Fan Static and Total Efficiency from a Site Test

Fan static and total efficiency from measured flow, static pressure rise, outlet velocity pressure and shaft or motor power, with the air power.

Method: Fan pressure and efficiency definitions (fan total = static + outlet velocity pressure)

Input parameters

Unit system: SI

Parameter	Value	Unit
Volume flow at fan inlet conditions	108,000	m³/h
Fan static pressure rise	2,500.0	Pa
Fan outlet area	1.2000	m²
Air or gas density at the fan	1.1000	kg/m³
Measured motor input	120.00	kW
Motor and drive efficiency	94.000	%

Calculated results

Parameter	Value	Unit
Outlet velocity pressure	343.75	Pa
Fan total pressure	2,843.8	Pa
Air power (total)	85.312	kW
Static efficiency	66.489	%
Total efficiency	75.632	%

Notes for this case

- Fan static pressure is fan total pressure minus outlet velocity pressure (ISO 5801 / AMCA definitions). Compare total efficiency with the maker's curve at the same flow.

Formula and method

$$p_v = \frac{\rho}{2}\left(\frac{Q}{A_o}\right)^2, \quad \Delta p_t = \Delta p_s + p_v, \quad \eta_t = \frac{Q\Delta p_t}{\eta_m P_{in}}$$

Variables

Q	Volume flow at fan inlet conditions	m³/s
Δp_s	Fan static pressure rise	Pa
A_o	Fan outlet area	m²
ρ	Air or gas density at the fan	kg/m³
P_{in}	Measured motor input	W
η_m	Motor and drive efficiency	-
p_v	Outlet velocity pressure	Pa
Δp_t	Fan total pressure	Pa
P_a	Air power (total)	W
η_s	Static efficiency	-
η_t	Total efficiency	-

Method and standards

Fan definitions.

Assumptions and limits

- Incompressible; steady.
- An efficiency above 100 % is flagged as a measurement or input error.

References

- Fan pressure and efficiency definitions (fan total = static + outlet velocity pressure)

Report details

Report reference	FCC-W3CW-1Z3D (the same inputs always give the same reference)
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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/mechanical/fans/fan-efficiency-site-test

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.