Evaporator Last-Body Vacuum and Syrup Temperature

Vacuum and absolute pressure of the last evaporator body for a vapour temperature (IF97), and the syrup temperature with its boiling-point elevation (Hugot ch. 32).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Vapour temperature of the last body Hugot: about 55 °C, 64 cmHg vacuum, keeps the syrup near 60 °C for the pans.	55.000	°C
Barometric pressure	101.33	kPa
Syrup brix	65.000	%

Calculated results

Parameter	Value	Unit
Absolute pressure	15.761	kPa
Vacuum (barometric minus absolute)	641.78	mmHg
Boiling-point elevation	3.1584	K
Syrup temperature	58.158	°C

Notes for this case

• The syrup leaves at 58.2 °C, below about 60 °C: it can form false grain in the pans (Java practice); a higher vacuum also raises entrainment.

Formula and method

$$p = p_{sat}(T_n), \quad h = p_a - p, \quad T_s = T_n + e$$

$$e = 0.025\,\frac{B(30+B)}{103.6-B}\left(1-\frac{0.54\,h}{229-h}\right) \quad (B \text{ in brix},\ h \text{ in cmHg},\ e \text{ in } ^\circ C)$$

Variables

T_n	Vapour temperature of the last body	K
p_a	Barometric pressure	Pa
B	Syrup brix	-
p	Absolute pressure	Pa
h	Vacuum (barometric minus absolute)	Pa
e	Boiling-point elevation	K
T_s	Syrup temperature	K

Method and standards

IF97 saturation with Hugot's boiling-point elevation.

Assumptions and limits

- Pure sucrose elevation by Hugot's formula; in it the vacuum is in cmHg (1 cmHg = 1333.224 Pa) against the local barometric pressure.
- The vacuum is a pressure difference, shown in mmHg; the absolute pressure is the figure to compare between sites.
- A note appears when the syrup leaves below about 60 °C.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)

- ch. 32
- maximum vacuum and boiling-point elevation
- pp. 494–497 and 610
- Saturation pressure from IAPWS-IF97

Report details

Report reference	FCC-YXJQ-WKVT (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/evaporation/evaporator-last-body-vacuum

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.