

A Report on the Activities in Mass and Related Quantities at NMIA  
Australia 2021-2023 related to CCM

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1. Research and Development Activities

Mass

- A 100 g automatic comparator with 0.1 µg resolution was commissioned and used for NMI's working standards and E1 weights calibration in the range of 100 g to 10 g.

Pressure and Vacuum

- Dimensional measurement and modelling of a 25 mm nominal diameter piston gauge. Improvement to mounting assembly to reduce temperature and other influences. Commence new traceability dissemination across the hydraulic scale to 500 MPa.
- Update to BIPM database CMC reviewed and updated to match actual capability to 500 MPa.
- NMIA provided technical assessor for the regular accreditation assessment review of MSL NZ pressure project.
- As a member of the CCM WG PV, NMIA: has contributed to:
  - Editorial review of the report on comparison SIM.M.P-S8
  - Technical review of the report on comparison EURAMET.M.P-S16 (50 to 250) MPa
  - Working group document "Proposal to adopt universal set of Units Under Calibration."
  - Technical review of the report on comparison CCM.P-K13 (10 to 500) Pa
  - Working group document "Guideline CMC risk-based check."

Force

- Focussed on maintenance and improvement of static force calibration capabilities.
- A 2 MN build-up system has been designed and assembled for compression calibrations in the range 0.1 – 2 MN. This system is expected to provide improved calibration uncertainty in this range and increased operational efficiency.
- Work has also commenced on recalibration of the NMIA 550 kN deadweight force machine using an in-situ weighing method developed at NMIA.

### Density

- Trial runs of Si sphere vs ULE sphere on the new hydrostatic weighing system used for solid density measurement have been conducted. The system is used to measure solid density standards with an estimated uncertainty better than 5 ppm using silicon sphere as reference standard.
- A new KRUSS surface tension tensiometer was installed to replace the old KRUSS tensiometer. Evaluation of the new instrument using Pt Ring vs plate is being conducted.

### Fluid Flow

- Improved density of LPG using 500mL high pressure pycnometer, aiming for  $u_{95} = 0.05\%$ ;
- Low temperature  $-90\text{ }^{\circ}\text{C}$  liquid butane test loop at rates up to 15L/min prototype built. Cooling provide by dry-ice ( $\text{CO}_2$ ).
- Temperature control from 5 to  $40\text{ }^{\circ}\text{C}$  of facility for test fluid is underway. 50 kW chiller and 30kW steamer purchased and work underway.

### 2. Status of Comparisons in Mass and Related Quantities

- NMIA has requested participation in a 100 MPa pressure comparison in gas, being piloted by/proposed by NMIJ.
- NMIA reviewed and provided feedback to the pilot laboratory in relation to APMP.M.P-K15 draft A. NMIA is a participant in this comparison.
- Final Report of APMP.M.D-K5 was published in 2023.
- CCM.D-K5: NMIA participated in liquid density comparison June 2022- Jan 2023.
- Ready to participate in CCM.D-K1-2023 in June 2023.
- Two comparisons on flow were completed in the last 2 years awaiting draft reports.

### 3. Publication

None.