EGAC Policy on Measurement Uncertainty For Calibration Laboratories

PB06L

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Table of Modification

Mod. No./Date	Proposed by	Page No.	Modification in brief (old/new, added, cancelled)
5.1/Sep 2010	Quality Manager	4/5 & 5/5	Adding Part 4
5.2/Oct 2011	Quality Manager	2/5 & 4/5	- Adding the OIML - The CMC terminology
5.3/May 2013	Quality Manager	2/5	- Adding ILAC P14 - To report Expanding uncertainty in two significant digits
5.4/Aug 2016	Quality Manager	All	No changes, just revision for all publications

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1. SCOPE

This document defines the policies for calibration laboratories (internal or external), for the estimation of measurement uncertainty.

The terms “calibration laboratory” and “calibration provider” as used in this document refer to both internal labs and external providers including calibration programs within testing labs.

2. ESTIMATION OF MEASUREMENT UNCERTAINTY

Estimation of measurement uncertainty is a crucial part of ensuring traceability. Where it is possible to calculate uncertainty, the calculations must be performed in accordance with ILAC P14 Latest version and the ISO *Guide to the Expression of Uncertainty in Measurement* (also known as GUM). This document can be obtained as an ISO document, or as an OIML document [OIML G 1-100].

Expanded uncertainties are typically reported in two significant digits using a coverage factor of $k = 2$ to approximate the 95 percent level of confidence.

Calibration certificates must provide statements of the measurement results and the associated uncertainty. Such statements must include the coverage factor and confidence level.

The laboratory must use appropriate methods to develop their uncertainty estimates. The method used to develop the uncertainty estimate must be defined and documented. All readings, observations, calculations, and derived data must be maintained.

Developing an uncertainty estimate generally requires statistical analysis of experimental data. Laboratories shall analyze the data in accordance with good statistical practice and methodology.

Sometimes, statistical studies cannot be performed for various reasons. In cases where statistical studies cannot be performed, an estimation of uncertainties is still required. See the *Guide to the Expression of Uncertainty in Measurement* for specific guidance on developing uncertainty budgets in such cases.

3. MEASUREMENT UNCERTAINTIES FOR ON-SITE CALIBRATIONS IN THE SCOPES OF ACCREDITATION

It is important that the scopes of accredited laboratories that perform calibrations on customers' sites do not contain potentially misleading values for on-site capabilities. The following points shall be observed:

EGAC staff shall ensure that Best Uncertainty is clearly defined on scopes of accreditation. This may be accomplished with the following footnote:

"**Best uncertainty** (was referred to as best measurement capability BMC and now as calibration and measurement capability CMC, see item 4 below) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or of nearly ideal measuring instruments. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The measurement uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer's device, to the environment (if the calibration is performed in the field), and to influences from the circumstances of the specific calibration."

In addition, when best uncertainty is cited for a calibration offered in the field, this uncertainty should be further qualified to emphasize that uncertainties obtained in the field are typically larger than uncertainties obtained in a stable laboratory environment. This may be accomplished with the following footnote:

"On-site calibration service is available for this calibration. Best uncertainty is for calibration at the laboratory's permanent facility; as noted above, uncertainties obtained in the field will typically be larger than the best uncertainty."

However, it is often easier for the laboratory to specify environment tolerances outside which no work will be done and to base best uncertainty estimates on those tolerances. The assessor should check these tolerances to see that they are reasonable and consistent with equipment specifications. In these cases, further qualification of the best uncertainty is unnecessary.

EGAC assessors shall ensure that The scope of an accredited laboratory clearly indicates which parameters are offered on-site. The laboratory that performs calibrations on a customer's site maintains a full list of all the equipment that is transported. For each parameter, the laboratory shall define the best uncertainty that it can achieve with each type of transported equipment.

4. MOVING TO CALIBRATION AND MEASUREMENT CAPABILITY (CMC)

4.1 Background:

Metrological traceability is disseminated to the market by accredited calibration laboratories via the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA) and by National Metrology Institutes (NMIs- like NIS in Egypt) under the Comité International des Poids et Mesures (CIPM) MRA. This traceability provides reliability in measurements around the world.
Currently, the services provided by many accredited calibration laboratories are described using the term "Best Measurement Capability" (BMC). This terminology is in widespread use in accreditation programs around the world.
NMIs (NIS in Egypt) have a similar description of the services provided to their customers; but use the term "Calibration and Measurement Capability" (CMC).

4.2 Change of terminology

In order to address this inconsistency in terminology the Bureau International des Poids et Mesures (BIPM) and the Regional Metrology Organizations (RMOs- like AFRMET in Africa)

have, in cooperation with ILAC and the Regional (Accreditation) Cooperation Bodies (like AFRAC in Africa and EA in EU), arrived at the following conclusion:
"In the context of the CIPM MRA and ILAC Arrangement, and in relation to the CIPM-ILAC Common Statement, the following shared definition is agreed upon:
CMC is a calibration and measurement capability available to customers under normal conditions:

(a) as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
(b) as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement."

As a consequence, this means that BMC and CMC shall be considered equal by accreditation bodies (like EGAC in Egypt), laboratories, their customers, the market and regulators. (The definitions used by the NMIs and the accreditation community were already aligned, but the terminology used to describe them was not.)
ILAC has therefore decided to make a change in terminology and in the future all references to BMC will be changed to CMC (see ILAC *2009-08-20 BMC to CMC Circular*).

4.3 Implications for accredited calibration laboratories

This change in terminology does not mean your current uncertainties need to be re-calculated. The current uncertainty of measurement quoted on your calibration certificates or reports will remain unchanged as a result of this change in terminology. If, however, a calibration laboratory currently use the term BMC on its calibration certificates, marketing material or documentation this will need to be changed to CMC. (Note: The term 'uncertainty of measurement' remains unchanged.)
All EGAC accredited laboratories should be using the CMC terminology. The concept of "using all the contributions from best existing devices under calibration in the calculation of the measurement uncertainty budget of the laboratory" is already used by the laboratories, reviewed by EGAC assessors, and displayed in the laboratories' scopes on EGAC's website. A workshop and awareness for both the laboratories and EGAC assessors were conducted on June 2009 to explain the difference between BMC & CMC and instruct the laboratories to use the CMC terminology. The use of the CMC terminology was conducted and reviewed by EGAC ever since. The Calibration laboratories should make this clear to there customers according to this document.

4.4 Greater Harmonization

The intention is to achieve world-wide harmonization of terminology in the dissemination of metrological traceability. Progress towards this goal and also providing clarity in the market place will be greatly assisted by accredited calibration laboratories and NMIs using the same terminology.
Whilst this terminology change will improve the dissemination of metrological traceability through-out the world, the on-going technical issues relating to measurement capability (eg contribution from device under test to the measurement uncertainty) continue to be addressed in-conjunction with BIPM. Future policy documents on these issues will be published in due course.

4.5 Further information

- ILAC 2009-08-20_BMC to CMC Circular is available from http://www.ilac.org/publicationsandresources.html

- Calibration and Measurement Capabilities – A Paper by the Joint BIPM/ILAC working group available from http://www.ilac.org/publicationsandresources.html
- PB06G "EGAC Policy on Measurement Uncertainty for Calibration Laboratories". http://www.egac.gov.eg/www/InfoCenter.aspx?InfoCenterTypeID=2