SADCMET LS7 COMPARISON

Calibration of a 1 metre Line Standard
Technical Protocol (Draft A)

Contents

1. Introduction

1.1 Equivalence of National Metrology Institutes is becoming more and more important. This is established by key comparisons set out by the CIPM. Specific key comparisons are decided upon and organised by the Consultive Committee for a specific field, which, in this case is the Consultive Committee for Length (CCL).

1.2 This technical protocol has been drawn up by the NML (South Africa). The procedure, which follows the guidelines established by the BIPM[1].

1.3 The goal of the comparisons for topics in dimensional metrology is to demonstrate the equivalence of routine calibration services offered by NMIs to clients, as listed in Appendix C of the BIPM Mutual Recognition Agreement (MRA). To this end, participants in this comparison agree to use the same apparatus and methods as is routinely applied when calibrating client artefacts.

2. Organisation

2.1 Participant Requirements

2.1.1 To be able to enter the capability into the BIPM's CMC database, the laboratory must offer this capability as a calibration service.

2.1.2 The participants must be able to present a detailed uncertainty budget.

2.1.3 By their declared intention to participate in this key comparison, the laboratory accepts the general instructions and technical protocols as stated in this document and commits themselves to follow the procedures rigorously.

[1] TJ Quinn, *Guidelines for CIPM key comparisons*, 1 March 1999, Paris

2.2 Participants

2.2.1 A list, tabled below, of participating laboratories was drafted.

Pilot Laboratory		
Mr O A Kruger	National Metrology Laboratory CSIR Meiring Naude road Pretoria 0001 SOUTH AFRICA	Tel: + 27 12 841 4340 Fax + 27 12 841 4458 e-mail: oakruger@nmisa.org
SADCMET		
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Mr V Facknath	Mauritius ?	VFacknath@msb.intnet.mu
Dr.: Soraya Abdel Aziz Khodier	Egypt?	dr_soraya@yahoo.com
Mr Sidonio	Mozambique?	Innog@emilmoz.com

2.3 Time Schedule

2.3.1 The comparison will commence with the CSIR/NML as the pilot laboratory. On completion of the comparison the artefacts will be returned to the pilot laboratory for verification of either drift or damage to the artefacts.

2.3.2 Each laboratory will have one month (4 weeks) in which to perform the calibration and a further 2 weeks to pass it on to the next laboratory. The schedule must be kept and no deviation from it will be allowed. Should a laboratory experience problems, be it in the measurements of the artefacts or with the customs of a country, the allotted time must be adhered to, even if it means not completing the measurements. Otherwise, the time schedule starts to run behind and it is very difficult to get back on track, which is unfair to the remaining laboratories.

2.3.3

Region	Laboratory	Start Date
Pilot laboratory		January 2007
	Kenya	1 August 2007
Pilot laboratory		

2.4 Handling of artefacts

2.4.1 The line standard should be examined immediately upon receipt. The condition of the line standard should be noted and communicated to the pilot laboratory. Please use the return form; appendix A4. This form can be either faxed or e mailed to the pilot laboratory.

2.4.2 No re-furbishing of the artefacts should be attempted. Laboratories should attempt to measure all gauges/artefacts, unless in doing so would result in damage to their equipment or the gauges.

2.4.3 The line standard should be inspected before being dispatched and any change in the condition during the measurements at the laboratory should be communicated to the pilot laboratory.

2.4.4 The laboratory must also inform the next laboratory via fax or e-mail when the artefacts are to be sent to them.

2.4.5 After the measurements, the artefacts must be packed in the original packaging before shipment to the next laboratory.

2.5 Transportation of artefacts

2.5.1 It is very important that the artefacts be packed and transported in the best possible manner, thus eliminating either damage, being lost or handled by unauthorised persons.

2.5.2 The artefacts should be accompanied by a suitable customs carnet (where appropriate) or documentation uniquely identifying the items. The packaging should be easily opened to enable inspection by custom officials. **The carnet ATA shall always be shipped with the package, never inside the box, but apart. Please be certain, that when receiving the package, you also receive the carnet**

2.5.3 Each laboratory must cover the cost of its own measurements; transportation to the next laboratory and any custom's charges incurred. The laboratory is also responsible for any damages which may occur within the country during the measurements and transportation. The pilot laboratory has no insurance for any loss or damage to the artefacts during transportation. Although the value of the artifacts is not very much, the cost for the comparison, taking into account the time spent by the laboratories to perform the measurements is very valuable.

3. Description of artefacts

3.1 The Line Standard to be measured is a one metre steel rule.
Serial number: 550274

3.2 The points are selected to determine the capability of the laboratory in calibrating rules. As the edge of the rule is not always well defined, only one point will be measured using the edge. This will give a good indication of the uncertainty involved in locating the edge of a rule. The remainder of the points will use the 10 mm position as the zero.

3.2 Points to be measured:
0 – 10 mm
10 – 10,5 mm
10 – 15 mm
10 – 500 mm
10 – 1000 mm

4. Measurement Instructions

4.1 Definitions

4.1.1 The rule must be supported on a flat surface or on its Bessel points. The measurements must be made on the edge of the rule.

4.2 Measurement methods

4.2.1 The rule must be measured against a laser interferometer or by direct comparison to a standard line scale according to the laboratories **internal procedures**.

5. MEASUREMENT UNCERTAINTIES

5.1 The uncertainty for the measurements of both the gauge blocks must be according to *ISO Guide for the Expression of Uncertainty in Measurement.*

5.2 All the measuring uncertainties must be included in the uncertainty budgets for. A template of the uncertainty budget, for line scales is attached in Appendix A3.

5.3 The uncertainty must be stated as the combined standard uncertainty and also be stated as the expanded uncertainty for k=2.

6. REPORTING OF RESULTS

6.1 The actual length and the deviation from the nominal length must be reported.

6.2 The results must be sent to the pilot laboratory within 2 months of the completion of the measurements. The results can be either faxed or emailed to the pilot laboratory.

6.3 The reference value to be used in this comparison has still to be decided upon. It is however proposed that a weighted average of the results, with weighting factors as normally derived from the stated uncertainties of the results be used as the reference value.

A.1 Measurement results

Laboratory:.....

Calibration table:

Nominal value (mm)	Measured Length (mm)	Length deviation (µm)	Effective degrees of Freedom v_i
0 – 10			
10 – 50			
10 – 100			
10 – 500			
10 – 1000			

Date:.....

Signature:.....

A.2 Description of the measuring system/set-up

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Make and type of standard laser/line scale used (include the uncertainty of the standard)

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Procedure of the measuring set-up used

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A.3 Uncertainty of measurement

Source of	x_i	$u(x_i)$	v_i	$c_i = \partial\beta_i / \partial x_i$	$u_i(\beta_i)$/sec

uncertainty					
		veff.			
		t distribution		$u_c^2(\alpha_{i\ I})$	

Combined standard uncertainty: $u_c(\alpha_i) =$ .....
Expanded standard uncertainty: = ...

A.4 Return form

Attention: Mr O Kruger
National Metrology Laboratory
P O Box 395
Building No 5
CSIR
Pretoria
South Africa
Fax: +27 12 841 4458
e-mail: oakruger@csir.co.za

We confirm having received the artefacts for the SADCMET –LK7 key comparison on a Line Standard on .....(date)

After visual inspection:

No damage has been observed

Damage has been observed (detailed comments)

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Laboratory:.....…