Juice Heater Duty and Steam Consumption

Heat to raise mixed or clear juice to temperature and the exhaust or vapour steam it condenses, with IF97 latent heat at the steam pressure.

Method: Energy balance with IAPWS-IF97 latent heat; Hugot; Handbook of Cane Sugar Engineering (juice heating)

Input parameters

Unit system: SI

Parameter	Value	Unit
Juice flow	260.00	t/h
Juice specific heat About 3.9 kJ/kg K for mixed juice; lower for syrup.	3.9000	kJ/(kg·K)
Juice in	35.000	°C
Juice out	103.00	°C
Heating steam or vapour pressure (absolute)	2.0000	bar
Heat losses (share of duty)	2.0000	%

Calculated results

Parameter	Value	Unit
Heater duty	19,153	kW
Steam saturation temperature	120.21	°C
Latent heat at steam pressure	2,201.6	kJ/kg
Steam condensed	31.946	t/h

Notes for this case

- Condensate leaves saturated; vapour from an evaporator effect saves live exhaust steam.

Formula and method

$$\dot{Q} = \dot{m}_j c_p (T_2 - T_1), \quad T_s = T_{sat}(p_s), \quad h_{fg} = h_g(p_s) - h_f(p_s), \quad \dot{m}_s = \frac{\dot{Q}(1 + k_l)}{h_{fg}(p_s)}$$

Variables

$\dot{m}_j$	Juice flow	kg/s
c_p	Juice specific heat	J/(kg·K)
T_1	Juice in	K
T_2	Juice out	K
p_s	Heating steam or vapour pressure (absolute)	Pa
k_l	Heat losses (share of duty)	-
$\dot{Q}$	Heater duty	W
T_s	Steam saturation temperature	K
h_{fg}	Latent heat at steam pressure	J/kg
$\dot{m}_s$	Steam condensed	kg/s

Method and standards

Energy balance.

Assumptions and limits

- Saturated condensate; saturated steam (no superheat credit, no condensate subcooling).
- The steam pressure is absolute: a gauge reading entered as absolute gives a saturation temperature about 20 K too low at 1

bar(g).

- c_p is your figure; the juice specific heat calculator gives it from brix and purity.

References

- Energy balance with IAPWS-IF97 latent heat; Hugot
- Handbook of Cane Sugar Engineering (juice heating)

Report details

Report reference	FCC-0GZ0-FA00 (the same inputs always give the same reference)
Generated	17 November 2026, 19:49 UTC
Calculator	Juice Heater Duty and Steam Consumption
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/sugar-ethanol/clarification/juice-heater-steam

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.