs \text{ theor.}} = 8.6 \text{ m}^3/\text{h}$

$V'_{nom} = 69 \text{ l/min}$

$50\% \cdot 69 \text{ l/min} = 34.5 \text{ l/min} = 2.07 \text{ m}^3/\text{h}$

$$\Delta p_{min} = 100 \times \left( \frac{V'_{max}}{k_{vs \text{ theor.}}} \right)^2 = 100 \times \left( \frac{2.07 \text{ m}^3/\text{h}}{8.6 \text{ m}^3/\text{h}} \right)^2 = 6 \text{ kPa}$$

**Maximum differential pressure**

Higher differential pressures across the valve are automatically compensated. A movement of the closing body 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 on the data sheet.

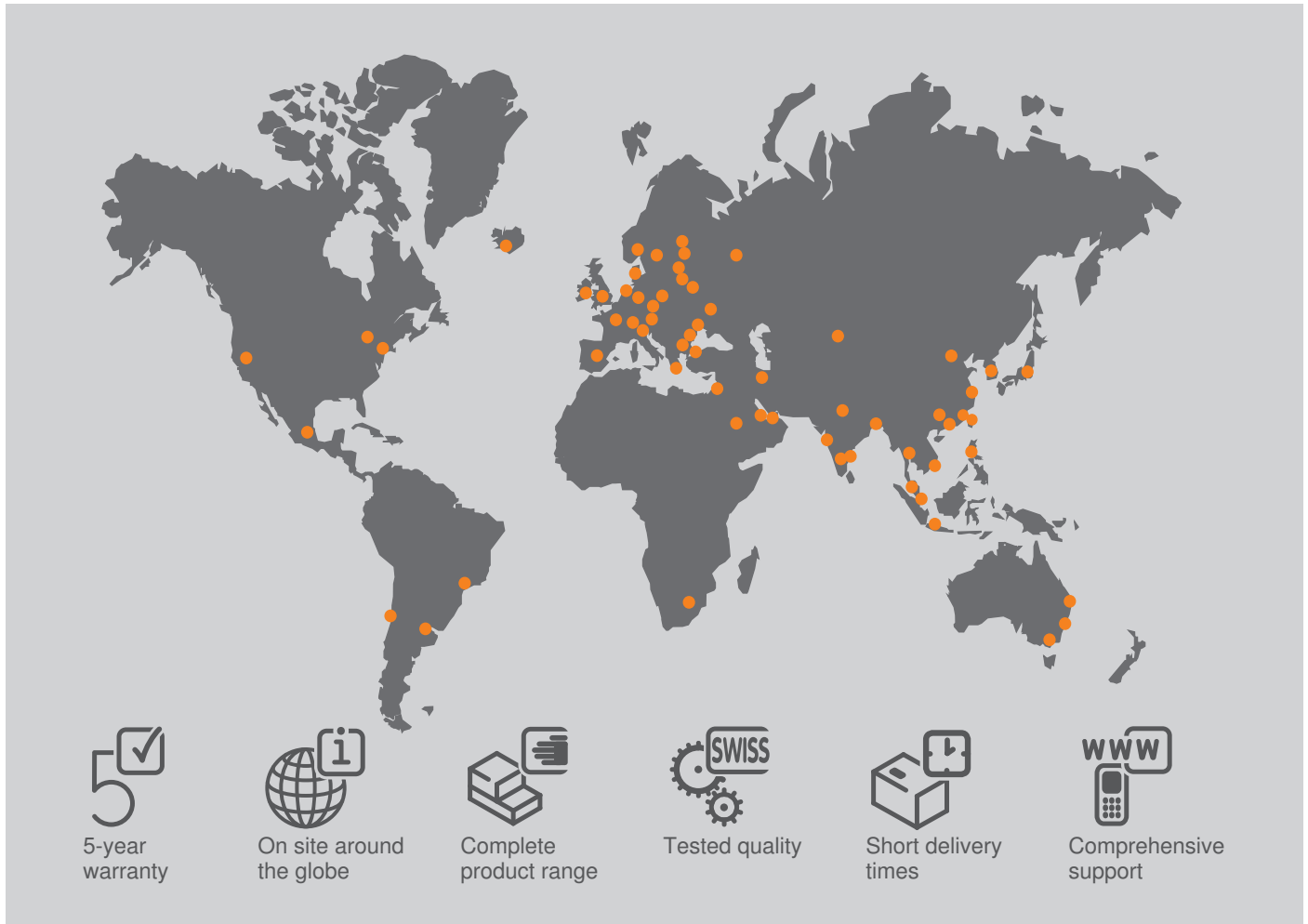
**Design on missing hydraulic data**

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.

# All-inclusive.



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BELIMO Automation AG  
Brunnenbachstrasse 1  
CH-8340 Hinwil, Switzerland  
Tel. +41 43 843 61 11  
Fax +41 43 843 62 68  
info@belimo.ch  
www.belimo.eu

Belimo worldwide: [www.belimo.com](http://www.belimo.com)

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