Milk Homogeniser Power and Temperature Rise

Hydraulic and motor power of a high-pressure homogeniser and the temperature rise of the product from flow and homogenising pressure.

Method: Hydraulic power of a positive-displacement homogeniser; Tetra Pak; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Product flow	10,000	L/h
Total homogenising pressure (both stages)	200.00	bar
Product density	1,030.0	kg/m³
Product specific heat	3.9000	kJ/(kg·K)
Pump and drive efficiency	80.000	%

Calculated results

Parameter	Value	Unit
Hydraulic power	55.556	kW
Motor power	69.444	kW
Temperature rise of the product	4.9788	K
Energy per 1000 L	6.9444	kWh

Notes for this case

• A homogeniser is a piston pump that forces product through a narrow gap; the hydraulic power is flow × pressure. Almost all of it turns into heat in the product as the fat globules are broken up, so the product warms by Δp/(ρ c_p): about 2.5 K per 100 bar for milk. Motor power adds pump and drive losses. The energy per 1000 L is the motor power divided by the flow.

Formula and method

$$P_h = \dot{V}\Delta p, \quad P_m = \frac{P_h}{\eta}, \quad \Delta T = \frac{\Delta p}{\rho c_p}$$

Variables

$\dot{V}$	Product flow	m³/s
Δp	Total homogenising pressure (both stages)	Pa
ρ	Product density	kg/m³
c_p	Product specific heat	J/(kg·K)
η	Pump and drive efficiency	-
P_h	Hydraulic power	W
P_m	Motor power	W
ΔT	Temperature rise of the product	K
e	Energy per 1000 L	J

Method and standards

Homogeniser.

Assumptions and limits

- All hydraulic power dissipated in the product.

References

Hydraulic power of a positive-displacement homogeniser, Tetra Pak, Dairy Processing Handbook (Tetra Pak Processing Systems,

Lund)

Report details

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Release checks	3 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/chemical/food-dairy/homogeniser-power-temperature-rise

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.