Alcoholometer Surface-Tension Correction (OIML R 22 Annex II)

Correction K to add to an alcoholometer or hydrometer reading when the liquid's surface tension differs from that at 20 °C, by OIML R 22 Annex II.

Method: OIML R 22 (1973); Alcoholometry; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Reading (scale units, e.g. % vol)	42.000	
Surface tension of the liquid at t R 22 Annex II table, e.g. 40 % mass: 31.3 mN/m at 0 °C, 29.9 at 20 °C.	31.300	mN/m
Surface tension at 20 °C (instrument adjustment)	29.900	mN/m
Sensitivity: scale length per scale unit	3.0000	mm
Stem diameter	4.0000	mm
Density of the liquid	950.00	kg/m³
Scale of the instrument	Alcoholometer: strength (% vol or % mass) rises up the stem	

Calculated results

Parameter	Value	Unit
Correction to add (scale units)	-0.050091	
Corrected reading	41.950	

Formula and method

The formula is shown on the calculator page: https://calc.firecad.com/sugar-ethanol/alcoholometry/alcoholometer-surface-tension-correction

Variables

r	Reading (scale units, e.g. % vol)	-
γ	Surface tension of the liquid at t	N/m
$\gamma(20\,°C)$	Surface tension at 20 °C (instrument adjustment)	N/m
E	Sensitivity: scale length per scale unit	m
d	Stem diameter	m
ρ	Density of the liquid	kg/m³
K	Correction to add (scale units)	-
$r + K$	Corrected reading	-
s	Scale direction: −1 for an alcoholometer (strength rises up the stem), +1 for a density hydrometer	-
g	Standard acceleration of gravity, 9.806 65	m/s²

Method and standards

OIML R 22 (1975), Annex II, p. 8: add the correction K = 4[γ − γ(20 °C)]/(g E d ρ) to the reading, with g = 9.806 65 m/s². R 22 does not state the sign for each kind of scale; it follows from the physics. A higher surface tension pulls the instrument deeper by 4Δγ/(ρ g d). On a density hydrometer, where values rise down the stem, it then reads low and K is added as printed. On an alcoholometer, where strength rises up the stem, it reads high and the correction changes sign.

Assumptions and limits

- Clean stem, standard meniscus.

- The density entered must be that of the liquid at the reading; it is not checked against the reading.

References

• OIML R 22 (1973)
• Alcoholometry
• and International Alcoholometric Tables (1975)
• Annex II
• correction of surface tension

Report details

Report reference	FCC-GHSF-BPXS (the same inputs always give the same reference)
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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/sugar-ethanol/alcoholometry/alcoholometer-surface-tension-correction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.