Evaporator Capacity from Installed Surface

Evaporation a multiple effect gives from its total surface by Hugot's rule (about 100/n kg/m²/h), against the evaporation needed, and surface per t cane/h.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Number of effects	4.0000	
Total heating surface	2,000.0	m²
Factor on Hugot's rate Hugot Table 32.21 shows about 1.2 with heat losses allowed for 2.4 m tubes; Webre's figures are higher still.	1.0000	
Crushing rate	100.00	t/h
Clear juice	100.00	t/h
Clear juice brix	13.000	%
Syrup brix	65.000	%

Calculated results

Parameter	Value	Unit
Evaporation per m² of total surface	25.000	kg/(m²·h)
Evaporation capacity	50,000	kg/h
Evaporation needed	80,000	kg/h
Load on the evaporator	160.00	%
Surface per t cane/h (m² per t/h)	20.000	m²

Notes for this case

- The evaporation needed is 160 % of what the surface gives by Hugot's rule: the evaporator is undersized for this juice, or needs higher temperatures or more bleeding to cope.
- Hugot: about 24 m² per t cane/h for a quadruple at 1 kg/cm² back-pressure (17 triple, 31 quintuple); more at lower back-pressure.

Formula and method

$$g = k\frac{100}{n}\ \mathrm{kg/(m^2\,h)}, \quad E_c = gS, \quad E = J\left(1 - \frac{B_0}{B_s}\right)$$

Variables

n	Number of effects	-
S	Total heating surface	m²
k	Factor on Hugot's rate	-
A	Crushing rate	kg/s
J	Clear juice	kg/s
B_0	Clear juice brix	-
B_s	Syrup brix	-
g	Evaporation per m² of total surface	kg/(m²·s)
E_c	Evaporation capacity	kg/s
E	Evaporation needed	kg/s

E/E_c	Load on the evaporator	-
S/A	Surface per t cane/h	m² per t/h

Method and standards

Hugot's rule of thumb.

Assumptions and limits

- Normal temperatures; moderate bleeding. Vapour bleeding and a pre-evaporator are not modelled.
- Crushing rate and clear juice are separate inputs and are not checked against each other; the crushing rate is used only for the surface per t cane/h.
- A note appears when the load exceeds 100 %.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 32
• rule for evaporation and Tables 32.17
• 32.21
• 32.32–32.33
• pp. 578–580 and 608–609

Report details

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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-capacity-check

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.