Calculation of the valve flow coefficient K_V

The procedure specified in the IEC 60534 standard is applied to determine the valve flow coefficient K_V. The relevant device-specific data can be found in the associated data sheets.

The equations below are given to allow a preliminary, simplified calculation of the valve flow coefficient to be performed.

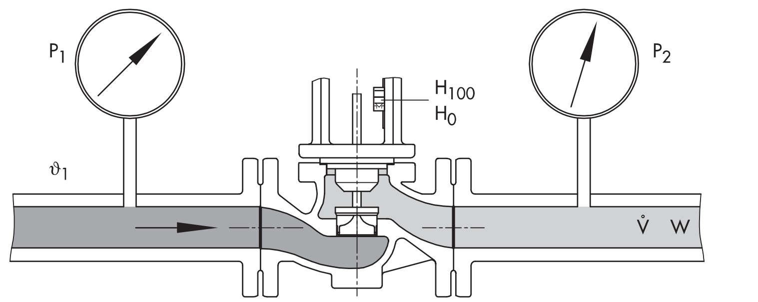
Please note that these equations do not take account of the influence of the connection fittings and the flow limitation in case of critical flow velocities.

Selection of the valve flow coefficient K_{VS}

On the basis of the calculated valve flow coefficient K_V, the appropriate valve flow coefficient K_{VS} for the relevant valve type can be selected from the associated data sheet.

If realistic operating values have been used for the calculation, the following applies in general:

– For **self-operated regulators:** $K_{Vmax} = 0.75 \cdot K_{VS}$
– For **motor-operated valves:** $K_{Vmax} = 0.9 \cdot K_{VS}$



p_1 Upstream pressure
p_2 Downstream pressure
H Travel
$\dot{V}$ Volume flow rate in m^3/h (gases)
W Mass flow rate in kg/h (liquids, steam)
ρ Density in kg/m^3 (general, also in liquids)
ρ_1 Density upstream of the valve in kg/m^3 (in gases and vapors)
ϑ_1 Temperature in °C upstream of the valve

Medium / Pressure drop	Liquids		Gases		Steam
	m^3/h	kg/h	m^3/h	kg/h	kg/h
$p_2 > \frac{p_1}{2}$	$K_V = \dot{V}\sqrt{\frac{\rho}{1000\ \Delta p}}$	$K_V = \frac{W}{\sqrt{1000\rho\ \Delta p}}$	$K_V = \frac{\dot{V}_G}{519}\sqrt{\frac{\rho_G T_1}{\Delta p\ p_2}}$	$K_V = \frac{W}{519}\sqrt{\frac{T_1}{\rho_G \Delta p\ p_2}}$	$K_V = \frac{W}{31.62}\sqrt{\frac{v_2}{\Delta p}}$
$\Delta p < \frac{p_1}{2}$					
$p_2 < \frac{p_1}{2}$			$K_V = \frac{\dot{V}_G}{259.5\ p_1}\sqrt{\rho_G T_1}$	$K_V = \frac{W}{259.5\ p_1}\sqrt{\frac{T_1}{\rho_G}}$	$K_V = \frac{W}{31.62}\sqrt{\frac{2v^*}{p_1}}$
$\Delta p > \frac{p_1}{2}$					

where:

p_1 [bar] Absolute pressure p_{abs}
p_2 [bar] Absolute pressure p_{abs}
Δp [bar] Absolute pressure p_{abs} (differential pressure $p_1 - p_2$)
T_1 [K] $273 + \vartheta_1$
$\dot{V}_G$ [m^3/h] Flow rate of gases, related to 0 °C and 1013 mbar

ρ [kg/m^3] Density of liquids
ρ_G [kg/m^3] Density of gases at 0 °C and 1013 mbar
v_1 [m^3/kg] Specific volume (v´ found in the steam table) for p_1 and ϑ_1
v_2 [m^3/kg] Specific volume (v´ found in the steam table) for p_2 and ϑ_1
v^* [m^3/kg] Specific volume (v´ found in the steam table) for $\frac{p_1}{2}$ and ϑ_1

Edition March 2012

Specifications subject to change without notice

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
Internet: http://www.samson.de