HTST Pasteuriser: Regeneration Efficiency and Duties

Regeneration efficiency of a plate pasteuriser and the heating and cooling duties left for hot water and chilled water, from milk flow and the section temperatures.

Method: Mass and energy balances (definitions): regeneration efficiency = heat recovered / heat needed from raw-milk to pasteurisation temperature

Input parameters

Unit system: SI

Parameter	Value	Unit
Milk flow	20,000	kg/h
Milk specific heat	3.9300	kJ/(kg·K)
Raw milk in	4.0000	°C
Milk leaving regeneration (heated side)	68.000	°C
Pasteurisation temperature	72.000	°C
Milk out after cooling	4.0000	°C

Calculated results

Parameter	Value	Unit
Regeneration efficiency	94.118	%
Heat recovered	1,397.3	kW
Heating duty	87.333	kW
Cooling duty	87.333	kW
Pasteurised milk leaving regeneration	8.0000	°C

Notes for this case

- Regeneration of 90–95 % is normal for HTST milk; the pasteurised side must stay at higher pressure than the raw side.

Formula and method

$$R = \frac{T_2 - T_1}{T_p - T_1}, \quad Q_h = \dot{M} c_p (T_p - T_2), \quad T_3 = T_p - (T_2 - T_1)$$

Variables

$\dot{M}$	Milk flow	kg/s
c_p	Milk specific heat	J/(kg·K)
T_1	Raw milk in	K
T_2	Milk leaving regeneration (heated side)	K
T_p	Pasteurisation temperature	K
T_o	Milk out after cooling	K
R	Regeneration efficiency	-
Q_r	Heat recovered	W
Q_h	Heating duty	W
Q_c	Cooling duty	W
T_3	Pasteurised milk leaving regeneration	K

Method and standards

Energy balance with equal flows and specific heats on both sides.

Assumptions and limits

- Equal mass flows and c_p; no losses.
- The cooled milk T_o must not exceed T_3. Regeneration above 95 % (a small approach T_p − T_2) is flagged: it needs a very large plate area.

References

• Mass and energy balances (definitions): regeneration efficiency = heat recovered / heat needed from raw-milk to pasteurisation temperature

Report details

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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/chemical/food-dairy/pasteuriser-regeneration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.