# Kirkbride Feed Stage Location for Multicomponent Distillation

Ratio of rectifying to stripping stages and the feed stage of a distillation column by the Kirkbride equation from key-component compositions and product rates.

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| Bottoms molar flow | 50.000 | |
| Distillate molar flow (same unit) | 50.000 | |
| Light key in the feed | 50.000 | % |
| Heavy key in the feed | 50.000 | % |
| Light key in the bottoms | 2.0000 | % |
| Heavy key in the distillate | 2.0000 | % |
| Total stages, excluding the reboiler | 20.000 | |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Rectifying to stripping stages | 1.0000 | |
| Stripping stages | 10.000 | |
| Rectifying stages | 10.000 | |
| Feed stage counted from the top | 11.000 | |

**Notes for this case**

- Kirkbride's empirical correlation, adequate for preliminary design; the feed stage is the first stage below the rectifying section. Check with a rigorous simulation, which may move it a stage or two.

## Formula and method

$$\log\frac{N_r}{N_s} = 0.206\log\left[\frac{B}{D}\frac{x_{f,HK}}{x_{f,LK}}\left(\frac{x_{b,LK}}{x_{d,HK}}\right)^2\right]$$

### Variables

| | | |
|---|---|---|
| $B$ | Bottoms molar flow | - |
| $D$ | Distillate molar flow (same unit) | - |
| $x_{f,LK}$ | Light key in the feed | - |
| $x_{f,HK}$ | Heavy key in the feed | - |
| $x_{b,LK}$ | Light key in the bottoms | - |
| $x_{d,HK}$ | Heavy key in the distillate | - |
| $N$ | Total stages, excluding the reboiler | - |
| $N_r/N_s$ | Rectifying to stripping stages | - |
| $N_s$ | Stripping stages | - |
| $N_r$ | Rectifying stages | - |
| $N_F$ | Feed stage counted from the top | - |

### Method and standards

Kirkbride's feed-location correlation.

### Assumptions and limits

- Empirical; constant molar overflow.

## Report details

| | |
|---|---|
| Report reference | FCC-V1K5-Z9DR (the same inputs always give the same reference) |
| Generated | 23 November 2026, 17:50 UTC |
| Calculator | Kirkbride Feed Stage Location for Multicomponent Distillation |
| Method last reviewed | 17 November 2026 |
| Software release | FireCAD Calc, release of 22 November 2026 |
| Release checks | 3 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/kirkbride-feed-stage

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.