Control Valve Characteristic, Authority and Installed Flow

Inherent and installed flow of a linear or equal-percentage control valve at a given opening, from rangeability and valve authority, with the installed gain.

Method: IEC 60534-2-4 (inherent characteristics)

Input parameters

Unit system: SI

Parameter	Value	Unit
Inherent characteristic	Equal percentage	
Valve travel (opening)	50.000	%
Inherent rangeability (largest to least controllable flow)	50.000	
Valve authority (valve Δp fully open ÷ system Δp)	30.000	%

Calculated results

Parameter	Value	Unit
Inherent relative flow (at constant Δp)	14.142	%
Installed relative flow (share of full-open flow)	25.238	%
Installed gain	0.94329	
Installed flow at the least controllable opening	3.6498	%

Formula and method

$$\varphi = x \ \text{(linear)} \qquad \varphi = R^{x-1} \ \text{(equal \%)} \qquad q = \frac{\varphi}{\sqrt{N + (1-N)\varphi^2}} \qquad \frac{dq}{dx} = \frac{N}{[N + (1-N)\varphi^2]^{3/2}} \frac{d\varphi}{dx} \qquad q_{min} = \frac{1/R}{\sqrt{N + (1-N)/R^2}}$$

Variables

char	inherent characteristic	–
x	travel	–
R	inherent rangeability	–
N	valve authority	–
φ	inherent relative flow	–
q	installed relative flow	–
dq/dx	installed gain	–
q_{min}	installed flow at the least controllable opening	–

Method and standards

Ideal inherent characteristics with a valve in series with a fixed-resistance system of constant total pressure drop.

Assumptions and limits

- Ideal characteristics; constant total system drop; turbulent flow.
- The least controllable inherent flow is 1/R of the full flow for either characteristic.
- The 0.25 authority warning is a common rule of thumb, not a standard limit.

References

- IEC 60534-2-4 (inherent characteristics)

Report details

Report reference	FCC-RSKN-N398 (the same inputs always give the same reference)
Generated	17 November 2026, 19:34 UTC
Calculator	Control Valve Characteristic, Authority and Installed Flow
Method last reviewed	12 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-rangeability

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.