Economiser or Air Heater on a Bagasse Boiler (Hugot)

Gas exit temperature and surface of an economiser or air heater on a bagasse boiler by Hugot's counter-current method (eqns 41.68–41.76).

Method: Hugot; Handbook of Cane Sugar Engineering; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Heat recovery	Economiser (feed water)	
Flue gas	121,900	kg/h
Gas specific heat Hugot: 0.27 + 0.00006T kcal/(kg·°C) at mean gas temperature T.	1.1932	kJ/(kg·K)
Gas entering	350.00	°C
Heat retained (losses) Hugot: 0.92–0.96.	95.000	%
Water or air flow	50,000	kg/h
Its specific heat Water about 1 kcal/(kg·°C); air 0.24.	4.1868	kJ/(kg·K)
Water or air entering	90.000	°C
Water or air leaving	165.00	°C
Heat-transfer coefficient Hugot: economisers 15–25 (to 35); air heaters 15–20 kcal/(m²·h·°C).	29.075	W/(m²·K)

Calculated results

Parameter	Value	Unit
Ratio αPC/(pc)	0.66009	
Heat recovered	4,361.3	kW
Gas leaving	236.38	°C
Surface	909.44	m²

Notes for this case

- Hugot's examples: economiser 50 t/h from 90 to 165 °C on 121 900 kg/h of gas at 350 °C: gas leaves at 236 °C, 918 m² at k = 25; air heater 30 → 200 °C on gas at 360 °C: 1 176 m² at k = 18.
- Economiser: keep the water leaving at least 30 °C below its saturation temperature at the feed pressure (not checked here: the feed pressure is not an input).

Formula and method

$$r = \frac{\alpha PC}{pc}, \quad T = T_0 - \frac{t - t_0}{r}, \quad S = \frac{\alpha PC}{k(1-r)} \ln \frac{T_0 - t}{T - t_0}$$

Variables

type	Heat recovery	-
P	Flue gas	kg/s
C	Gas specific heat	J/(kg·K)
T_0	Gas entering	K
α	Heat retained (losses)	-
p	Water or air flow	kg/s
c	Its specific heat	J/(kg·K)

t_0	Water or air entering	K
t	Water or air leaving	K
k	Heat-transfer coefficient	W/(m²·K)
r	Ratio αPC/(pc)	-
$\dot{Q}$	Heat recovered	W
T	Gas leaving	K
S	Surface	m²

Method and standards

Hugot's counter-current heat balance.

Assumptions and limits

- Counter-current flow; constant specific heats. Hugot's gas specific heat rises with temperature (0.27 + 0.00006 T kcal/(kg·°C)); enter its value at the mean gas temperature.
- The type choice only selects the notes; the same counter-current formula serves both. The economiser's 30 °C margin below saturation is not checked.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 41
• economisers and air heaters
• eqns 41.68–41.76 and examples
• pp. 975–988

Report details

Report reference	FCC-7PV3-WX8W (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	Economiser or Air Heater on a Bagasse Boiler (Hugot)
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/steam-power/bagasse-boiler-heat-recovery

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.