Diffuser Extraction by Counter-Current Theory

Extraction of a counter-current diffuser from the draft ratio and the number of transfer units (Hugot eqn 23.12), and overall extraction with a mill ahead of it.

Method: Hugot; Handbook of Cane Sugar Engineering; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Draft ratio (juice drawn per juice entering with the solids)	1.1000	
Transfer units ΔL of the diffuser	15.000	
Extraction of a mill ahead of the diffuser (0 for a cane diffuser)	0	%

Calculated results

Parameter	Value	Unit
Sugar left per sugar entering	3.0290	%
Diffuser extraction	96.971	%
Overall extraction	96.971	%

Notes for this case

- Hugot: a bagasse diffuser after a mill extracting 70 % that extracts 97 % of the rest gives 99 % overall.

Formula and method

$$\frac{\varepsilon}{Z_0} = \frac{(q-1)e^{-(q-1)N/q}}{q - e^{-(q-1)N/q}}, \quad E_d = 1 - \frac{\varepsilon}{Z_0}, \quad E = e_m + (1 - e_m)E_d$$

Variables

q	Draft ratio (juice drawn per juice entering with the solids)	-
N	Transfer units ΔL of the diffuser	-
e_m	Extraction of a mill ahead of the diffuser (0 for a cane diffuser)	-
ε/Z_0	Sugar left per sugar entering	-
E_d	Diffuser extraction	-
E	Overall extraction	-

Method and standards

Hugot's counter-current diffusion theory.

Assumptions and limits

- Ideal counter-current stages; calibrate N from plant results (it has no direct physical input).
- Draft here is Hugot's theoretical ratio, juice drawn per juice entering with the solids. The diffuser draft balance calculator uses draft per cane (draft juice % cane); the two are not the same number.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 23
- counter-current theory
- eqns 23.5–23.12
- pp. 361–366
- and p. 368

Report details

Report reference	FCC-F04B-9BKY (the same inputs always give the same reference)
Generated	17 November 2026, 19:33 UTC
Calculator	Diffuser Extraction by Counter-Current Theory
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/diffusion/diffuser-extraction-theory

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.