Evaporator Condensate Flash Cascade

Vapour flashed from condensate passing from one calandria to the next colder one, stage by stage through four more calandrias, with IF97 enthalpies (Hugot ch. 32).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Condensate leaving the first calandria	30,000	kg/h
Temperature of that condensate	120.00	°C
Temperature of calandria 2	111.00	°C
Temperature of calandria 3	100.00	°C
Temperature of calandria 4	85.000	°C
Temperature of calandria 5	55.000	°C

Calculated results

Parameter	Value	Unit
Vapour flashed into calandria 2	514.42	kg/h
Vapour flashed into calandria 3	607.61	kg/h
Vapour flashed into calandria 4	794.52	kg/h
Vapour flashed into calandria 5	1,489.6	kg/h
Total vapour flashed	3,406.2	kg/h
Condensate left at the end	26,594	kg/h
Share flashed	11.354	%

Notes for this case

- Hugot: flashing condensates from vessel to vessel raises the evaporation of a quadruple by about 4.6 %.
- Only the first calandria's condensate is followed; in a full cascade each later calandria's own condensate joins it and flashes too, so the real total is higher.

Formula and method

$$F_i = \dot{m}_{L,i-1}\frac{h_f(T_{i-1}) - h_f(T_i)}{h_g(T_i) - h_f(T_i)}, \quad \dot{m}_{L,i} = \dot{m}_{L,i-1} - F_i$$

Variables

$\dot{m}_c$	Condensate leaving the first calandria	kg/s
T_0	Temperature of that condensate	K
T_1	Temperature of calandria 2	K
T_2	Temperature of calandria 3	K
T_3	Temperature of calandria 4	K
T_4	Temperature of calandria 5	K
F_1	Vapour flashed into calandria 2	kg/s
F_2	Vapour flashed into calandria 3	kg/s
F_3	Vapour flashed into calandria 4	kg/s
F_4	Vapour flashed into calandria 5	kg/s
$\sum F$	Total vapour flashed	kg/s

$\dot{m}_L$	Condensate left at the end	kg/s
$\Sigma F/\dot{m}_c$	Share flashed	-

Method and standards

Adiabatic flash with IF97.

Assumptions and limits

- Saturated condensate; no heat loss.
- Only the condensate leaving the first calandria is followed through four stages. Each later calandria's own condensate, which joins the cascade in Hugot's scheme, is not added, so the total flash is lower than a full cascade gives. For fewer stages, read the first outputs only.

References

- Hugot
- Handbook of Cane Sugar Engineering
- 3rd ed. (Elsevier, 1986)
- ch. 32
- condensates and Table 32.8
- pp. 516–520
- Saturation enthalpies from IAPWS-IF97

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-condensate-flash

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.