Beer Column Stripping Steam (Madson)

Steam to strip ethanol from beer from beer flow, strength and the liquid-to-vapour ratio at the base, per litre of product (Madson, Alcohol Textbook ch. 22).

Method: Jacques; Lyons and Kelsall (eds.); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Beer	22.712	m³/h
Ethanol in the beer By volume.	10.000	%
Liquid / vapour ratio at the base Madson: about 5.0 for 10 % beer, 6.33 for 5 % beer.	5.0000	
Density used for the water in the beer	998.55	kg/m³

Calculated results

Parameter	Value	Unit
Water in the beer	20,412	kg/h
Stripping steam	4,082.3	kg/h
Ethanol in the beer	2,271.2	L/h
Steam per litre of ethanol	1.7974	kg/L

Notes for this case

• Madson's examples: 100 gpm of 10 % beer at L/V = 5 takes 9 000 lb/h of steam, 15 lb per gallon of product; 5 % beer at L/V = 6.33 takes 25 lb/gal. 15 lb/gal is 1.80 kg of steam per litre of ethanol.

Formula and method

$$L = Q(1-x)\rho_w, \quad V = \frac{L}{L/V}, \quad \frac{V}{\dot{V}_E} = \frac{V}{Qx}$$

Variables

Q	Beer	m³/s
x	Ethanol in the beer	-
L/V	Liquid / vapour ratio at the base	-
ρ_w	Density used for the water in the beer	kg/m³
L	Water in the beer	kg/s
V	Stripping steam	kg/s
$\dot{V}_E$	Ethanol in the beer	m³/s
$V/\dot{V}_E$	Steam per litre of ethanol	kg/m³

Method and standards

Madson's simplified stripping balance.

Assumptions and limits

- Beer fed at its boiling point; constant molal overflow. The heat to preheat the beer to its boiling point is not included: add it if the beer is fed cold.

References

• Jacques
• Lyons and Kelsall (eds.)

- The Alcohol Textbook
- 4th ed. (Nottingham University Press, 2003)
- ch. 22 (Madson)
- ethanol distillation: the fundamentals
- Table 1

Report details

Report reference	FCC-GDC1-6VBG (the same inputs always give the same reference)
Generated	17 November 2026, 19:36 UTC
Calculator	Beer Column Stripping Steam (Madson)
Method last reviewed	13 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/sugar-ethanol/ethanol-distillation/beer-column-stripping-steam

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.