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

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

3. List of relevant publications


V. Josephat Obwoge Bangi, Mark Siedel, Sipho 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 µL- 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.