Massecuite Reheating: Power, Coil and Electric Heater

Heat to reheat low-grade massecuite before curing (Hugot eqns 35.53–35.54), the water coil it needs and the length of an electric-resistance reheater (eqn 35.55).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Massecuite flow	8.0000	m³/h
Massecuite density	1,500.0	kg/m³
Massecuite specific heat	1.7585	kJ/(kg·K)
Temperature in	40.000	°C
Temperature out Hugot: about 50–52 °C, at most 57 °C.	52.000	°C
Coil area per m³/h of massecuite Hugot: 30–35 m² per m³/h with water no more than 3 °C above saturation.	32.500	
Supply voltage	400.00	V
Power factor	100.00	%
Outer / inner diameter of the annulus	1.7674	

Calculated results

Parameter	Value	Unit
Reheating power	70.338	kW
Water coil area	260.00	m²
Mean conductance 6.5(T − 30) µS/cm	104.00	
Electric heater active length	3.8476	m

Notes for this case

- Hugot: viscosity halves for each 5 °C rise; reheating improved a Cuban factory's C sugar purity from 84.7 to 89.4 and cut molasses purity by 1.3 points.

Formula and method

$$P = Qdc(t - t_0), \quad A_c = a_c Q, \quad k = 6.5(T - 30), \quad L = 3.68 \times 10^6 \frac{P \log(D/d)}{kV^2 \cos\varphi} \ [P\,\mathrm{kW}]$$

Variables

Q	Massecuite flow	m³/s
d	Massecuite density	kg/m³
C	Massecuite specific heat	J/(kg·K)
t_0	Temperature in	K
t	Temperature out	K
a_c	Coil area per m³/h of massecuite	-
V	Supply voltage	V
$\cos\varphi$	Power factor	-
D/d	Outer / inner diameter of the annulus	-
P	Reheating power	W
A_c	Water coil area	m²

k	Mean conductance 6.5(T − 30) µS/cm	-
L	Electric heater active length	m

Method and standards

Hugot's reheater formulae (Wright's length formula).

Assumptions and limits

- Mean conductance from Hugot's estimate, with T the mean of the inlet and outlet temperatures in °C.
- Wright's length formula is empirical: P in kW, k in µS/cm, V in volts and L in metres; the page converts from SI.
- A note appears for outlet temperatures above 57 °C.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 35
• reheating of massecuite
• eqns 35.52–35.55
• pp. 807–811

Report details

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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/pan-boiling/massecuite-reheating

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.