Gilliland Correlation: Stages from Nmin, Rmin and R

Theoretical stages at a working reflux from Fenske minimum stages and Underwood minimum reflux, by the Molokanov equation fitted to Gilliland's correlation.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Minimum stages (Fenske)	8.0000	
Minimum reflux ratio	1.2000	
Operating reflux ratio	1.5000	

Calculated results

Parameter	Value	Unit
(R − Rmin)/(R + 1)	0.12000	
(N − Nmin)/(N + 1)	0.53373	
Theoretical stages	18.302	

Formula and method

$$\frac{N-N_{min}}{N+1}=1-\exp\left[\frac{1+54.4\psi}{11+117.2\psi}\cdot\frac{\psi-1}{\psi^{0.5}}\right],\quad \psi=\frac{R-R_{min}}{R+1}$$

Variables

N_{min}	Minimum stages (Fenske)	-
R_{min}	Minimum reflux ratio	-
R	Operating reflux ratio	-
ψ	(R − Rmin)/(R + 1)	-
Y	(N − Nmin)/(N + 1)	-
N	Theoretical stages	-

Method and standards

Perry's Eq. (13-30).

Assumptions and limits

- Near-ideal mixtures; the correlation scatters about ±30 % in N, so read the stage count to the nearest whole stage or so, whatever the number of figures shown.

References

- Perry's Chemical Engineers' Handbook
- 9th ed. (McGraw-Hill, 2019)
- sec. 13 (distillation)
- Eq. (13-30)
- Molokanov et al.
- Int. Chem. Eng. 12(2): 209 (1972)

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/chemical/separation/gilliland-molokanov-stages

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.