Control Valve Cv for Gas and Vapour

Required Cv and Kv of a control valve for gas or vapour from mass flow, inlet pressure and density, pressure drop, specific heat ratio and the valve's x_T factor.

Method: Gas sizing equation W = N_6F_pYC_v√($xp_1ρ_1$); Y = 1 − x/(3F_γx_T) (ISA-75.01 / IEC 60534-2-1 form)

Input parameters

Unit system: SI

Parameter	Value	Unit
Mass flow	5,000.0	kg/h
Inlet pressure (absolute)	10.000	bar
Pressure drop	3.0000	bar
Inlet density	8.5000	kg/m³
Ratio of specific heats	1.4000	
Pressure-drop ratio factor (valve data)	0.70000	

Calculated results

Parameter	Value	Unit
Pressure-drop ratio Δp/p_1	0.30000	
Choked limit of x	0.70000	
Expansion factor	0.85714	
Required Cv	42.314	
Required Kv	36.556	
Choked flow (1 = yes)	0	

Notes for this case

• Standard gas sizing form W = N_6F_pYC_v√($xp_1ρ_1$), N_6 = 27.3 (kg/h, bar, kg/m³), no fittings (F_p = 1). Above F_γx_T the flow is choked and more pressure drop gives no more flow. Select a valve with Cv about 1.25–1.4 times this at maximum flow.

Formula and method

$$C_v = \frac{W}{27.3\,Y\sqrt{x\,p_1\rho_1}},\quad K_v = \frac{W}{31.6\,Y\sqrt{x\,p_1\rho_1}},\quad Y = 1 - \frac{x}{3F_\gamma x_T},\quad F_\gamma = \frac{\gamma}{1.4},\quad x \le F_\gamma x_T$$

Variables

W	Mass flow	kg/s
p_1	Inlet pressure (absolute)	Pa
Δp	Pressure drop	Pa
ρ_1	Inlet density	kg/m³
γ	Ratio of specific heats	-
x_T	Pressure-drop ratio factor (valve data)	-
x	Pressure-drop ratio Δp/p_1	-
$F_\gamma x_T$	Choked limit of x	-
Y	Expansion factor	-
C_v	Required Cv	-
K_v	Required Kv	-
choked	Choked flow (1 = yes)	-

Method and standards

Gas valve sizing.

Assumptions and limits

- No pipe reducers; turbulent flow.

References

- Gas sizing equation $W = N_6 F_p Y C_v \sqrt{(x p_1 \rho_1)}$
- $Y = 1 - x/(3 F_\gamma x_T)$ (ISA-75.01 / IEC 60534-2-1 form)

Report details

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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-gas

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.