



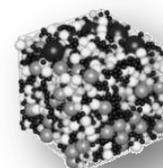
The Laboratory of Properties of Liquids is responsible for the development, and maintenance of the national standards of liquids density, viscosity, surface tension, handling to:

- participate and coordinate inter-laboratory comparisons;
- perform measurement audits of: calibration of hydrometers, oscillation-type density meters and capillary viscometers and of determination of density, viscosity and surface tension of liquids;
- perform calibrations of hydrometers, oscillation-type density meters, viscometers (capillary, rotational and Stabinger), rheometers and tensiometers.
- determinate the density, surface tension, viscosity and the rheological parameters of liquid samples;
- develop, prepare and certificate of liquid reference materials for density, surface tension and viscosity;
- develop new measurement methods;
- conduct training activities in metrology field of fluid properties;
- participate in national and international project development and research.

Density, ρ

kilogram per cubic meter, kg/m^3

Defined as the mass per unit volume of a substance at a given temperature and pressure.



Viscosity, dynamic viscosity, η

Pascal second, Pa·s

Ratio between the applied shear stress and shear rate. It is sometimes called the coefficient of dynamic viscosity, or simply viscosity. Thus dynamic viscosity is a measure of the resistance to flow or deformation of a liquid.



Kinematic viscosity, ν

square meter per second, m^2/s

Defined as the resistance to flow of a fluid under gravity.



Surface tension, σ

Newton per meter, N/m

Force perpendicular to a line element in a surface divided by the length of the line.



The measurements traceability is obtained to national and international standards, and to certified reference materials.

The accuracy of the measurements performed is proven through the participation in projects and in international comparisons, and it is demonstrated by the acceptance and inclusion of the Measurement and Calibration Capabilities (CMC) in the BIPM database.

Calibration

MEASURING INSTRUMENT	MEASURING INTERVAL	EXPANDED UNCERTAINTY* ($k=2$)
Hydrometers	[500; 2 000] kg m ⁻³	0,1 kg m ⁻³
Oscillation-type density meters (also available <i>in situ</i> calibration service)	[0; 3 000] kg m ⁻³	[0,01; 0,03] kg m ⁻³
Capillary viscometers	[0,001; 30] mm ² s ⁻²	0,6 %
Rotational viscometers	Under implementation	-
Rheometers	Under implementation	-
Tensiometers	[18, 73] mN m ⁻¹	[0,1; 0,5] mN m ⁻¹

Determination and Certification of Liquids

QUANTITY	MEASURING INTERVAL	EXPANDED UNCERTAINTY* ($k=2$)
Density	[0; 3 000] kg m ⁻³	[0,01; 0,03] kg m ⁻³
Viscosity	[1,2; 20 000] mm ² s ⁻¹	0,6 %
Surface tension	[18, 73] mN m ⁻¹	[0,1; 0,5] mN m ⁻¹
Rheologic properties	Under consulting	-

Certified Reference Materials

REFERENCE MATERIAL For Density	CERTIFIED MENSURAND (at 20 °C)	EXPANDED UNCERTAINTY* ($k=2$)	TIME STABILITY
Aqueous solutions			
Ethanol (C ₂ H ₅ OH)	[789; 997] kg·m ⁻³	[0,38; 0,08] kg·m ⁻³	1 year
Ultrapure water (H ₂ O)	998 kg m ⁻³	0,010 kg m ⁻³	1 year
Ethanol (C ₂ H ₅ OH)	[984; 978] kg·m ⁻³ [10; 15] cL L ⁻¹	0,017 kg·m ⁻³ 0,1 cL L ⁻¹	1 year
Glucose (C ₆ H ₁₂ O ₆)	[1 140; 1 170] kg m ⁻³	[0,28; 0,38] kg·m ⁻³	1 year
Sodium Chloride (NaCl)	[1 140; 1 170] kg m ⁻³	0,030 kg m ⁻³ 0,10 kg m ⁻³	6 months 1 year
Sodium Bromide (NaBr)	[1 114; 1 370] kg·m ⁻³	[0,19; 0,72] kg·m ⁻³	1 year
Organic solvents (1 component)			
n-Hexane (C ₆ H ₁₄)	660 kg m ⁻³	0.045 kg m ⁻³	1 year
Isooctane (C ₈ H ₁₈)	692 kg m ⁻³	0.048 kg m ⁻³	1 year
n-Nonane (C ₉ H ₂₀)	718 kg m ⁻³	0.051 kg m ⁻³	1 year
n-Decane (C ₁₀ H ₂₂)	730 kg m ⁻³	0.040 kg m ⁻³	1 year
n-Undecane (C ₁₀ H ₂₂)	740 kg m ⁻³	0.048 kg m ⁻³	1 year
n-Dodecane (C ₁₂ H ₂₆)	749 kg m ⁻³	0.034 kg m ⁻³	1 year
Toluene (C ₇ H ₈)	867 kg m ⁻³	0.033 kg m ⁻³	1 year
Dimethyl phthalate (C ₁₀ H ₁₀ O ₄)	1191 kg m ⁻³	0.037 kg m ⁻³	1 year
Tetrachloroethylene (C ₂ Cl ₄)	1623 kg m ⁻³	0.059 kg m ⁻³	1 year
Organic solvents (2 components)			
Mixtures of Isooctane (C ₈ H ₁₈) and Tetrachloroethylene (C ₂ Cl ₄)	[692; 1 623] kg m ⁻³	0,31 kg·m ⁻³	1 year

Notes:



- Expanded uncertainty as published in the BIPM key comparison database (KCDB) of the CIPM MRA; *The expanded uncertainty presented in the tables above refers to the lower possible uncertainty to be obtained with the methods in the reference conditions and with certain metrological characteristics of the measuring instruments to be calibrated or characteristics of homogeneity and stability in case of liquid samples to be tested.

PORTUGUESE INSTITUTE FOR QUALITY

Rua António Gião, 2,
2829-513 Caparica
Portugal

LABORATORY OF PROPERTIES OF LIQUIDS

TEAM

Andreia Furtado (MSc.)
(Head)
Tel (+351) 212 948 211
E-mail afurtado@ipq.pt

Jorge Pereira (MSc.)
Tel (+351) 212 948 213
E-mail jpereira@ipq.pt