Fan Heat Gain and Temperature Rise of the Air Stream

Heat added to an air stream by a fan from flow, total pressure rise and efficiencies, whether the motor is in the air stream, and the air temperature rise.

Method: Energy balance: shaft power = V Δp / η_f; all dissipated in the air (ASHRAE Handbook—Fundamentals ch. 18)

Input parameters

Unit system: SI

Parameter	Value	Unit
Air flow	20,000	m³/h
Fan total pressure rise	101.97	mmWC
Fan efficiency	70.000	%
Motor efficiency	92.000	%
Motor position	In the air stream	
Air density	1.2000	kg/m³
Air specific heat	1.0060	kJ/(kg·K)

Calculated results

Parameter	Value	Unit
Shaft power	7.9365	kW
Motor input	8.6266	kW
Heat to the air	8.6266	kW
Air temperature rise	1.2863	K

Notes for this case

- All the fan's shaft work ends up as heat in the air; the motor loss joins it only if the motor sits in the stream.

Formula and method

$$P_s = \frac{\dot{V}\Delta p_t}{\eta_f}, \quad P_e = \frac{P_s}{\eta_m}, \quad \dot{Q} = P_e \text{ (motor in the air stream) or } P_s \text{ (motor outside)}, \quad \Delta T = \frac{\dot{Q}}{\rho c_p \dot{V}}$$

Variables

$\dot{V}$	Air flow	m³/s
Δp_t	Fan total pressure rise	Pa
η_f	Fan efficiency	-
η_m	Motor efficiency	-
motor	Motor position	-
ρ	Air density	kg/m³
c_p	Air specific heat	J/(kg·K)
P_s	Shaft power	W
P_e	Motor input	W
$\dot{Q}$	Heat to the air	W
ΔT	Air temperature rise	K

Method and standards

Energy balance.

Assumptions and limits

- Steady state.

References

- Energy balance: shaft power = V Δp / η_f
- all dissipated in the air (ASHRAE Handbook—Fundamentals ch. 18)

Report details

Report reference	FCC-FB6D-B48W (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Fan Heat Gain and Temperature Rise of the Air Stream
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 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/hvac/loads/fan-heat-gain

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.