Surface Tension by Corresponding States (Brock–Bird)

Surface tension of a nonpolar or moderately polar organic liquid from its critical temperature, critical pressure and normal boiling point (Brock–Bird).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Temperature	30.000	°C
Normal boiling point	35.000	°C
Critical temperature	226.00	°C
Critical pressure	54.900	bar

Calculated results

Parameter	Value	Unit
Miller factor	5.1129	
Surface tension	22.360	mN/m

Notes for this case

• Perry's: about 5 %; not for strongly polar or hydrogen-bonded liquids (water, alcohols, acids). Estimate for design; use measured data where they exist.

Formula and method

$$\sigma = 5.553 \times 10^{-5}\, p_c^{2/3} T_c^{1/3} F (1 - T_r)^{11/9} \ \text{mN/m} \ (p_c \ \text{Pa}), \quad F = \frac{T_{br}(\ln p_c - 11.5261)}{1 - T_{br}} - 1.3281$$

Variables

T	Temperature	K
T_b	Normal boiling point	K
T_c	Critical temperature	K
p_c	Critical pressure	Pa
F	Miller factor	-
σ	Surface tension	N/m

Method and standards

Brock–Bird–Miller corresponding states.

Assumptions and limits

- Nonpolar and moderately polar organics.
- Inconsistent critical constants can make the Miller factor zero or negative; the page then stops.

References

• Perry's Chemical Engineers' Handbook
• 9th ed. (McGraw-Hill, 2019)
• sec. 2
• Eqs. (2-118) and (2-119) (Brock and Bird, modified by Miller) with the ethyl mercaptan example

Report details

Report reference	FCC-1X2S-24DT (the same inputs always give the same reference)
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Calculator	Surface Tension by Corresponding States (Brock–Bird)
Method last reviewed	13 November 2026
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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/physical-properties/brock-bird-surface-tension

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.