Data sheet

3-way control valves VK 3

Description / Application

VK 3 valves are a range of 3 port high specification flanged valves for chilled water, LPHW, MPHW, HPHW (low, medium or high pressure hot water) steam and thermo oil applications. The cast iron body with stainless steel plug and seat is suitable for pressures up to 25 bar. These valves may be used with glycol concentrations of up to 50 % making them suitable for ice storage applications.

Main data:
- Cast iron / stainless steel construction.
- Flanged connections DN 15 to 100 mm
- Suitable for water, steam or thermo oil
- Nominal pressure 25 bar
- Suitable for use with AMV(AME) 56 K or AMV(AME) 85 K and 86 K actuators.
- Suitable for use with ethylene and propylene glycol up to 50 % concentration.
- Compliance with PED directive 97/23/EC.

Ordering

Type	DN (mm)	k_{vs} (m^3/h)	Stroke (mm)	Recom. Δp (bar)	Code No.
VK3 15/4.0	15	4.0	15	5.0	**065Z3201**
VK3 20/6.3	20	6.3		5.0	**065Z3202**
VK3 25/10	25	10		5.0	**065Z3203**
VK3 32/16	32	16		5.0	**065Z3204**
VK3 40/25	40	25		5.0	**065Z3205**
VK3 50/40	50	40		5.0	**065Z3206**
VK3 65/63	65	63	35	4.5	**065Z3207**
VK3 65/63*				4.5	**065Z3210**
VK3 80/100	80	100		3.0	**065Z3208**
VK3 100/160	100	160		2.0	**065Z3209**
VK3 100/160*				2.0	**065Z3211**

* designed for pipe system PN 16

Note:
k_{vs} - is the flow in m^3/h of water at a temperature between 5 °C and 40 °C which passes through a valve open at the nominal stroke with 100 kPa (1 bar) pressure drop.

Max. Δp is the physical limit of differential pressure the valve will close against.

The recommended Δp is based on the generation of noise, plug erosion etc. It should be checked against the Δp figure calculated from the chart on page 3 or the equation below, with the valve fully opened at design flow rate.

$$\Delta P_{valve} = S\left(\frac{Q}{k_{vs}}\right)^2$$

where S = specific gravity
Q = flow rate in m^3/h

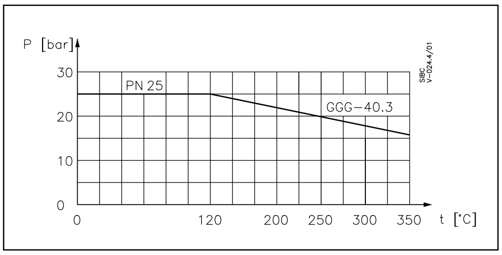
Δp_{valve} = pressure drop across the valve in bar (fully open).

Conversion factors
1 bar = 100 kPa = 14.5 psi
1 l/s = 1 kg/s = 3.6 m^3/h

Technical data

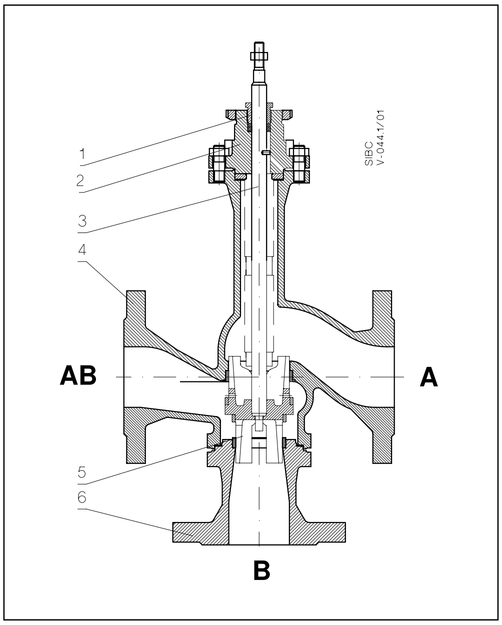
Pressure stage	PN 25
Control range	linear
Media	Circulation water / Thermo oil / Glycolic water up to 50 % / Steam up to 6 bar max.
Leakage loss	0.05 % of k_{vs}
Medium temperature	2 - 350 °C
Stroke	15 mm (DN 15 - 50); 35 mm (DN 65 - 100)
Material	Body: Ductile iron EN-GJS-400-18-LT (GGG 40.3) Valve seat: Stainless steel Cone: Stainless steel Stem: Stainless steel Stuffing box: PTFE
Connection	Flanged ISO 7005-2

Maximum working pressure



Design

1. Stuffing box
2. Valve cover
3. Spindle with bellows
4. Valve body
5. Cone
6. Valve supplementary



Disposal

The valve must be dismantled and the elements sorted into various material groups before disposal.

Installation

Hydraulic connections

Mount according to flow direction as indicated on valve body, AB is *always* the outlet port; inlets are A (two port) or A and B (three port).

Valve Mounting

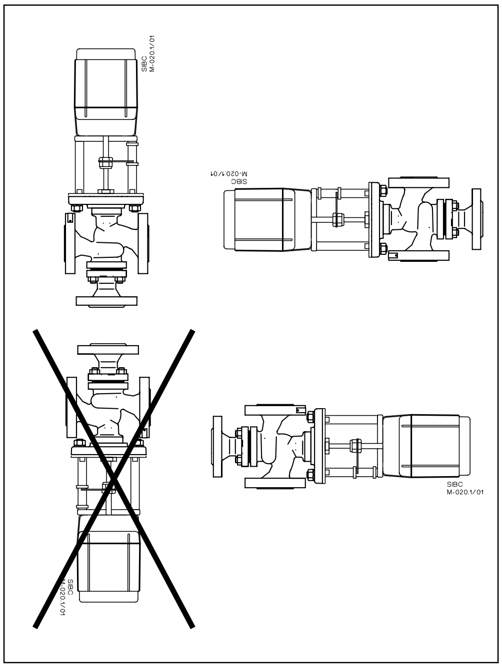
Before mounting the valve be sure that the pipes are clean and free from swarf. It is essential that the pipes are lined up squarely with the valve at each connection and that they are free from vibrations.

Install the motorized control valve with the actuator in a horizontal or vertical position but not upside down (at high temperatures the horizontal position is preferred).

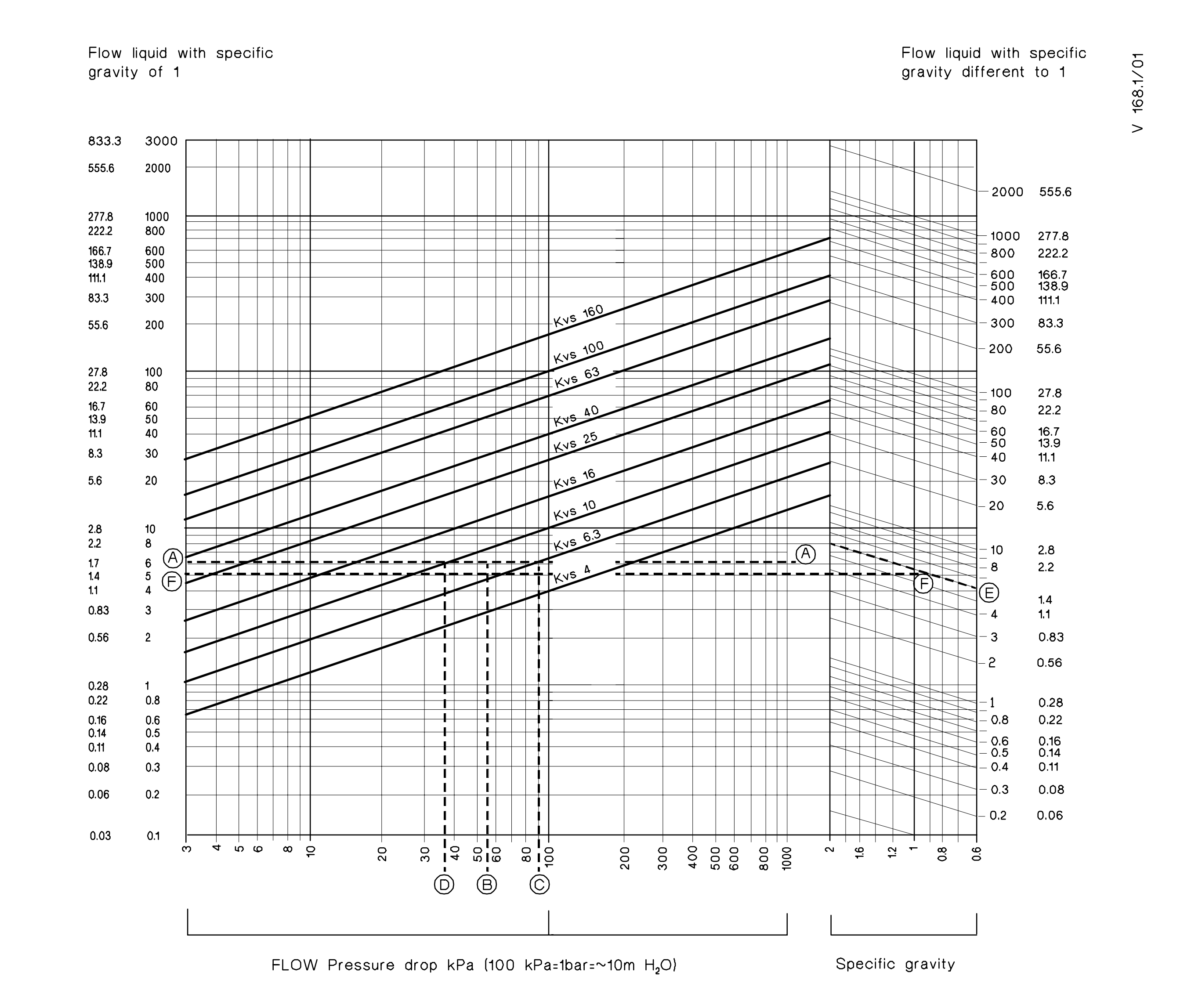
Leave sufficient clearance to facilitate the dismantling of the actuator from the valve body for maintenance purposes.

The valve must not be installed in an explosive atmosphere or at an ambient temperature higher than 50 °C or lower than 0 °C. It must not be subject to steam jets, water jets or dripping liquid.

Note that the actuator may be rotated up to 360° with respect to the valve body, by loosening the retaining fixture. After this operation retighten.



Control valve sizing diagram for fluids



Control valve sizing diagram for fluids

Example:

1 For fluids with specific gravity of 1 (e.g. water)
Design data:
Flow rate: 6 m^3/h
System pressure drop: 55 kPa

Locate the horizontal line representing a flow rate of 6 m^3/h (line A–A). The valve authority is given by the equation:

$$\text{Valve authority, } a = \frac{\Delta P1}{\Delta P1 + \Delta P2}$$

Where:
$\Delta P1$ = pressure drop across the fully open valve,
$\Delta P2$ = pressure drop across the rest of the circuit with a fully open valve

The ideal valve would give a pressure drop equal to the system pressure drop (ie. an authority of 0.5);

If $\Delta P1 = \Delta P2$
$a = \Delta P1/2^*\Delta P1 = 0.5$

In this example an authority of 0.5 would be given by a valve having a pressure drop of 55 kPa at that flow rate (point B). The intersection of line A–A with a vertical line drawn from B lies *between* two diagonal lines; this means that no ideally-sized valve is available. The intersection of line A–A with the diagonal lines gives the pressure drops stated by real, rather than ideal, valves. In this case, a valve with kvs 10 would give a pressure drop of 36 kPa (point C):

$$\text{hence valve authority} = \frac{36}{36 + 55} = 0.396$$

The next valve, with kvs 6.3, would give a pressure drop of 90 kPa (point D):

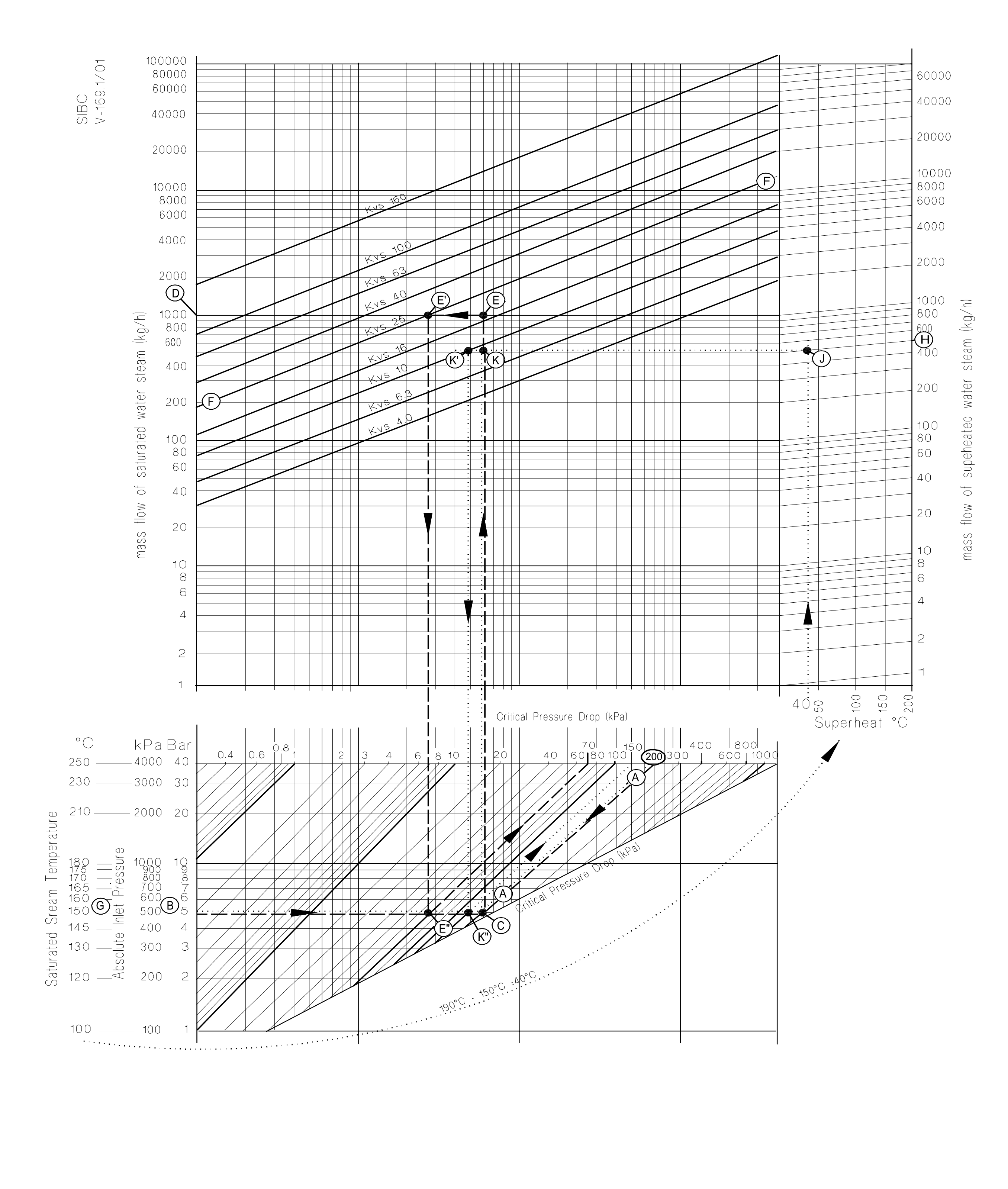
$$\text{hence valve authority} = \frac{90}{90 + 55} = 0.62$$

Generally, for a 2 port application, the smaller valve would be selected (giving a valve authority greater valve, and hence greater controlability). However, this will increase the total pressure and should be checked by the system designer for compatibility with available pump head, etc. The ideal authority is 0.5 with a preferred range of between 0.4 and 0.7.

2 For fluids with specific gravity different from 1
Design data:
Flow rate: 6 m^3/h of fluid, S.G. 0.9
System pressure drop: 10 kPa

For this example, the left hand axis of the diagram must be ignored. Starting from the RH axis, the flow rate of 6 m^3/h is located (point E). The intersection of the diagonal line from point E with a vertical line from S.G. = 0.9 gives the starting point for the effective flow rate line F-F. The process then continues as for Example 1, so 10 kPa intersects F-F nearest to the kvs 16 diagonal. The intersection of F-F with kvs 16 gives a valve pressure drop of 12.7 kPa (point G).

Control valve sizing diagram for steam



Control valve sizing diagram for steam

Examples:

1 For Saturated steam

Design data:
Flow rate: 1000 kg/h
Absolute inlet pressure: 5 bar (500 kPa)

The absolute inlet pressure is 500 kPa. 40% of this is 200 kPa.

Locate the diagonal line corresponding to the pressure drop of 200 kPa (line A-A).

Read the absolute inlet pressure on the lower left hand scale (point B), and draw a horizontal line across until it meets the pressure drop diagonal (A-A) at point C.

From this point extend a vertical line upwards until it meets the horizontal line representing the steam flow of 1000 kg/h from point D. The intersection of this is point E.

The nearest diagonal kvs line above this is line F-F with a kvs of 25. If the ideal valve size is not available the next largest size should be selected to ensure design flow.

Control valve sizing diagram for steam
The pressure drop through valve at the flow rate is found by the intersection of the 1000 kg/h line with F-F and dropping a vertical; this actually hits the horizontal line for 500 kPa inlet pressure at a pressure drop diagonal of 70 kPa. This is only 14% of the inlet pressure and the control quality will not be good until the valve has partially closed. As with all steam valves this compromise is necessary since the next smaller valve would not pass the required flow (maximum flow would have been about 900 kg/h).

The maximum flow for same inlet pressure is found by extending the vertical line through point E until it crosses the kvs 25 line F-F and reading off the flow (1500 kg/h).

2 For Superheated steam

Design data:
Flow rate: 500 kg/h
Absolute inlet pressure: 5 bar (500 kPa)
Steam temperature: 190 °C

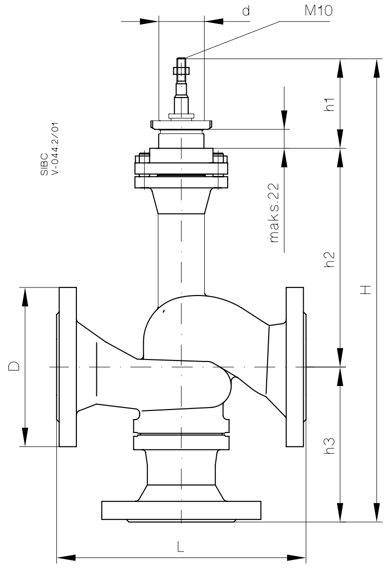
The procedure for superheated steam is much the same as for saturated steam, but uses a different flow scale which slightly elevates the readings according to the degree of superheat.

As before, the diagonal pressure drop line A-A is located as before for 40 % of 500 (200 kg/h). The horizontal inlet pressure line through point B is now extended to the left to read off the corresponding saturated steam temperature at point G (150 °C). The difference between the saturated steam temperature and the superheated steam temperature is 190 - 150 = 40 °C.

The superheated steam flow is found on the upper right hand scale, point H, and the diagonal line is followed down from here until it meets a vertical line from the steam temperature elevation (40 °C) at point J.

As before, the horizontal line through point B is drawn to cut line A-A at point C and the point where the vertical line from this point meets the horizontal line from point J is the operating point (point K). This horizontal line, J-K, is the corrected flow line. The nearest diagonal line above this is for kvs 10. A vertical line dropped from the intersection of J-K with the 10 kvs line intersects the 500 kPa inlet pressure line at a pressure drop diagonal of about 150 kPa. This is about 30% of the inlet pressure which will give reasonable control quality (compared to recommended ratio of 40%). Although the next smaller valve would give better control, it would not pass the required flow (maximum flow would have been about 350 kg/h).

Dimensions



DN	L mm	H mm	D mm	h_1 mm	h_2 mm	h_3 mm	d mm	Weight kg
15	130	383.5	95	97.5	166	120	47e9	6.5
20	150	383.5	105	97.5	166	120	47e9	7.5
25	160	403.5	115	97.5	166	140	47e9	9.0
32	180	403.5	140	97.5	166	140	47e9	11.5
40	200	403.5	150	97.5	141	165	47e9	13.5
50	230	403.5	165	97.5	141	165	47e9	17.0
65	290	514.5	185	87.5	247	180	57e9	25.0
80	310	528.5	200	87.5	246	195	57e9	32.0
100	350	551.5	235	87.5	239	225	57e9	47.0