

METROLOGY SEMINAR

JUNE 25-26, 2009

UNBS, UGANDA
MASS METROLOGY IN INDUSTRY



john.kiwanuka@unbs.go.ug

MASS METROLOGY IN INDUSTRY

Author and presenter:

John KIWANUKA K. N.

Acting Head

**Mechanical Metrology Labs Division
National Metrology Laboratory (NML)
Uganda National Bureau of Standards
*e-mail: john.kiwanuka@unbs.go.ug***



Introduction

While standards were principally appreciated for their technical advantages, they are today increasingly recognized for the benefits they bring in all dimensions of sustainable development: economic, environmental and societal.

UNBS undertakes this role through the National Metrology Laboratory (NML) by ensuring metrology in industry.



Definitions

Metrology in the simplest terms can be referred to as the **science of measurements**

Emphasis shall be on **mass** which is the quantity of matter in an object

Mass is the building block of matter such that almost all physical quantities involve mass

More Definitions

density : Mass/Volume;

force : Mass x Acceleration;

Torque: Force x arm length at a given angle;

Pressure: Force/area (mass x acceleration/area);

Mole: as in chemistry, etc.





john.kiwanuka@unbs.go.ug

MASS METROLOGY IN INDUSTRY

Mass Metrology

The mandate of UNBS is to **develop** and **promote** Standardization, Quality assurance, **Metrology**, and Testing (SQMT) practices to enhance the competitiveness of local industry, strengthen Uganda's economy, protect the health sector, safety and the environment and promote quality, and fair trade (through calibration and verification)

All the four i.e. SQMT revolve around mass and in order to realise their value NML under takes calibration of equipment used in industry and as may be required by the client



Available Mass standards



NML has mass physical (not paper) standards ranging from M1, F1, E2, E1 (1mg to 500kg) and the national standard, the primary and as such the lab can calibrate mass pieces from M3 to E2, and balances from class IV to class I including precision, analytical and domestic



Realization of mass

All countries have their primary as a 1kg standard yet that is not used in every day life to transact business.

This means there is need to establish for instance the 500kg mass as used for testing and calibration of weigh-bridges or to calibrate a class II precision balance of 160g, or further still calibration of a 1mg mass piece!

Realization of mass

Amalgamation

This can be achieved by fixing a 1kg mass piece matched with the 1kg with the standard to generate two 1kgs

i.e. 1 vs 1^* ,

$$1 + 1^* = 2,$$

Then 2 vs 2^*

$$2 + 2^* = 4,$$

And $4 + 1^* = 5$

Then 5 vs 5^*

Leading to $5 + 5^*$ to make 10 and so on until one realizes 20, 50, 100, 200, 500, 1000, 5000, 10000, 50000, 100000kg!

Realization of mass

Split

This involves setting two 500g mass pieces that are both calibrated against the standard 1kg (1000g)

i.e. $500 + 500^*$ vs 1000;

Then $200 + 200 + 100 = 500$;

Then $50 + 50 = 100$;

Then $20 + 20 + 10 = 50$;

$5 + 5 = 10$;

$2 + 2 + 1 = 5$;

$0.5 + 0.5 = 1$;

$0.2 + 0.2 + 0.1 = 0.5$;

$0.05 + 0.05 = 0.1$;

$0.02 + 0.02 + 0.01 = 0.05$;

$0.005 + 0.005 = 0.01$;

$0.002 + 0.002 + 0.001 = 0.005$

0.001g is the 1mg

Calibration

Calibration:

When the stakes are as high as the current global economic crisis, you need to be able to trust the amounts you use or produce !!!

This can only be achieved through calibration.

What then is calibration and why is it important?

Calibration is a series of comparisons between the known and the unknown for which we want to establish the true or corrected value. The known is usually referred to as the standard or reference material (R), and the unknown as the unit under test (UUT)

Calibration and its importance

A balance, weighing scale, weigh-bridge with an un-correctable error can cause a lot of problems in industry (and beyond i.e. the environment).

For example a micro balance used in a pharmaceutical industry can lead to adverse and un-reversible fatal consequences to a patient to whom a dose containing such drug has been administered (leading to DEATH!)



Its importance and more examples

- How about monitoring and controlling the inputs (raw materials);
- And then determining and regulating production and stocking levels e.g. in the steel industry;
- What about controlling animal feed to regulate production/productivity of say cattle (less feed or the important nutrients less milk/beef; excessive feed or nutrients does not necessarily lead to more milk, etc)



More examples and applications

- What about monitoring the weight of a new born baby (*more esp. the 1st born*)?
- What about getting to understand how much one should consume to maintain the 'figure' as in women and to avoid men-pregnancies or corruption pots in men; leave alone what we use in the gym!



john.kiwanuka@unbs.go.ug

MASS METROLOGY IN INDUSTRY

More applications

- Weighing equipment technicians not forgetting our own Legal Metrology Department officers in commerce also need to use mass pieces (weights) of known mass and associated uncertainty and to use calibrated balances (say for testing traders weights).
- Important to note is that a '*calibration*' without uncertainty is not worth referring to as calibration

Metrology

The intended need and importance to provide quality products [goods and services] by enterprises that wish to remain competitive and to ensure measurements that are traceable to national and international standards, and the desire to penetrate international economies, and meet the requirements of product specifications.

This has lead to an increase in the number of companies requesting for calibration of equipment used in production of goods and services.



Metrology

Co-operation among metrology service providers in the region (EAC, SADC) in collaboration with PTB-GTZ have encouraged and enhanced sharing of equipment, skilled manpower and training facilities.

NML mass has been participating in a number of mass inter-comparisons within the EAC and the SADC region.



What to expect:

Mass being the building block of matter such that almost all physical quantities involve mass and due to the dynamic nature of metrology, no country however scientifically mighty, is an island, NML now needs:

- 1. To prepare the present national metrology laboratories for accreditation, MASS as the flag bearer for NML;
- 2. A regional collaboration in metrology matters;
- 3. Expansion of its metrological capacities and competence to cover fields of measurement as required by the users.



Remarks:

- ▶ There is an increasing need for accuracy and traceability of measurements globally in support of trade, health & safety and the environment. This has put enormous pressure on the national institution (UNBS) set up to and ensure its practicability.
- ▶ However, there are no national institutions available to offer the required training for Metrologists and metrology users and therefore collaboration with international partners and/or other national institutions which have advanced in these areas, having gone through the stages of bottle-neck development processes we are experiencing is of crucial importance; here now is the opportunity as offered by UNBS in this seminar



Conclusion:

- ▶ Mass is the building block of matter such that almost all physical quantities involve and revolve around mass.
- ▶ There is an increasing need for accuracy and traceability of measurements globally in support of health & safety, the environment, and trade, thus commerce.



THANKS

- ▶ We are grateful that you, our guests as participants have been able to attend and as such blessed our occasion
- ▶ Feel free always to come to NML in case of doubt, we will always serve you to our best and hopefully to your full satisfaction

Thank you for listening
ANY QUESTIONS?