Fan and Duct System Curve Operating Point

Air flow and pressure where a fan curve p = p_0 − a Q^2 meets the duct system curve p = k Q^2, with the fan power, from a fan point and a system point.

Method: Fan and system curves (Fan Engineering, Buffalo Forge; AMCA 200 terminology)

Input parameters

Unit system: SI

Parameter	Value	Unit
Fan shut-off pressure	15.000	mbar
A fan flow on its curve	36,000	m³/h
Fan pressure at that flow	11.000	mbar
A system flow	36,000	m³/h
System resistance at that flow	10.000	mbar
Fan efficiency at the duty	70.000	%

Calculated results

Parameter	Value	Unit
Air flow at the operating point	37,264	m³/h
Pressure at the operating point	10.714	mbar
Shaft power	15.843	kW

Notes for this case

- A duct system with no static lift: resistance goes with Q^2. Real fan curves are not parabolas near stall; stay right of the peak.

Formula and method

$$p_{fan} = p_0 - aQ^2, \quad p_{sys} = kQ^2, \quad Q^* = \sqrt{\frac{p_0}{a+k}}$$

Variables

p_0	Fan shut-off pressure	Pa
Q_f	A fan flow on its curve	m³/s
p_f	Fan pressure at that flow	Pa
Q_s	A system flow	m³/s
p_s	System resistance at that flow	Pa
η	Fan efficiency at the duty	-
Q	Air flow at the operating point	m³/s
p	Pressure at the operating point	Pa
P	Shaft power	W

Method and standards

Intersection of the two curves.

Assumptions and limits

- Parabolic curves.
- Fan curve, system curve and efficiency on one pressure basis: fan total pressure with total efficiency, or fan static pressure with static efficiency.

References

- Fan and system curves (Fan Engineering, Buffalo Forge; AMCA 200 terminology)

Report details

Report reference	FCC-J56D-TGBW (the same inputs always give the same reference)
Generated	17 November 2026, 19:44 UTC
Calculator	Fan and Duct System Curve Operating Point
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/mechanical/fans/fan-operating-point

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.