Plate-Fin Exchanger: Fin Efficiency and Overall Surface Efficiency

Fin efficiency of rectangular fins brazed between two plates, the finned share of the surface, the overall surface efficiency and fin mass per unit length.

Input parameters

Unit system: SI

Parameter	Value	Unit
Plate spacing (fin height)	24.000	mm
Fin thickness	0.060000	mm
Fin density	15.240	1/in
Heat transfer coefficient	170.00	W/(m²·K)
Fin thermal conductivity	401.00	W/(m·K)
Fin material density	8,933.0	kg/m³

Calculated results

Parameter	Value	Unit
Fin length, half the plate spacing	12.000	mm
Fin parameter (2h/(k_fδ))^½	118.88	1/m
mℓ	1.4265	
Fin efficiency	62.457	%
Fin share of the total surface	93.711	%
Overall surface efficiency	64.818	%
Heat transfer area per unit flow length and width	30.656	
Fin mass per square metre of passage plan area	7.7181	kg/m²

Notes for this case

• Fins heated from both plates are treated as two fins of length ℓ = b/2 with an adiabatic mid-plane; fin edge area is neglected. Areas are per metre of flow length per metre of width of one passage.

Formula and method

$$\eta_f = \frac{\tanh(m\ell)}{m\ell}, \quad m = \left(\frac{2h}{k_f \delta}\right)^{1/2}, \quad \ell = \frac{b}{2}$$

$$\eta_o = 1 - \frac{A_f}{A}(1 - \eta_f)$$

Variables

b	Plate spacing (fin height)	m
δ	Fin thickness	m
n_f	Fin density	1/m
h	Heat transfer coefficient	W/(m²·K)
k_f	Fin thermal conductivity	W/(m·K)
ρ_f	Fin material density	kg/m³

ℓ	Fin length, half the plate spacing	m
m	Fin parameter (2h/(k_fδ))^½	1/m
$m\ell$	mℓ	-
η_f	Fin efficiency	-
A_f/A	Fin share of the total surface	-
η_o	Overall surface efficiency	-
A/W	Heat transfer area per unit flow length and width	-
m_{fin}	Fin mass per square metre of passage plan area	kg/m²

Method and standards

Straight rectangular fin with an adiabatic tip and the overall surface efficiency of a finned passage.

Assumptions and limits

- Uniform h; one-dimensional conduction in the fin.

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/heat-transfer/plate-fin-surface-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.