Steam per Evaporation and Saving of an Added Effect

Steam an n-effect evaporator needs without bleeding (about E/n) and the steam saved by adding one more effect, E/(n(n − 1)), after Hugot eqn 32.34.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Evaporation	80,000	kg/h
Number of effects	4.0000	

Calculated results

Parameter	Value	Unit
Steam with n effects	20,000	kg/h
Steam with n − 1 effects	26,667	kg/h
Steam saved by the n-th effect	6,666.7	kg/h
Evaporation per kg of steam	4.0000	

Notes for this case

- Each added effect saves less: going from 3 to 4 effects saves 1/12 of the evaporation. Bleeding and losses change the absolute figures.

Formula and method

$$S_n \approx \frac{E}{n}, \quad \Delta S = \frac{E}{n-1} - \frac{E}{n} = \frac{E}{n(n-1)}$$

Variables

E	Evaporation	kg/s
n	Number of effects	-
S_n	Steam with n effects	kg/s
S_{n-1}	Steam with n − 1 effects	kg/s
ΔS	Steam saved by the n-th effect	kg/s
E/S	Evaporation per kg of steam	-

Method and standards

Rillieux's rule as given by Hugot.

Assumptions and limits

- No bleeding; equal latent heats.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 32
- eqn 32.34 and pp. 553 and 580–583

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-effects-steam-saving

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.