Alcoholic Strength from Density and Temperature (OIML)

Alcoholic strength by mass and by volume from the density of an ethanol–water mixture measured at any temperature from −20 to +40 °C (OIML R 22 Tables V–VII).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Measured density at t	948.20	kg/m³
Temperature of the liquid R 22 formula range −20 to +40 °C.	20.000	°C

Calculated results

Parameter	Value	Unit
Strength by mass	33.214	%
Strength by volume at 20 °C	39.903	%
Density at 20 °C	948.20	kg/m³

Formula and method

$$\rho(p,t) = \rho_{\text{measured}} \Rightarrow p, \quad q = p\,\frac{\rho_{20}(p)}{\rho_{20}(1)}, \quad \rho_{20}(1) \approx 789.24\ \text{kg/m}^3$$

Variables

ρ_t	Measured density at t	kg/m³
t	Temperature of the liquid	K
p	Strength by mass	-
q	Strength by volume at 20 °C	-
ρ_{20}	Density at 20 °C	kg/m³

Method and standards

Inversion of the R 22 formula by bisection, as Tables V–VII are built.

Assumptions and limits

- Binary ethanol–water.
- Density between pure ethanol and water at t.
- Below 0 °C dilute mixtures freeze; the R 22 formula is then applied to supercooled liquid and the result has no practical meaning for a frozen sample.
- The inversion assumes density falls steadily with strength at a fixed temperature, as the R 22 formula does over its range.

References

• OIML R 22 (1973)
• Alcoholometry
• and International Alcoholometric Tables (1975): formula of Wagenbreth and Blanke
• pp. 12–13

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/sugar-ethanol/alcoholometry/alcohol-strength-from-density-oiml

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.