Control Valve Cv and Kv for Liquids (IEC 60534)

Flow coefficient Kv and Cv of a control valve on liquid service by IEC 60534-2-1, with the choked-flow limit for cavitation and flashing.

Method: IEC 60534-2-1:2011 (sizing equations for fluid flow); ANSI/ISA-75.01.01

Input parameters

Unit system: SI

Parameter	Value	Unit
Volume flow	60.000	m³/h
Upstream pressure (absolute) Absolute; choose a gauge unit to enter gauge readings.	95.000	bar
Downstream pressure (absolute)	89.000	bar
Liquid density at the inlet	955.00	kg/m³
Vapour pressure at the inlet temperature Water: 2.34 kPa at 20 °C, 1.209 bar at 105 °C, 3.62 bar at 140 °C.	1.2090	bar
Critical pressure of the liquid Water 220.64 bar (IAPWS).	220.64	bar
Liquid pressure recovery factor of the valve From the valve maker; about 0.9 for globe valves, 0.6–0.7 for full-bore ball and butterfly valves.	0.90000	

Calculated results

Parameter	Value	Unit
Flow coefficient Kv (m³/h, bar)	23.937	
Flow coefficient Cv (US gpm, psi)	27.673	
Pressure drop across the valve	600.00	kPa
Choked-flow pressure drop	7,603.0	kPa
Pressure drop used for sizing	600.00	kPa
Liquid critical pressure ratio factor	0.93927	
Choked (1 = yes)	0	

Formula and method

$$K_v = Q\sqrt{\frac{\rho_1/\rho_0}{\Delta p_s}} \quad (Q \text{ in } \mathrm{m^3/h},\ \Delta p_s \text{ in bar},\ \rho_0 = 1000\ \mathrm{kg/m^3}) \qquad C_v = \frac{K_v}{0.865}$$

$$F_F = 0.96 - 0.28\sqrt{\frac{p_v}{p_c}} \qquad \Delta p_{ch} = F_L^2\,(p_1 - F_F p_v) \qquad \Delta p = p_1 - p_2 \qquad \Delta p_s = \min(\Delta p,\ \Delta p_{ch})$$

Variables

Q	volume flow	m³/s
p_1	upstream pressure, absolute	Pa
p_2	downstream pressure, absolute	Pa
ρ_1	liquid density at the inlet	kg/m³
p_v	vapour pressure at the inlet temperature	Pa
p_c	critical pressure of the liquid	Pa
F_L	liquid pressure recovery factor	–

K_v	flow coefficient Kv	–
C_v	flow coefficient Cv	–
Δp	pressure drop across the valve	Pa
Δp_{ch}	choked-flow pressure drop	Pa
Δp_s	pressure drop used for sizing	Pa
F_F	liquid critical pressure ratio factor	–
choked	1 when the flow is choked	–
ρ_0	reference density of water, 1 000	kg/m³

Method and standards

IEC 60534-2-1:2011 §6 for incompressible fluids in turbulent flow, with the numerical constants N_1 of its Table 1 (Kv: 1 with m³/h and bar; Cv: 0.865). The same equations appear in ANSI/ISA-75.01.01.

Assumptions and limits

- Turbulent flow; very viscous liquids need the Reynolds-number factor F_R.
- No reducers attached to the valve (F_P = 1); with reducers the coefficient rises.
- F_L from the valve maker for the valve type and opening.
- ρ_1 and p_v are separate entries: take both at the same inlet temperature (for water, from steam tables); they are not checked against each other.
- Choked flow means cavitation or flashing: the calculation gives the coefficient; trim selection and noise are the maker's.

References

• IEC 60534-2-1:2011 (sizing equations for fluid flow)
• ANSI/ISA-75.01.01

Report details

Report reference	FCC-C3Z2-5BC4 (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Control Valve Cv and Kv for Liquids (IEC 60534)
Method last reviewed	10 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/control-valves/control-valve-cv-liquid

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.