Entrainment Separator: Allowable Vapour Velocity (Souders–Brown)

Allowable vapour velocity, area and diameter of a vapour space or entrainment separator from the Souders–Brown coefficient, vapour flow and densities (IF97 vapour).

Method: Souders and Brown (1934) v = K √((ρ_l − ρ_v)/ρ_v); vapour density from IAPWS-IF97

Input parameters

Unit system: SI

Parameter	Value	Unit
Vapour flow	20.000	t/h
Vapour pressure (absolute)	16.000	kPa
Liquid (juice or syrup) density	1,250.0	kg/m³
Souders–Brown coefficient From the separator maker or your practice.	0.060000	m/s

Calculated results

Parameter	Value	Unit
Vapour density (saturated)	0.10603	kg/m³
Allowable vapour velocity	6.5142	m/s
Vapour space area	8.0430	m²
Diameter	3.2001	m

Notes for this case

- Sugar in the condenser water is lost sugar: check entrainment by testing tail water.

Formula and method

$$v_{max} = K\sqrt{\frac{\rho_l - \rho_v}{\rho_v}}, \quad A = \frac{\dot{m}_v}{\rho_v v_{max}}$$

Variables

$\dot{m}_v$	Vapour flow	kg/s
p	Vapour pressure (absolute)	Pa
ρ_l	Liquid (juice or syrup) density	kg/m³
K	Souders–Brown coefficient	m/s
ρ_v	Vapour density (saturated)	kg/m³
v_{max}	Allowable vapour velocity	m/s
A	Vapour space area	m²
D	Diameter	m

Method and standards

Souders–Brown.

Assumptions and limits

- Saturated vapour.
- The default K of 0.06 m/s is a starting value with no particular source: the velocity and area scale directly with K, so use the separator maker's figure or your plant practice.

References

- Souders and Brown (1934) v = K √((ρ_l − ρ_v)/ρ_v); vapour density from IAPWS-IF97

Report details

Report reference	FCC-4FAA-CKZB (the same inputs always give the same reference)
Generated	17 November 2026, 19:36 UTC
Calculator	Entrainment Separator: Allowable Vapour Velocity (Souders–Brown)
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/evaporation/entrainment-separator-velocity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.