FENIKS BB

HVAC control and supervision systems


# Flow Controller with the Integrated Control Valve

# KV, KVP

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# Flow Controller with the Integrated Control Valve Type: KV, KVP

## Description

Combi-valve, a flow controller with the integrated control valve, controls and limits the water flow in district heating systems. The combi-valve is used with the electric actuators LV.., NV.., EV.. and it is controlled by the microprocessor controller.
Flow limitation and regulation is done by the pressure actuator with a diaphragm without additional energy and the integrated control valve with an electric actuator. The position of the control valve cone is determined by the position of the setting ring and the movement of the electric valve actuator. The pressure actuator with a diaphragm is connected to the valve entry by the impulse tube. Each pressure change on the valve entry causes the movement of the control diaphragm and flow controller cone and makes the fluid flow orifice larger or smaller. The pressure actuator with a diaphragm keeps the differential pressure through the control valve constant, $\Delta p_{cv}$ = 0,2 bar.

The minimum required differential pressure on the combi-valve is: $\Delta pv_{min} = \Delta p_{cv} + (Q/K_{vs})^2$
In order to ensure the proper flow regulation, the differential pressure on the valve must be:
$\Delta p_v > \Delta p_{vmin}$
Q – fluid flow rate

### KV (PN 16)

| DN | $K_{vs}$ (m³/h) | Stroke (mm) | Type |
|---|---|---|---|
| 15 | 1,6 | 10 | KV 015/1,6 |
| 15 | 2,5 | 10 | KV 015/2,5 |
| 15 | 4 | 10 | KV 015/4 |
| 20 | 6,3 | 11 | KV 020/6,3 |
| 25 | 6,3 | 11 | KV 025/6,3 |
| 25 | 8 | 11 | KV 025/8 |
| 32 | 12,5 | 13 | KV 032/12,5 |
| 40 | 16 | 13 | KV 040/16 |
| 40 | 20 | 13 | KV 040/20 |
| 50 | 25 | 13 | KV 050/25 |
| 50 | 32 | 13 | KV 050/32 |
| 65 | 50 | 15 | KV 065/50 |
| 80 | 80 | 18 | KV 080/80 |
| 100 | 125 | 21 | KV 100/125 |
| 125 | 180 | 21 | KV 125/180 |

### KVP (PN 25)

| DN | $K_{vs}$ (m³/h) | Stroke (mm) | Type |
|---|---|---|---|
| 15 | 1,6 | 10 | KVP 015/1,6 |
| 15 | 2,5 | 10 | KVP 015/2,5 |
| 15 | 4 | 10 | KVP 015/4 |
| 20 | 6,3 | 11 | KVP 020/6,3 |
| 25 | 6,3 | 11 | KVP 025/6,3 |
| 25 | 8 | 11 | KVP 025/8 |
| 32 | 12,5 | 13 | KVP 032/12,5 |
| 40 | 16 | 13 | KVP 040/16 |
| 40 | 20 | 13 | KVP 040/20 |
| 50 | 25 | 13 | KVP 050/25 |
| 50 | 32 | 13 | KVP 050/32 |
| 65 | 50 | 15 | KVP 065/50 |
| 80 | 80 | 18 | KVP 080/80 |
| 100 | 125 | 21 | KVP 100/125 |
| 125 | 180 | 21 | KVP 125/180 |

## Technical Data

### Valve

| Nominal diameter: | DN | 15 | 15 | 15 | 20 | 25 | 25 | 32 | 40 | 40 |
|---|---|---|---|---|---|---|---|---|---|---|
| $K_{VS}$ value: | (m³/h) | 1,6 | 2,5 | 4 | 6,3 | 6,3 | 8 | 12,5 | 16 | 20 |
| Minimum flow: | (m³/h) | 0,10 | 0,25 | 0,4 | 0,6 | 0,6 | 0,8 | 1,3 | 2,6 | 2,6 |
| Maximum flow: | (m³/h) | 0,8 | 1,3 | 2 | 3 | 3 | 4 | 6,5 | 9,5 | 11 |
| Nominal pressure: | PN (bar) | 16 (KV) or 25 (KPV) | | | | | | | | |
| Cavitation factor Z: | | 0,6 | | | 0,55 | | | | 0,50 | |
| Leakage according to the standard EN 60534-4 | | ≤0,02% $K_{VS}$ | | | | | | ≤0,05% $K_{VS}$ | | |
| Fluid: | | circulation water, water quality according to VDI 2035 | | | | | | | | |
| Fluid maximum temperature: | (C⁰) | 140* | | | | | | | | |
| Type of connection: | | Flanges (EN 1092-2) | | | | | | | | |
| Approximate valve weight: | (kg) | 7 | 7 | 7 | 8,5 | 10 | 10 | 13 | 15 | 15 |
| Valve body material: | | EN-GJL-250 (KV) or EN-GJS-400-18-LT (KVP) | | | | | | | | |
| Gasket material: | | FPM, EPDM (ISO1629) | | | | | | | | |
| Cone, stem, seat and spring material: | | WN1.4057, WN1.4404, WN1.4021, WN1.4310 | | | | | | | | |

### Valve

| Nominal diameter: | DN | 50 | 50 | 65 | 80 | 100 | 125 |
|---|---|---|---|---|---|---|---|
| $K_{VS}$ value: | (m³/h) | 25 | 32 | 50 | 80 | 125 | 180 |
| Minimum flow: | (m³/h) | 3,2 | 3,2 | 6 | 8 | 12,6 | 16 |
| Maximum flow: | (m³/h) | 14 | 16 | 28 | 40 | 60 | 80 |
| Nominal pressure: | PN (bar) | 16 (KV) or 25 (KPV) | | | | | |
| Cavitation factor Z: | | 0,50 | | 0,45 | 0,40 | 0,35 | |
| Leakage according to the standard EN 60534-4 | | ≤0,05% $K_{VS}$ | | | | class III L1 | |
| Fluid: | | circulation water, water quality according to VDI 2035 | | | | | |
| Fluid maximum temperature: | (C⁰) | 140* | | | | | |
| Type of connection: | | Flanges (EN 1092-2) | | | | | |
| Approximate valve weight: | (kg) | 22 | 22 | 39 | 48 | 71 | 86 |
| Valve body material: | | EN-GJL-250 (KV) or EN-GJS-400-18-LT (KVP) | | | | | |
| Gasket material: | | FPM, EPDM (ISO1629) | | | | | |
| Cone, stem, seat and spring material: | | WN1.4057, WN1.4404, WN1.4021, WN1.4310 | | | | | |

* short-term overdraft of fluid temperature 150°C

### Mechanical Controller

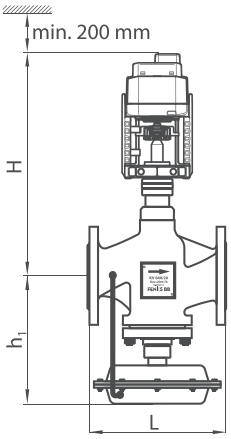
| Nominal diameter: | DN | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 100 | 125 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Effective surface: | (cm²) | 80 | | | | | | 300 | | | |
| Maximum pressure difference: | (bar) | 10 (KV) or 15 (KVP)[1] | | | | | | | | | |
| Diff. pressure across the control valve: | (bar) | 0,2 | | | | | | | | | |
| Diaphragm material: | | EPDM (fibre reinforced) | | | | | | | | | |
| Impulse tube: | | Ø6 | | | | | | Ø8 | | | Ø10 |
| | | WN1.4301 | | | | | | | | | |
| Weight: | (kg) | 2,5 | | | | | | 7 | | | |

## Note

[1)]The maximum differential pressure required on the valve ($\Delta p_{max}$), which ensures operating without cavitation is calculated according to the formula:
$\Delta p_{max} = z \cdot (p_1 - p_v)$.
$p_1$ – absolute pressure at the valve entry; $p_v$ – absolute evaporation pressure at the maximum operating temperature, z – cavitation factor.
**Example:** Calculation of $\Delta p_{max}$ for KVP 050/032, PN25.
Given data: $p_1$= 24 bar, z= 0,50, maximum circulation water temperature is $t_{max}$ = 110 °C.
Solution: For the water temperature $t_{max}$ = 110°C the absolute evaporation pressure is $p_v$ = 1,434 bar.
The calculated maximum differential pressure is $\Delta p_{max}$ = 0,50·(24-1,434) = 11,3 bar.
**Caution:** Valve cavitation is harmful, it causes damage and shortens its service life.

## Dimensions

| DN | (mm) | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 100 | 125 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L | (mm) | 130 | 150 | 160 | 180 | 200 | 230 | 290 | 310 | 350 | 400 |
| $h_1$ | (mm) | 170 | 190 | 205 | 210 | 220 | 235 | 360 | 400 | 425 | 480 |
| H | (mm) | 245 | 270 | 295 | 300 | 300 | 305 | 435 | 450 | 465 | 480 |




**DN** Nominal diameter
**L** Distance between flanges
**$h_1$** Height from the flange axes
**H** Height from the valve axes to the top of the actuator

## Electric Actuator

Three types of electric actuators are used as combi-valve electric actuators. For control valves in the range from DN15 to DN32, an electric actuator of type LV.. is used; for valves in the range from DN40 to DN50, an electric actuators of type NV.. is used; and for valves in the range from DN65 and DN125, an electric actuators of type EV.. is used.

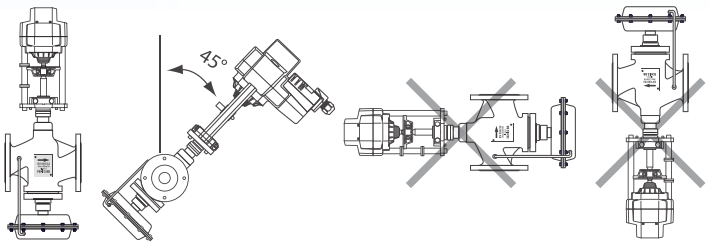
Valve with the LV.. actuator (DN15 – DN32)

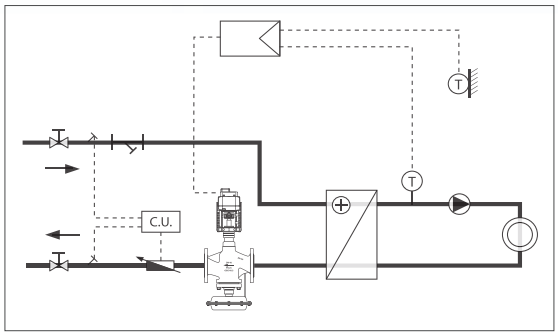
Valve with the NV.. actuator (DN40 – DN50)

Valve with the EV.. actuator (DN65 – DN125)

## Installation

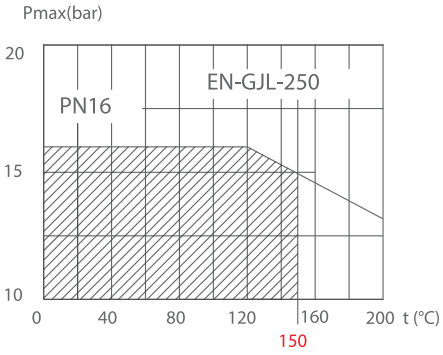
**The recommended installation position** is in the horizontal return pipe of the primary network, while the electric valve actuator is put vertically upward, at an angle of ± 45° in relation to the vertical axis of the pipe.
**The permissible installation position** is in the horizontal supply pipe.
The direction of the arrow on the valve should be aligned with the direction of fluid flow through the valve.
The strainer should be installed upstream of the valve.
Metal particles must not be in the circulation water for the valve correct function.

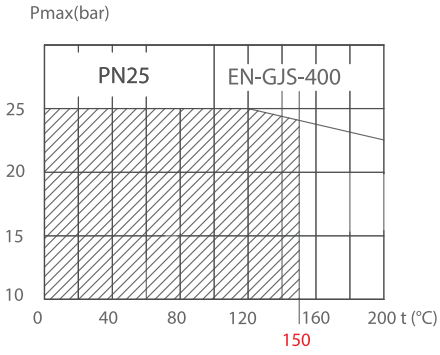



Valve installed on the primary return pipe

## Pressure and Temperature Diagram

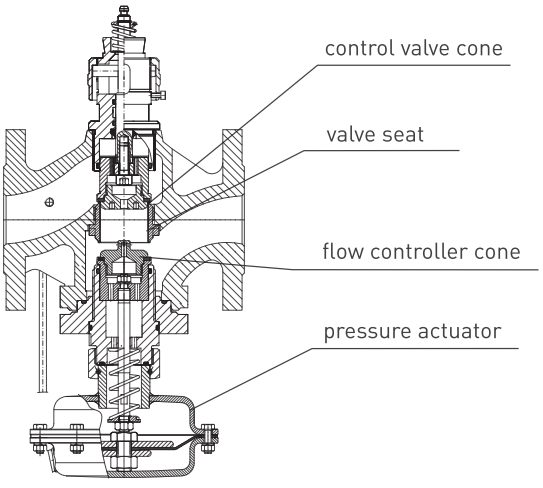


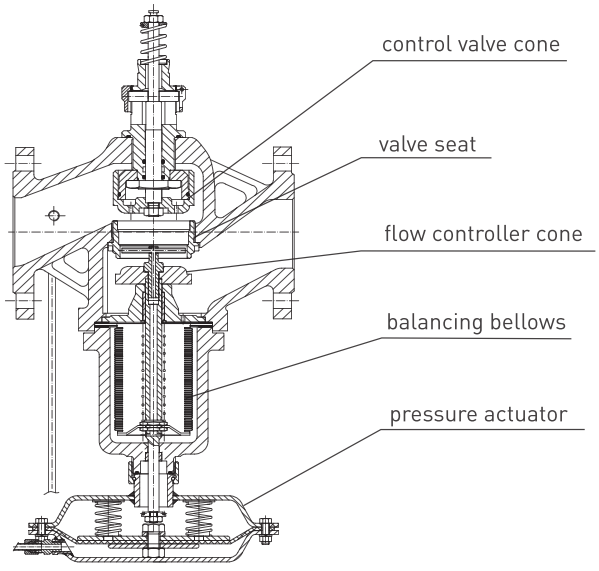

- Operating area

The maximum operating pressure is in a function of the circulation water temperature

## Design




(DN15 – DN50)

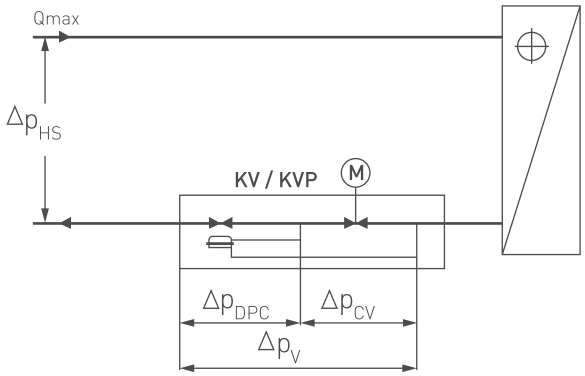



(DN65 – DN125)

## Valve Sizing

**Example**

The combi-valve in the HS is used for the limitation and regulation of the circulation water flow in the district heating system.
In that manner, the circulation water temperature is regulated in the supply pipe of the radiator heating system.
Given data:
$Q_{max}$ = 6,7 m³/h - maximum flow in the HS,
$\Delta p_{HS}$ = 3 bar - available pressure difference in the HS,
$\Delta p_{pl}$ = 0,5 bar - pressure drop in the pipe network of the HS at the maximum design flow.

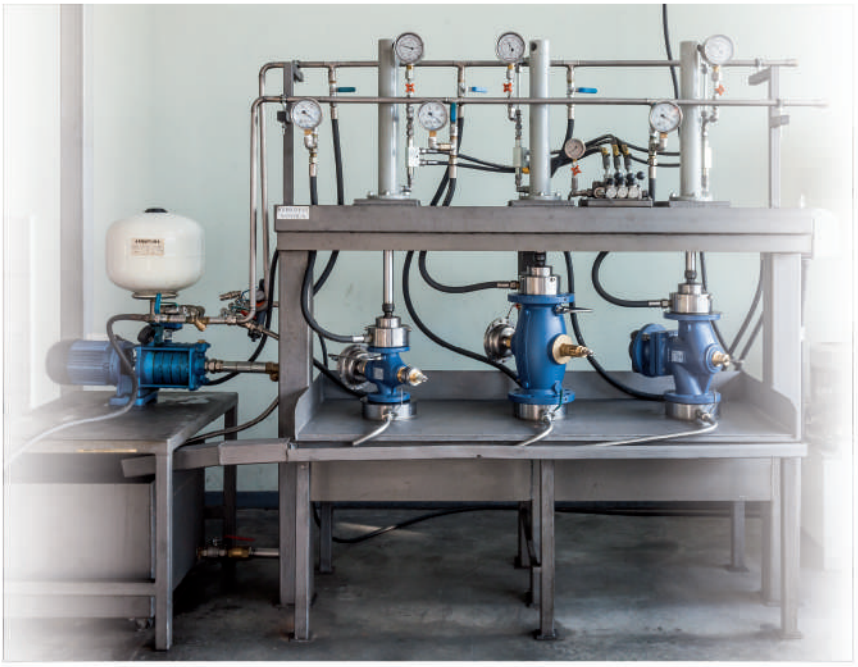



**The following is to be calculated:**

a) Nominal diameter of the combi-valve, nominal coefficient of the differential pressure controller flow, pressure drop on the control valve with an electric actuator, flow limitation setting range.
b) Minimum pressure drop on the combi-valve required for the maximum design flow limitation.
c) Velocity of water at the outlet of the combi-valve at the maximum design flow.

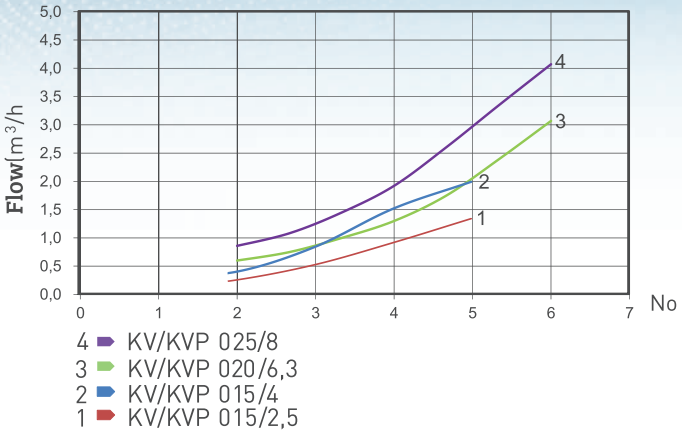
**Solution:**

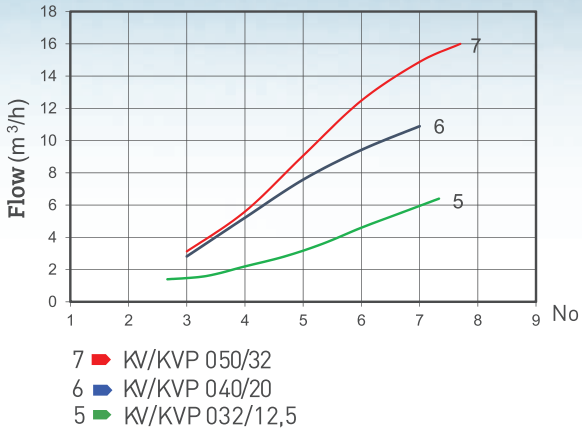
The nominal diameter of the valve is calculated according to:
$DN = (354 \cdot Q_{max}/v)^{1/2}$
v [m/s] – velocity of water at the outlet of the valve
The recommended velocity of water at the outlet of the valve, significant for its selection, is 2 m/s. When the recommended speed rate is exceeded, the noise level increases, which does not necessarily mean cavitation too. $DN = (354 \cdot 6,7/2)^{1/2} = 34,4$ mm
According to the calculated value of DN = 34,4 mm, the combi valve KV 40 with the following characteristics was selected:
Nominal coefficient of the differential pressure controller flow: $k_{vs}$ = 20,0 m³/h,
Pressure drop on the control-valve with an electric actuator: $\Delta p_{cv}$ = 0,2 bar,
Flow limitation setting range: 2,6 do 11 m³/h.
Minimum pressure drop on the combi-valve required for the maximum limitation of the required flow: $\Delta p_{vmin} = \Delta p_{cv} + \Delta p_{dpc} = 0,2 + (Q_{max} / k_{vs})^2$
$\Delta p_{cv}$ [bar] - differential pressure on the control valve with an electric actuator, $\Delta p_{dpc}$ [bar] – pressure drop on the differential pressure controller when it is fully open.
$\Delta p_{vmin} = 0,2 + (6,7 / 20)^2 = 0,31$ bar.
The available differential pressure on the combi valve in the HS: $\Delta p_v = \Delta p_{HS} - \Delta p_{pl} = 3 - 0,5 = 2,5$ bar.
The value of $\Delta p_v$ is greater than the minimum required of 0,31 bar and allows the correct function of the combi-valve.
For the selected combi-valve KV40, the velocity of water at the outlet of the valve at the maximum design flow in the HS is:
$v = 354 \cdot Q_{max} / DN^2 = 354 \cdot 6.7/40^2 = 1,5$ m/s.

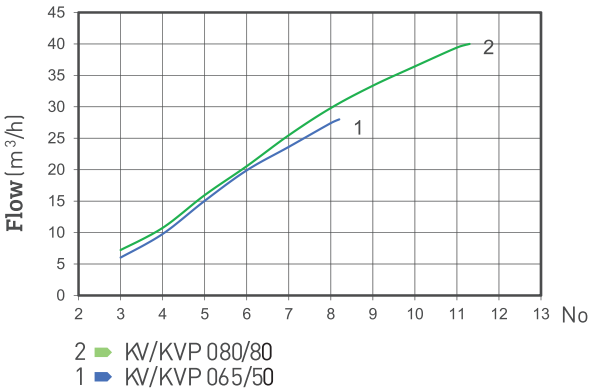


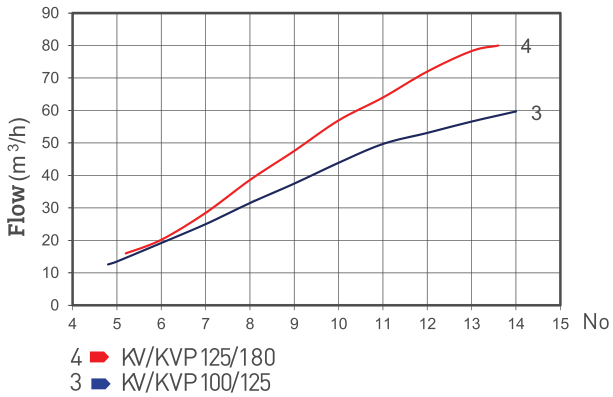
## Flow Setting

KV/KVP (015-125) flow setting curves




The maximum flow through the valve can be set by the flow meter or the flow setting diagram. The required flow rate is set by rotating the setting ring from its lowest position on the valve, counterclockwise. The values on the X-axes represent the number of the full rotations of the setting ring (No.).
The values in the diagram are approximate.

## Safety Instructions

The product complies with the PED Directive 2014/68/EU. Certificate number: No 1837-PED-0199.
Prior to the valve installation and disassembly, it is necessary to switch off circulation pumps, close check valves and gradually relieve the system from pressure.
Only trained and authorized personnel may perform activities of installation and disassembly, start-up and maintenance, in accordance with the applicable legal regulations in the country of the user.

After the termination of use, disassemble the product, sort the parts into groups of materials and hand them over to the authorized waste collection and recycling organizations in order to preserve the environment, while complying with the regulations of the country of the user.



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Quality Management System, Environmental Management System and Occupational Health and Safety Management System are conducted in accordance with the requirements of the international standards ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007.