Fan Specific Speed, Specific Diameter and Duty Coefficients

Dimensionless specific speed and specific diameter of a fan duty, with flow and pressure coefficients, to compare fan types and check a selection.

Method: Similarity parameters of turbomachines

Input parameters

Unit system: SI

Parameter	Value	Unit
Volume flow	36,000	m³/h
Fan total pressure rise	152.96	mmWC
Gas density	1.2000	kg/m³
Rotational speed	1,480.0	rpm
Impeller diameter	0.90000	m

Calculated results

Parameter	Value	Unit
Specific speed ω√Q/(Δp/ρ)^¾	2.3314	
Specific diameter D(Δp/ρ)^¼/√Q	1.6923	
Flow coefficient Q/(nD³)	0.55611	
Pressure coefficient Δp/(ρn²D²)	2.5363	
Tip speed	69.743	m/s

Notes for this case

• ω in rad/s, n in rev/s for φ and ψ. Low specific speed and large specific diameter point to centrifugal fans (high pressure, low flow); high specific speed and small specific diameter to mixed-flow and axial fans. Good designs lie near the Cordier line of ω_s against D_s.

Formula and method

$$\omega_s = \frac{\omega\sqrt{Q}}{(\Delta p/\rho)^{3/4}}, \quad D_s = \frac{D(\Delta p/\rho)^{1/4}}{\sqrt{Q}}, \quad \varphi = \frac{Q}{nD^3}, \quad \psi = \frac{\Delta p}{\rho n^2 D^2}$$

Variables

Q	Volume flow	m³/s
Δp_t	Fan total pressure rise	Pa
ρ	Gas density	kg/m³
n	Rotational speed	rad/s
D	Impeller diameter	m
ω_s	Specific speed ω√Q/(Δp/ρ)^¾	-
D_s	Specific diameter D(Δp/ρ)^¼/√Q	-
φ	Flow coefficient Q/(nD³)	-
ψ	Pressure coefficient Δp/(ρn²D²)	-
u	Tip speed	m/s

Method and standards

Turbomachine similarity.

Assumptions and limits

- Incompressible flow.

References

Similarity parameters of turbomachines

Report details

Report reference	FCC-FCMT-FZ6E (the same inputs always give the same reference)
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Calculator	Fan Specific Speed, Specific Diameter and Duty Coefficients
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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-specific-speed-diameter

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.