Distillation Condenser and Reboiler Duties from Reflux

Vapour and liquid flows in both column sections and the condenser and reboiler duties from distillate, reflux ratio, feed condition and molar latent heats.

Method: Perry's Chemical Engineers' Handbook; 9th ed. (McGraw-Hill, 2019); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Distillate	40.000	kmol/h
Feed	100.00	kmol/h
Reflux ratio L/D	2.0000	
Feed condition q	1.0000	
Latent heat of the overhead vapour	32.000	kJ/mol
Latent heat of the bottoms	38.000	kJ/mol

Calculated results

Parameter	Value	Unit
Reflux	80.000	kmol/h
Vapour to the condenser	120.00	kmol/h
Liquid in the stripping section	180.00	kmol/h
Boil-up	120.00	kmol/h
Condenser duty	1,066.7	kW
Reboiler duty	1,266.7	kW

Formula and method

$$L = RD, \quad V = (R+1)D, \quad L' = L + qF, \quad V' = V - (1-q)F, \quad Q_C = V\lambda_D, \quad Q_R = V'\lambda_B$$

Variables

D	Distillate	mol/s
F	Feed	mol/s
R	Reflux ratio L/D	-
q	Feed condition q	-
λ_D	Latent heat of the overhead vapour	J/mol
λ_B	Latent heat of the bottoms	J/mol
L	Reflux	mol/s
V	Vapour to the condenser	mol/s
L'	Liquid in the stripping section	mol/s
V'	Boil-up	mol/s
Q_C	Condenser duty	W
Q_R	Reboiler duty	W

Method and standards

Section balances with constant molar overflow.

Assumptions and limits

- Total condenser; saturated reflux.
- Inputs that give a negative stripping liquid L' or boil-up V' are rejected.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 13 (distillation)
- constant molar overflow and feed condition

Report details

Report reference	FCC-YRZG-1R4F (the same inputs always give the same reference)
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Calculator	Distillation Condenser and Reboiler Duties from Reflux
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/chemical/separation/condenser-reboiler-duty

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.