Packed-Tower Air Stripping: Blower and Pump Power

Blower brake power from air flow and tower pressure drop, pump power to lift water to the top, total power and specific energy of packed-tower aeration.

Input parameters

Unit system: SI

Parameter	Value	Unit
Water flow	0.010000	m^3/s
Air-to-water ratio	30.000	
Tower cross-section	0.80000	m^2
Gas pressure drop per metre of packing	100.00	Pa/m
Packing depth	4.0000	m
Pumping lift (to the top of the tower)	4.5000	m
Loss coefficient for demister, support and ducts, $N·s^2/m^4$	275.00	
Air temperature	15.000	°C
Ambient pressure	101.33	kPa
Air density	1.2250	kg/m^3
Water density	999.10	kg/m^3
Blower efficiency	50.000	%
Pump efficiency	70.000	%

Calculated results

Parameter	Value	Unit
Air flow	0.30000	m^3/s
Air mass flow	0.36750	kg/s
Demister, support and duct losses	38.672	Pa
Blower discharge (tower inlet) pressure	101.76	kPa
Blower brake power	0.26275	kW
Pump brake power	0.62986	kW
Total power	0.89261	kW
Specific energy	0.024795	kWh/m^3

Notes for this case

• Adiabatic blower equation with n_a = (γ − 1)/γ = 0.283 for air (molar mass 28.97). The pump term covers only the lift to the distributor; add pipe friction and any distributor pressure.

Formula and method

$$P_{blower} = \frac{G_{me} R T}{M n_a \eta_b}\left[\left(\frac{P_{in}}{P_{out}}\right)^{n_a} - 1\right], \quad P_{in} = P_{amb} + \frac{\Delta P}{L} L + \left(\frac{Q_a}{A}\right)^2 k_p$$

$$P_{pump} = \frac{\rho_l Q h_p g}{\eta_p}, \quad E = \frac{P_{blower} + P_{pump}}{Q}$$

Variables

Q	Water flow	m³/s
Q_a/Q	Air-to-water ratio	-
A	Tower cross-section	m²
$\Delta P/L$	Gas pressure drop per metre of packing	Pa/m
L	Packing depth	m
h_p	Pumping lift (to the top of the tower)	m
k_p	Loss coefficient for demister, support and ducts, N·s²/m⁴	-
T	Air temperature	K
P_{amb}	Ambient pressure	Pa
ρ_g	Air density	kg/m³
ρ_l	Water density	kg/m³
η_b	Blower efficiency	-
η_p	Pump efficiency	-
Q_a	Air flow	m³/s
G_{me}	Air mass flow	kg/s
ΔP_{losses}	Demister, support and duct losses	Pa
P_{in}	Blower discharge (tower inlet) pressure	Pa
P_{blower}	Blower brake power	W
P_{pump}	Pump brake power	W
P_{total}	Total power	W
E	Specific energy	J/m³

Method and standards

Adiabatic compression power and hydraulic lift for packed-tower aeration.

Assumptions and limits

- Adiabatic blower; atmospheric outlet.

Report details

Report reference	FCC-48F4-FW5V (the same inputs always give the same reference)
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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/environmental/drinking-water/air-stripping-blower-pump-power

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.