Wort Boiling: Evaporation and Steam

Water evaporated in the brewhouse wort kettle from the evaporation rate and boil time, the heat to bring wort to the boil and evaporate, and the steam.

Method: Mass and energy balances (definitions); Steam and water properties from IAPWS-IF97

Input parameters

Unit system: SI

Parameter	Value	Unit
Wort volume	100.00	m³
Wort density	1,040.0	kg/m³
Wort specific heat	3.9500	kJ/(kg·K)
Wort temperature into the kettle	72.000	°C
Evaporation per hour (share of the wort mass)	6.0000	%
Boil time	60.000	min
Steam pressure (absolute)	4.0000	bar

Calculated results

Parameter	Value	Unit
Water evaporated	6.2400	t
Heat (heat-up + evaporation)	25.573	GJ
Steam	11.987	t

Notes for this case

- Modern low-evaporation kettles (4–6 % per hour) with vapour condensers recover much of the boil heat.

Formula and method

$$E = V\rho\, e\, t_b, \quad Q = V\rho c_p (T_b - T_1) + E h_{fg}$$

Variables

V	Wort volume	m³
ρ	Wort density	kg/m³
c_p	Wort specific heat	J/(kg·K)
T_1	Wort temperature into the kettle	K
e	Evaporation per hour (share of the wort mass)	-
t_b	Boil time	s
p_s	Steam pressure (absolute)	Pa
E	Water evaporated	kg
Q	Heat (heat-up + evaporation)	J
m_s	Steam	kg

Method and standards

Heat-up and evaporation balance.

Assumptions and limits

- Atmospheric boiling at sea level (1 atm), whatever the site altitude; no kettle heat losses or heating-surface inefficiency, so the steam is a minimum.
- The evaporation rate is a share of the wort mass (V ρ) per hour. A rate quoted as a share of hot wort volume gives a water mass about 4 % lower (water is less dense than wort).

References

- Mass and energy balances (definitions)
- Steam and water properties from IAPWS-IF97

Report details

Report reference	FCC-60M8-JVXJ (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	Wort Boiling: Evaporation and Steam
Method last reviewed	13 November 2026
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/chemical/food-dairy/wort-boiling-evaporation

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.