Beer Preheating by Stillage: Heat Recovery

Heat recovered and the beer outlet temperature when beer is preheated by hot stillage in a counter-flow exchanger with a given approach at the cold end.

Method: Counter-flow heat balance and log-mean temperature difference (definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Beer flow	100.00	t/h
Beer specific heat	4.0000	kJ/(kg·K)
Beer in	32.000	°C
Stillage flow	90.000	t/h
Stillage specific heat	4.0500	kJ/(kg·K)
Stillage in	105.00	°C
Approach: stillage out minus beer in	10.000	K

Calculated results

Parameter	Value	Unit
Heat recovered	6,378.8	kW
Stillage out	42.000	°C
Beer out	89.409	°C
Log-mean temperature difference	12.589	K

Notes for this case

- Stillage fouls quickly: use wide-gap plate or spiral exchangers and allow for cleaning.

Formula and method

$$T_{s,out} = T_{b,in} + \Delta T_{ap}, \quad Q = \dot{m}_s c_s (T_{s,in} - T_{s,out}), \quad T_{b,out} = T_{b,in} + \frac{Q}{\dot{m}_b c_b}$$

Variables

$\dot{m}_b$	Beer flow	kg/s
c_b	Beer specific heat	J/(kg·K)
$T_{b,in}$	Beer in	K
$\dot{m}_s$	Stillage flow	kg/s
c_s	Stillage specific heat	J/(kg·K)
$T_{s,in}$	Stillage in	K
ΔT_{ap}	Approach: stillage out minus beer in	K
Q	Heat recovered	W
$T_{s,out}$	Stillage out	K
$T_{b,out}$	Beer out	K
ΔT_{lm}	Log-mean temperature difference	K

Method and standards

Heat balance with a cold-end approach.

Assumptions and limits

- No phase change; no losses.
- The cold-end approach is imposed. When the beer is the smaller capacity stream the hot end pinches first; a note appears when the hot-end difference falls below 5 K.

References

- Counter-flow heat balance and log-mean temperature difference (definitions)

Report details

Report reference	FCC-S977-72JP (the same inputs always give the same reference)
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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/ethanol-distillation/beer-stillage-heat-exchanger

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.