Fan Motor Rating (kW with Margin and Cold Start)

Motor rating for a fan: power absorbed plus the motor margin, rounded to the next IEC standard rating, and the power when started on cold air.

Method: ISO 5801 (fan power); AMCA 99 (fan laws); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Power absorbed from	Flow, pressure and efficiency	
Volume flow at the fan inlet	72,000	m³/h
Fan pressure	305.91	mmWC
Fan efficiency From the fan maker at the duty point. Default from FireCAD design practice; enter your specification's value.	80.000	%
Fan shaft power (from the maker's data)	130.00	kW
Motor margin over the power absorbed 10 % for fan motors. Default from FireCAD design practice; enter your specification's value.	10.000	%
Gas temperature at the duty point	35.000	°C
Molar mass of the gas at the duty point Air 28.97; flue gas about 30 (coal, oil) or 27.5–28.5 (natural gas).	28.965	kg/kmol
Air temperature at a cold start	35.000	°C

Calculated results

Parameter	Value	Unit
Standard motor rating (IEC 60072-1)	90.000	kW
Minimum motor rating (absorbed + margin)	82.500	kW
Power absorbed at the duty point	75.000	kW
Power on cold air at the same speed and flow	75.002	kW
Standard rating that also covers the cold start	90.000	kW

Formula and method

$$P_s = \frac{\dot{V}\Delta p}{\eta_f} \quad (\text{or } P_{s,in}) \qquad P_{m,min} = P_s(1 + m_m) \qquad P_c = P_s \frac{M_{da}/T_c}{M_h/T_h}$$

Variables

basis	power from flow and pressure, or shaft power entered	–
$\dot{V}$	volume flow at the fan inlet	m³/s
Δp	fan pressure	Pa
η_f	fan efficiency	–
$P_{s,in}$	shaft power from the maker's data	W
m_m	motor margin	–
T_h	gas temperature at the duty point	K
M_h	molar mass of the gas at the duty point	kg/kmol
T_c	air temperature at a cold start	K

P_{std}	standard motor rating	W
$P_{m,min}$	minimum motor rating	W
P_s	power absorbed at the duty point	W
P_c	power on cold air at the same speed and flow	W
$P_{std,c}$	standard rating that also covers the cold start	W
M_{da}	molar mass of dry air	kg/kmol

Method and standards

Fan power per ISO 5801; cold-start power by the AMCA 99 fan laws at constant speed and volume (power in proportion to density, ideal gas at the same pressure); ratings from IEC 60072-1. Default efficiency and margin are FireCAD design practice (owner, 2026-11-10).

Assumptions and limits

- Same inlet pressure hot and cold.
- Fan pressure and efficiency on one basis (total with total efficiency, or static with static efficiency).
- No separate drive efficiency: for a belt or fluid-coupling drive divide the fan shaft power by the drive efficiency, or allow for it in the motor margin.
- Starting torque, acceleration time and the motor's thermal limits during a damper-closed start are not checked here.

References

• ISO 5801 (fan power)
• AMCA 99 (fan laws)
• IEC 60072-1 (standard motor ratings)

Report details

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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-motor-rating

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.