

Establishing traceability for liquid density measurements



EMPIR 17RPT02-rhoLia May 2018 - April 2021

Needs & Motivation

concerning liquid density measurement capabilities

- Emerging NMIs/Countries
- Implement/improve measurement capabilities (1st and 2nd levels)
- Demonstrate competence and comparability of these measurements results
- Provide new measurements, calibrations services and CRMs to accreditated laboratories, research centres and industries
- European Community
- Increase knowledge/expertise on liquid density metrology and on the temperature, pressure, viscosity and viscoelasticity effects
- Enhance competitiveness and confidence of the national industries (e.g. oil and prepackaged food) by producing accurate density measurements fulfilling the European Directives and National Laws
- Update of international standards and reference documents used in Legal Metrology regarding the use of oscillation-type density meters
- Guidance documents for the metrological, scientific and industrial communities

Objectives

A. Implement/improve the national measurement capabilities in liquid density metrology in emerging (8) NMIs

> Density: [600; 1 700] kg/m³ Temperature: [5; 60] °C

- Hydrostatic weighing method (1st level)
- Intended U: [0.002; 0.005] kg/m³ (at atmospheric pressure)
- Oscillation-type density meters (2nd level)
 - Viscosity: [0.7; 2 000] mPa s (ideally up to 10 000 mPa s)
- Intended *U*: [0.010; 0.050] kg/m³ (at atmospheric pressure)
- Intended U: [0.10; 0.50] kg/m3 ([1; 600] bar, at 20 °C)
- Robustness of 1st and 2nd level measuring methods
- Production of density CRMs
- B. Establish the degree of equivalence of liquids density measurements (via comparisons)
- C. Develop individual strategies for the long-term operation of the developed capabilities







Consortium

> 12 Partners (11 NMIs & 1 density meters manufacturer); 19 Collaborators; Project advisory board

Leading European representation: 3 experienced NMIs (BEV-PTP, GUM and PTB); density meters manufacturers; Legal Metrology Organizations; Standardization & Accreditation Institutes; Inspection Authorities; Industries (oil & food)



WP5 Management & Coordination



33.1 PM



Early Impact

WP2

Hydrostatic weighing & **Reference liquids**



- Comparisons (diagnostic & consolidation)
- Robustness studies (effect of: surface tension, viscosity and viscoelasticity)

IPO.

12.0 PM

Improving liquid density measurement capabilities

Implementation of gained knowledge Selection and provision of RM

Development of individual long-term strategies

WP3

Oscillation-type density meters 31.5 PM

- Comparisons (diagnostic & consolidation)
- Robustness studies (effect of: viscosity, temperature and viscoelasticity)
- Robustness studies at high pressure (up to 600 bar)

Wider Impact

- Capacity to extend/improve liquid density mesurement capabilities
- Provide support to policy makers with reliable data
- Enhance of community and international confidence regarding economical transactions



- Creation of a cohesive network of European NMIs able to share experiences concerning liquids density measurements
- Stronger involvement of the emerging NMIs in BIPM-CCM and EURAMET TC-M
- Definition of roadmaps for individual strategies of the emerging NMIs, describing the uptake of the developed capacities

Legal Metrology **Organizations**



Standardization Institutes



Accreditation Institutes



New guidance documents

- 3 EURAMET Guides
- **Good Practice Guide for Industry**

WP4

- Input to revision of reference documents
- ISO standard (15212)
- OIML (Guide 14) and WELMEC (Guide 6.4)
- Training to disseminate best practices in liquid density metrology
- National courses for end-users
- International stakeholders workshop

Documents,

- Provision of national metrological infrastructures and proficiency testing schemes to support accreditation bodies and field laboratories
- New accreditations in the liquid density traceability chain





Prepackaged Food



- Wine consumption (EU, 2015)
- Olive oil consumption (EU, 2017)

pa.eu/agriculture/sites/agriculture/files/olive-oil/prices/market











Manufacturers



Economica



