Air Stripping Tower for Ammonia: Diameter, HTU, NTU and Height

Air-to-water ratio from the stripping factor, liquid and gas loading from the packing pressure-drop correlation, tower diameter, HTU, NTU and packing height.

Input parameters

Unit system: SI

Parameter	Value	Unit
Water flow	4,000.0	m³/d
Inlet ammonia	40.000	mg/L
Outlet ammonia	1.0000	mg/L
Henry's constant (atm)	0.75000	
Total pressure	1.0000	atm
Stripping factor	2.0000	
Overall transfer coefficient	0.012500	1/s
Ordinate from the pressure-drop chart	0.30000	
Packing factor	20.000	
Air density	1.2040	kg/m³
Water density	998.20	kg/m³
Water viscosity	1.0020	cP

Calculated results

Parameter	Value	Unit
Air-to-water ratio by volume	3,555.3	m³/m³
Abscissa (L'/G')(ρ_G/ρ_L)^½	0.008104	
Gas loading	4.2429	kg/(m²·s)
Liquid loading	0.98942	kg/(m²·s)
Tower diameter	7.7117	m
Height of a transfer unit	0.079296	m
Number of transfer units	6.0408	
Packing height	0.47902	m

Notes for this case

- Read the ordinate from the generalised pressure-drop chart at the abscissa shown and the chosen pressure drop. Add 2-3 m to the packing height for the plenum and gas outlet.

Formula and method

$$\frac{G}{L}=\frac{SP_T}{H},\quad G'=\left[\frac{Y\rho_G(\rho_L-\rho_G)}{C_f\mu_L^{0.1}}\right]^{1/2},\quad A=\frac{Q\rho_L}{L'}$$

$$HTU=\frac{Q}{K_L aA},\quad NTU=\frac{S}{S-1}\ln\frac{(C_o/C_e)(S-1)+1}{S},\quad Z=HTU\cdot NTU$$

Variables

Q	Water flow	m³/s
C_o	Inlet ammonia	kg/m³
C_e	Outlet ammonia	kg/m³
H	Henry's constant (atm)	-
P_T	Total pressure	Pa
S	Stripping factor	-
$K_L a$	Overall transfer coefficient	1/s
Y	Ordinate from the pressure-drop chart	-
C_f	Packing factor	-
ρ_G	Air density	kg/m³
ρ_L	Water density	kg/m³
μ_L	Water viscosity	Pa·s
G/L	Air-to-water ratio by volume	m³/m³
X	Abscissa (L'/G')(ρ_G/ρ_L)^½	-
G'	Gas loading	kg/(m²·s)
L'	Liquid loading	kg/(m²·s)
D	Tower diameter	m
HTU	Height of a transfer unit	m
NTU	Number of transfer units	-
Z	Packing height	m

Method and standards

Packed tower stripping design (HTU-NTU method).

Assumptions and limits

- Dilute, isothermal; K_La from pilot data or a correlation.

Report details

Report reference	FCC-6P79-34DM (the same inputs always give the same reference)
Generated	23 November 2026, 17:42 UTC
Calculator	Air Stripping Tower for Ammonia: Diameter, HTU, NTU and Height
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/wastewater/ammonia-air-stripping-tower

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Reopens the calculator with the inputs of this report.