Pure Ethanol at 20 °C in a Steel Tank Measured at t

Volume of pure ethanol at 20 °C and bulk volume at 20 °C of spirit measured at temperature t in a steel container calibrated at 20 °C, OIML R 22 Tables XI.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Volume measured at t	10,000	L
Strength entered as	% vol (by volume at 20 °C)	
Alcoholic strength	40.000	%
Temperature of the liquid R 22 formula range −20 to +40 °C.	20.000	°C
Cubical (volume) expansion of the steel, about 3 × linear R 22: 36 × 10^{-6} /°C, the volume coefficient (three times the linear 12 × 10^{-6}). Shown in µm/(m·K), i.e. 10^{-6} /K.	36.000	µm/(m·K)

Calculated results

Parameter	Value	Unit
Density at t	948.05	kg/m³
Bulk volume at 20 °C	10,000	L
Pure ethanol at 20 °C	4,000.0	L
Pure ethanol per unit measured volume	40.000	%

Formula and method

$$v = V_t \frac{p\,\rho_t}{\rho_{20}(1)}[1+\beta(t-20)] = V_t \frac{q\,\rho_t}{\rho_{20}}[1+\beta(t-20)], \quad V_{20} = V_t \frac{\rho_t}{\rho_{20}}[1+\beta(t-20)]$$

Variables

V_t	Volume measured at t	m³
basis	Strength entered as	-
S	Alcoholic strength	-
t	Temperature of the liquid	K
β	Cubical (volume) expansion of the steel, about 3 × linear	1/K
ρ_t	Density at t	kg/m³
V_{20}	Bulk volume at 20 °C	m³
$\mathcal{V}$	Pure ethanol at 20 °C	m³
v/V_t	Pure ethanol per unit measured volume	-

Method and standards

R 22 Annex I formulas for Tables XI.

Assumptions and limits

- Tank calibrated at 20 °C.
- β is the cubical (volume) coefficient, 36 × 10^{-6} /K in R 22; entering the linear coefficient (about 12 × 10^{-6}) would under-correct the tank by two thirds.
- Uniform temperature.

References

• OIML R 22 (1973)

- Alcoholometry
- and International Alcoholometric Tables (1975)
- Annex I
- Tables XIa and XIb

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/ethanol-volume-steel-tank-oiml

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.