Hot Water Storage: Heat-Up Time and Energy

Time and energy to heat a hot water storage tank from one temperature to another with a heater of given power and efficiency, with water from IF97.

Method: Q = m (h₂ − h₁) with IAPWS-IF97 enthalpies

Input parameters

Unit system: SI

Parameter	Value	Unit
Tank volume	2,000.0	L
Starting temperature	15.000	°C
Final temperature	60.000	°C
Heater power (input)	24.000	kW
Heater efficiency (including losses)	95.000	%

Calculated results

Parameter	Value	Unit
Water mass (density at the start)	1,998.4	kg
Heat to the water	104.43	kWh
Energy input	109.92	kWh
Heat-up time	4.5801	h

Notes for this case

- Water enthalpies from IAPWS-IF97 at 3 bar(a); a stratified tank delivers hot water before the whole volume is heated.

Formula and method

$$Q = m(h_2 - h_1), \quad t = \frac{Q}{\eta P}$$

Variables

V	Tank volume	m³
T_1	Starting temperature	K
T_2	Final temperature	K
P	Heater power (input)	W
η	Heater efficiency (including losses)	-
m	Water mass (density at the start)	kg
Q	Heat to the water	J
E	Energy input	J
t	Heat-up time	s

Method and standards

Energy balance.

Assumptions and limits

- Fully mixed tank.

References

- Q = m (h₂ − h₁) with IAPWS-IF97 enthalpies

Report details

Report reference	FCC-V3TH-FSMY (the same inputs always give the same reference)
Generated	17 November 2026, 19:49 UTC
Calculator	Hot Water Storage: Heat-Up Time and Energy
Method last reviewed	12 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/hvac/chillers/hot-water-storage-heatup

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.