Juice Heater Coefficient (Hugot and Others)

Heat-transfer coefficient of a tubular juice heater by Hugot's formula (eqn 30.11) with his scaling factor (30.18), and by Hausbrand's and the Australian formulae.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Heating vapour temperature	115.00	°C
Juice velocity in the tubes	1.8000	m/s
Hugot coefficient Hugot: 6; up to 8 with little scale; 5 or 7 with his scale terms.	6.0000	
Scaling factor A Hugot: 6 favourable, 4 average, 3 unfavourable juice.	6.0000	
Days since cleaning	0	d

Calculated results

Parameter	Value	Unit
Hugot, clean tubes	802.47	W/(m²·K)
Hugot, after J days	802.47	W/(m²·K)
Hausbrand 750√(V + 0.007)	1,062.4	W/(m²·K)
Australian 900√V	1,404.3	W/(m²·K)

Notes for this case

- Hugot's formulae are in kcal/(m²·h·°C) on the inside tube area; converted to W/(m²·K) here. Keep juice velocity at 1.5–2 m/s.

Formula and method

$$k_H = CT\left(\frac{U}{1.8}\right)^{0.8}, \quad k = k_H\sqrt{\frac{A_s}{A_s + J}}, \quad k_{Hb} = 750\sqrt[3]{U + 0.007}, \quad k_{Au} = 900\sqrt{U}\ [\mathrm{kcal/(m^2\,h\,^\circ C)}]$$

Variables

T	Heating vapour temperature	K
U	Juice velocity in the tubes	m/s
C	Hugot coefficient	-
A_s	Scaling factor A	-
J	Days since cleaning	s
k_H	Hugot, clean tubes	W/(m²·K)
k	Hugot, after J days	W/(m²·K)
k_{Hb}	Hausbrand 750√(V + 0.007)	W/(m²·K)
k_{Au}	Australian 900√V	W/(m²·K)

Method and standards

Hugot's empirical heater formulae.

Assumptions and limits

- Tubular heaters, condensing vapour.
- In the formulas T is in °C and U in m/s and the results in kcal/(m²·h·°C), although the Variables table gives SI units; the page converts.
- The velocity ranges over which the three correlations were fitted are not stated; a note appears outside the usual 1.5–2 m/s.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 30
• eqns 30.8–30.11 and 30.18–30.19
• pp. 451–455

Report details

Report reference	FCC-KWQ2-7185 (the same inputs always give the same reference)
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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-coefficient

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.