Rectifier Vapour, Condenser Duty and Cooling Water

Overhead vapour, condenser duty and cooling-water flow of a rectifying column from the distillate rate, the reflux ratio and the latent heat of the overhead.

Method: Overhead balance V = D (R + 1); Q = V λ (McCabe–Thiele constant molal overflow)

Input parameters

Unit system: SI

Parameter	Value	Unit
Distillate (product draw)	3,300.0	kg/h
Reflux ratio L/D	3.5000	
Latent heat of the overhead vapour Near 0.9–1.0 MJ/kg for vapour near the ethanol–water azeotrope.	950.00	kJ/kg
Cooling-water rise	8.0000	K

Calculated results

Parameter	Value	Unit
Overhead vapour	14,850	kg/h
Condenser duty	3,918.8	kW
Cooling water	421.19	t/h

Notes for this case

- In multi-pressure plants this heat reboils a lower-pressure column instead of going to cooling water.

Formula and method

$$V = D(R+1), \quad \dot{Q}_c = V\lambda, \quad \dot{m}_w = \frac{\dot{Q}_c}{c_w \Delta T_w}$$

Variables

D	Distillate (product draw)	kg/s
R	Reflux ratio L/D	-
λ	Latent heat of the overhead vapour	J/kg
ΔT_w	Cooling-water rise	K
V	Overhead vapour	kg/s
$\dot{Q}_c$	Condenser duty	W
$\dot{m}_w$	Cooling water	kg/s
c_w	Cooling-water specific heat, 4 186.8	J/(kg·K)

Method and standards

Balance.

Assumptions and limits

- Total condenser.

References

- Overhead balance V = D (R + 1); Q = V λ (McCabe–Thiele constant molal overflow)

Report details

Report reference	FCC-Y7ZF-2KSC (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/ethanol-distillation/rectifier-condenser-duty

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.