Evaporator Body Heating Surface

Heating surface of one evaporator or pan body from its evaporation, the heating and body pressures, the boiling-point elevation and the overall coefficient (IF97).

Method: Q = U A ΔT with boiling-point elevation; latent heats from IAPWS-IF97

Input parameters

Unit system: SI

Parameter	Value	Unit
Evaporation in this body	40.000	t/h
Heating steam or vapour pressure (absolute)	2.0000	bar
Body (vapour space) pressure (absolute)	1.6000	bar
Boiling-point elevation	0.50000	K
Overall heat-transfer coefficient	2,500.0	W/(m²·K)

Calculated results

Parameter	Value	Unit
Useful temperature difference	6.4133	K
Heat duty	24,675	kW
Heating surface	1,538.9	m²
Heating steam or vapour condensed	40.348	t/h

Notes for this case

- Juice is taken entering at its boiling point; U falls from the first to the last body as brix rises.

Formula and method

$$\Delta T = T_{sat}(p_h) - [T_{sat}(p_b) + BPE], \quad \dot{Q} = E\,h_{fg}(p_b), \quad A = \frac{\dot{Q}}{U \Delta T}$$

Variables

E	Evaporation in this body	kg/s
p_h	Heating steam or vapour pressure (absolute)	Pa
p_b	Body (vapour space) pressure (absolute)	Pa
BPE	Boiling-point elevation	K
U	Overall heat-transfer coefficient	W/(m²·K)
ΔT	Useful temperature difference	K
$\dot{Q}$	Heat duty	W
A	Heating surface	m²
$\dot{m}_s$	Heating steam or vapour condensed	kg/s

Method and standards

Energy balance.

Assumptions and limits

- Feed at boiling point and no heat loss: for a colder feed, or with losses, more steam is condensed than shown; flash from a hotter feed reduces it.
- For a pan the same balance is used, with no massecuite-specific terms (crystallisation heat, changing level and brix).

References

- Q = U A ΔT with boiling-point elevation; latent heats from IAPWS-IF97

Report details

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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/evaporator-heating-surface

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.