Absorber Minimum Liquid Rate

Minimum liquid-to-gas ratio of a counter-current absorber where the leaving liquid would be in equilibrium with the entering gas, and the design liquid rate.

Method: Operating line through (x_2, y_2) touching equilibrium at the gas inlet: $(L/G)_{min} = (y_1 - y_2)/(y_1/m - x_2)$

Input parameters

Unit system: SI

Parameter	Value	Unit
Solute in the gas entering	2.0000	%
Solute in the gas leaving	0.10000	%
Solute in the liquid entering	0	%
Equilibrium slope y = mx	1.2000	
Design multiple of the minimum	1.5000	
Gas molar flow	100.00	kmol/h

Calculated results

Parameter	Value	Unit
Minimum liquid-to-gas ratio	1.1400	
Design ratio	1.7100	
Liquid molar flow	171.00	kmol/h
Solute in the leaving liquid	1.1111	%

Notes for this case

- Dilute system with a straight equilibrium line; a curved line can pinch in the middle of the column.

Formula and method

$$\left(\frac{L}{G}\right)_{min} = \frac{y_1 - y_2}{y_1/m - x_2}$$

Variables

y_1	Solute in the gas entering	-
y_2	Solute in the gas leaving	-
x_2	Solute in the liquid entering	-
m	Equilibrium slope y = mx	-
f	Design multiple of the minimum	-
G	Gas molar flow	mol/s
$(L/G)_{min}$	Minimum liquid-to-gas ratio	-
L/G	Design ratio	-
L	Liquid molar flow	mol/s
x_1	Solute in the leaving liquid	-

Method and standards

Mass balance at the pinch.

Assumptions and limits

- Dilute, straight equilibrium line.
- Mole fractions and total flows stand in for the exact solute-free ratios (Y = y/(1 − y), X, carrier flows G_s, L_s); the error grows with y_1, and the page warns above 10 % solute.

References

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Report details

Report reference	FCC-5P85-FPMT (the same inputs always give the same reference)
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Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/chemical/separation/absorber-minimum-liquid

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.