

NMISA Report to the CCM

May 2021

1. Main development activities in Mass and Related Quantities

The following are the development projects running within mass and related quantities:

- Upgrade of the hydrostatic weighing system
The project aims to improve the instruments and techniques by which the density of solids from 2 kg to 10 kg is determined.
- Development of low liquid flow measurements
Developing the capability for the calibration of low volume liquid flow instrumentation, such as those used to control intravenous drug administration.
- Upgrade of hydraulic amplification force machines
The project entailed improvements of the machines' control systems, where the lifting and the taring systems were upgraded. The next phase includes upgraded hydraulics, automation field instruments and integration of the control systems.
- Upgrade of low and vacuum pressure system
The old vacuum system was replaced in 2020 and the laboratory has developed the software to automate the readings from the system. A new spinning rotor gauge has also been procured to work on the new vacuum calibration system.
- Dynamic pressure
Acquired NIBP to provide dynamic blood pressure simulations for testing of non-invasive blood pressure monitors. APMP provided a training in 2019.

1.1 Redefinition of the kilogram

- Kibble Balance

NMISA partnered with NPL on the development of a table-top Kibble balance. In 2019, two engineers from NMISA spent time at the NPL working on sub-components of the system. Unfortunately, no collaboration work was possible in 2020 due to Covid-19 travel restrictions in both countries. The pandemic also affected the planned delivery time of the systems.

NMISA received their FG5-X gravimeter from Micro-G Lacoste to measure “*g*”. The system was tested, and measurements completed in various laboratories at NMISA.

2. Participation in relevant comparisons

Comparison ID	Subfield	Number of participants	Pilot Laboratory	Status
AFIMETS.M.M-K7	Mass pieces (0.5 g to 5 kg)	6	NIS	Draft A
AFRIMETS.M.D-S4	Hydrometers	3	NIS	Draft B
AFRIMETS.FF-K4.2015	Volume - 100 μ L micropipettes	12	NIS/IPQ	Completed, August 2020
Bilateral with INMETRO	Torque, 50 Nm -1 kNm	2	NMISA	Completed, March 2021
Bilateral with TUBITAK UME	Force 1 kN	2	NMISA	Completed, September 2020
AFRIMETS.M.F-S2	Force 500 kN	3	KEBS	Completed, April 2021
AFRIMETS.M.FF-S1	Flow, (50 – 5 000) mL/min	3	NMISA	Running
AFRIMETS.M.P-K2	Pressure, (10 to 110) kPa	5	NMISA	Running

3. List of relevant publications

- I. Sonntag C, Mametja T, Karsten A, “A Low-Cost Kibble Balance for Africa”, in *Proceedings of the CPEM conference August 2020, Boulder, Colorado*. DOI:10.1109/cpem49742.2020.9191904
- II. Mametja T G, “An uncertainty budget for the precursor Watt balance for South Africa“, MSc dissertation at the University of Cape Town.
- III. Dlamini S, “NMISA’s New 5kN Deadweight force standard machine” *Acta Imeko*, December 2020, Volume 9, Number 5, 85 – 87
- IV. D Jonker, W M Dlamini, R M Molefe, “Flow Instability Evaluation at NMISA Gas Flow laboratory”, *Flowmeko 2019*, 18th International flow measurement conference, Portugal, Lisbon, LNEC, 26-28, June 2019
- V. Josephat Obwoye Bangi, Mark Siedel, Siphon Dlamini and James Matosse, “Force Afrimets Supplementary Comparison AFRIMETS.M. F-S2”, April 2021, *Metrologia*, Volume 58, Number 1A
- VI. A M Sadek, Elsa Batisa, Souyam Samira, Prince Tawiah, Thomas Mautjana, Peter Molefe, Munyaradzi Mubaiwa, Given Kalonga, Vida Kirenga Rusimbi, Dominic Ondoro “Volume Comparison at 100 μ L- calibration of micropipettes”, August 2020, *Metrologia*, Volume 57, Number 1A

4. General

In May 2019, NMISA hosted a successful “Revised SI” conference to officially celebrate the Revised SI in South Africa. The conference was well attended by both local and international delegates.

NMISA partnered with a local university (University of Cape Town) to design fun icons for the SI units. A set of four posters were designed for distribution in schools and is also available for free on-line.

The Torque laboratory was recommended for re-accreditation by SANAS (South African National Accreditation Systems) with improved calibration and measurement capabilities and extended calibration range to include 20 kNm.

NMISA continue to provide technical assistance to the SADC region through specialised training and peer-assessment on behalf of accreditation bodies. Due to travel restrictions some of the planned technical training had to be postponed. However, in 2021, metrologists from the Malawi bureau of standards were trained at NMISA in the calibration of pressure instruments using different pressure standards.