Rotameter (Variable Area) Density Correction

Corrected flow of a rotameter used on a fluid of different density from its calibration fluid, for liquids and gases, from the float density.

Method: Force balance on the float of a variable-area meter (ISO 11605 principle)

Input parameters

Unit system: SI

Parameter	Value	Unit
Scale reading (in the calibration fluid)	100.00	
Float density	8,000.0	kg/m³
Density of the calibration fluid	1,000.0	kg/m³
Density of the actual fluid	850.00	kg/m³

Calculated results

Parameter	Value	Unit
Volume flow correction factor	1.0962	
Actual volume flow	109.62	
Mass flow ratio factor (k ρ₂/ρ₁)	0.93178	

Notes for this case

- Viscosity effects are ignored; for gases use the density at the meter's actual pressure and temperature.

Formula and method

$$k = \sqrt{\frac{\rho_1(\rho_f - \rho_2)}{\rho_2(\rho_f - \rho_1)}}, \quad Q_v = k\,Q_s$$

Variables

Q_s	Scale reading (in the calibration fluid)	-
ρ_f	Float density	kg/m³
ρ_1	Density of the calibration fluid	kg/m³
ρ_2	Density of the actual fluid	kg/m³
k	Volume flow correction factor	-
Q_v	Actual volume flow	-
Q_m	Mass flow ratio factor (k ρ₂/ρ₁)	-

Method and standards

Drag on the float balances its submerged weight.

Assumptions and limits

- Same viscosity regime.

References

- Force balance on the float of a variable-area meter (ISO 11605 principle)

Report details

Report reference	FCC-PMK0-VHM6 (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/instrumentation/flow/rotameter-density-correction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.