IQAS-027

Policy for Measurement Uncertainty in Calibration

AMENDMENT SHEET

Sr. No.	Page No.	Clause No.	Date of Amendment	Reasons of amendment	Amendment details	Remark	Approved by
1.							
2.							
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1. **Objective**
   Policy for Measurement Uncertainty in calibration and Testing.
2. **Scope:**
   All the accredited and applicant CABs comes under the preview of this document.
3. **Responsibility:**
   IQAS ,accredited and applicant CABs.
4. **Reference**
   ILAC P-14:09/2020,/ILAC G-17, ISO/IEC 17025:2017

5. **Policy on the evaluation of Measurement Uncertainty in Calibration and Testing**

5.1 For Calibration Laboratories

a) Calibration laboratories seeking accreditation must provide documentation supporting their claims of Calibration Measurement Capability (CMC).
b) These assertions should adhere to the principles outlined in the Guide to the Expression of Uncertainty in Measurement (GUM) and be substantiated by relevant documentary evidence, subject to regular updates.
c) The laboratory must provide its customers with the relevant CMCs.
d) When a laboratory opts to alter the time span between two calibration events, it must provide valid justification, and the supporting records for such justifications must be maintained.

5.2 **For Testing Laboratories**

a) Testing laboratories are required to compute the measurement uncertainty and furnish the report to the customer upon request.

b) Testing laboratories must take into account measurement uncertainty when providing opinions or interpretations of the results concerning the suitability of the tested product.

c) As per ISO/IEC 17025:2017 Clause 7.6.3, testing laboratories are required to evaluate measurement uncertainty.

d) Recognizing that certain test methods may limit the ability to rigorously evaluate measurement uncertainty, an estimation must be conducted relying on an understanding of either theoretical principles or practical experience regarding the method's performance.

e) There's no requirement to assess measurement uncertainty for a specific test.if

i) Note 1 of Clause 7.6 of ISO/IEC 17025:2017 is applicable, i.e., where a well-recognized test method specifies the limits of the major sources of measurement uncertainty and the laboratory follows the test method and the reporting instructions;

ii) Note 2 of Clause 7.6. is applicable, i.e., the measurement uncertainty of the result obtained by following a well-recognized method has been established and is included in the test method.

f) IQAS verifies a laboratory's competency in evaluating Measurement Uncertainty by reviewing the uncertainty budget examples provided by the testing laboratory for each category of test methods listed in the Scope of Accreditation, except in cases where Note 1 or Note 2 of 7.6.3 are applicable. Although IQAS may examine some uncertainty evaluations during the onsite visit, the laboratory must maintain documented examples of Measurement Uncertainty evaluation for each category of tests.

g) The uncertainty budgets must undergo periodic review and updating as needed.

h) The laboratory must conduct an uncertainty analysis and disclose uncertainty to its customers under any of the following circumstances:

i) The customer asks the uncertainty

ii) If there exists a regulatory or analogous requirement.

iii) When a conformity statement is necessary, the laboratory and its customer must establish and agree upon a decision rule. Even when employing a basic acceptance rule, the laboratory is still required to conduct a measurement uncertainty analysis to assess the risks associated with accepting the results.

iv) The laboratory might choose not to disclose Measurement Uncertainty (MU) if there's an arrangement to present results in a simplified manner. Nevertheless, the lab must still adhere to other stipulations of this policy, such as conducting uncertainty analysis and maintaining records.

6. Policy on Scopes of Accreditation of Calibration Laboratories

6.1 The scope of accreditation of an accredited calibration laboratory shall include the calibration and measurement capability (CMC) expressed in terms of:
a) measurand or reference material;
b) calibration or measurement method or procedure and type of instrument or material to be calibrated or measured;
c) measurement range and additional parameters where applicable, e.g. frequency of applied voltage;
d) measurement uncertainty.

6.2 There shall be no ambiguity in the expression of the CMC on the scopes of accreditation and, consequently, on the smallest measurement uncertainty that can be expected to be achieved by a laboratory during a calibration or a measurement. Where the measurand covers a value, or a range of values, one or more of the following methods for expression of the measurement uncertainty shall be applied:
a) A single value, which is valid throughout the measurement range.
b) A measurement range. In this case a calibration laboratory shall ensure that linear interpolation is appropriate in order to find the uncertainty at intermediate values.
c) An explicit function of the measurand and/or a parameter.
d) A matrix where the values of the uncertainty depend on the values of the measurand and additional parameters.
e) A graphical form, providing there is sufficient resolution on each axis to obtain at least two significant digits for the uncertainty.
Open intervals ((example 1) “$0 < U < x$”, or (example 2) for a resistance interval of 1 to 100 ohms, the uncertainty stated as “less than 2 µΩ/Ω”) are incorrect in the expressions of CMCs.

6.3 The uncertainty covered by the CMC shall be expressed as the expanded uncertainty having a coverage probability of approximately 95 %. The unit of the uncertainty shall always be the same as that of the measurand or in a term relative to the measurand, e.g., percent, µV/V or part per 10^6. Because of the ambiguity of definitions, the use of terms “PPM” and “PPB” are not acceptable. The CMC quoted shall include the contribution from a best existing device to be calibrated such that the CMC claimed is demonstrably realisable.

Note 1: The term "best existing device" is understood as a device to be calibrated that is commercially or otherwise available for customers, even if it has a special performance (stability) or has a long history of calibration.

Note 2: When it is possible that the best existing device can have a contribution to uncertainty from repeatability equal to zero, this value may be used in the evaluation of the CMC. However other fixed uncertainties associated with the best existing device shall be included.

Note 3: In exceptional instances, such as evidenced in very limited number of CMCs in the KCDB, it is recognized that a "best existing device" does not exist and/or contributions to the uncertainty attributed to the device may significantly affect the uncertainty. If such contributions to uncertainty from the device can be separated from other contributions, then the contributions from the device may be excluded from the CMC statement. For such a case, however, the scope of accreditation shall clearly identify that the contributions to the uncertainty from the device are not included

6.4 Where laboratories offer services such as reference value provision, the uncertainty covered by the CMC shall include factors related to the measurement procedure as it will be carried out on a sample, i.e., typical matrix effects, interferences, etc. shall be considered. The uncertainty covered by the CMC will not generally include contributions arising from the instability or inhomogeneity of the material. The CMC shall be based on an analysis of the inherent performance of the method for typical stable and homogeneous samples.
Note: *The uncertainty described by the CMC for the reference value measurement is not identical with the uncertainty associated with a reference material provided by a reference materials producer. The expanded uncertainty of a certified reference material will in general be higher than the uncertainty described by the CMC of the reference measurement on the reference material.*

7. Policy on Statement of Measurement Uncertainty of Calibration Laboratories

7.1 An accredited calibration laboratory reports the measurement uncertainty in compliance with the GUM.

7.2 The measurement result shall include the measured quantity value y and the associated expanded uncertainty U. In calibration certificates the measurement result should be reported as $y \pm U$ associated with the units of y and U. Tabular presentation of the measurement result may be used and the relative expanded uncertainty $U / |y|$ may also be provided if appropriate. The coverage factor and the

coverage probability shall be stated on the calibration certificate. To this an explanatory note shall be added, which may have the following content:
"The reported expanded measurement uncertainty is stated as the standard measurement uncertainty multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %."
Note: *For asymmetrical uncertainties other presentations than y ± U may be needed. This concerns also cases when uncertainty is determined by Monte Carlo simulations (propagation of distributions) or with logarithmic units* .

7.3 The numerical value of the expanded uncertainty shall be given to, at most, two significant digits. Where the measurement result has been rounded, that rounding shall be applied when all calculations have been completed; resultant values may then be rounded for presentation. For the process of rounding, the usual rules for rounding of numbers shall be used, subject to the guidance on rounding provided i.e in Section 7 of the GUM.
Note: *For further details on rounding, see the GUM and ISO 80000-1:2009*

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7.4 Contributions to the uncertainty stated on the calibration certificate shall include relevant short-term contributions during calibration and contributions that can reasonably be attributed to the customer's device. Where applicable the uncertainty shall cover the same contributions to uncertainty that were included in evaluation of the CMC uncertainty component, except that uncertainty components evaluated for the best existing device shall be replaced with those of the customer's device. Therefore, reported uncertainties tend to be larger than the uncertainty covered by the CMC. Contributions that cannot be known by the laboratory, such as transport uncertainties, should normally be excluded in the uncertainty statement. If, however, a laboratory anticipates that such contributions will have significant impact on the uncertainties attributed by the laboratory, the customer should be notified according to the general clauses regarding tenders and reviews of contracts in ISO/IEC 17025.

7.5 As the definition of CMC implies, accredited calibration laboratories shall not report a smaller measurement uncertainty than the uncertainty described by the CMC for which the laboratory is accredited.

7.6 As required in ISO/IEC 17025, accredited calibration laboratories shall present the measurement uncertainty in the same unit as that of the measurand or in a term relative to the measurand (e.g. percent).

Genereal Requirements:

i)Calibration Labs must adhere to the ILAC Policy for measurement uncertainty in calibration, known as ILAC P-14.

ii) Testing laboratories must comply with the ILAC Guidelines for measurement uncertainty in testing, referred to as ILAC G-17.

iii) Laboratories must adhere to the principles outlined in the Guide to the Expression of Uncertainty in Measurement (GUM).

iv) Testing laboratories have the option to consult the EURACHEM/CITAC Guide CG 4 (2012), titled "Quantifying Uncertainty in Analytical Measurement," Third edition, accessible from www.eurachem.org.