Volume Contraction on Mixing Ethanol and Water

Volume, strength and contraction when pure ethanol and water are mixed at 20 °C, from the OIML R 22 densities: 50 L + 50 L gives about 96.5 L.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Pure ethanol at 20 °C	50.000	L
Water at 20 °C	50.000	L

Calculated results

Parameter	Value	Unit
Volume of the mixture at 20 °C	96.463	L
Contraction	3.5373	%
Strength by mass	44.155	%
Strength by volume at 20 °C	51.834	%

Formula and method

$$p = \frac{V_e \rho_e}{V_e \rho_e + V_w \rho_w}, \quad V_m = \frac{V_e \rho_e + V_w \rho_w}{\rho_{20}(p)}, \quad q = \frac{V_e}{V_m}$$

Variables

V_e	Pure ethanol at 20 °C	m³
V_w	Water at 20 °C	m³
V_m	Volume of the mixture at 20 °C	m³
$\Delta V/(V_e + V_w)$	Contraction	-
p	Strength by mass	-
q	Strength by volume at 20 °C	-
ρ_e, ρ_w	Densities of ethanol and water at 20 °C (R 22)	kg/m³

Method and standards

Mass balance with R 22 densities at 20 °C.

Assumptions and limits

- Both liquids at 20 °C; after mixing, back to 20 °C.

References

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

Report details

Report reference	FCC-QXJR-RZJH (the same inputs always give the same reference)
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Calculator	Volume Contraction on Mixing Ethanol and Water
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/sugar-ethanol/alcoholometry/ethanol-water-mixing-contraction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.