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IAS GUIDE FOR REPRESENTING SCOPES OF ACCREDITATION FOR CALIBRATION LABORATORIES

1. INTRODUCTION AND SCOPE

This document provides IAS guidelines for the representation of a calibration laboratory's scope of accreditation. The scope of accreditation document represents an accreditation body's official declaration of a laboratory's calibration and measurement capabilities (CMC) and attests to the fact that the laboratory has the technical competence to perform the activities listed on this document. It also serves as a means to provide the customer of an accredited calibration laboratory with a clear description of a laboratory's activities covered by their ISO/IEC 17025 accreditation.

The purpose of this guide is to outline the IAS requirements for calibration scopes of accreditation, and to establish guidelines that minimize sources of variability in order to ensure that all IAS scopes of accreditation for calibration laboratories are similar in appearance and display similar levels of detail.

2. DEFINITIONS

BIPM: Bureau International des Poids et Mesures (BIPM). BIPM is the organization whose task is to ensure world-wide uniformity of measurements and their traceability to the International System of Measurements (SI).
http://www1.bipm.org/en/home/

ILAC: The International Laboratory Accreditation Cooperation.
http://www.ilac.org

International System Of Units (SI): System of units, based on the International System of Quantities, their names and symbols, including a series of prefixes and their names and symbols, together with rules for their use, adopted by the General Conference.

NIST: National Institute of Standards and Technology, the NMI for the U.S.
http://www.nist.gov

NMI: National Measurement Institute

CMC: a *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.

CIPM: International Committee on Weights and Measures (CIPM)
http://www.bipm.org/en/committees/cipm/

3. GUIDELINES

3.1 All scopes of accreditation for calibration laboratories must comply with the requirements of ILAC P14, ILAC Policy for Uncertainty in Calibration. While this guidance document does not repeat all the ILAC requirements stated in ILAC P14, all ILAC policies must be observed when formulating scopes of accreditation.

3.2 While the representation of physical quantities in SI units is preferred, IAS recognizes that it is oftentimes necessary for a laboratory to describe its CMC in the units used when performing the calibrations, in order to provide its customers with a clear and unambiguous description of its capabilities. IAS therefore allows representation of CMC in non-SI units, as needed. Conversion to SI units, where applicable, can be achieved by applying conversion factors as outlined in NIST Special Publication 811.

3.3 Minimum requirements

3.3.1 Calibration Discipline

The scope of accreditation for calibration laboratories is grouped into general calibration disciplines: Dimensional, Mechanical, Thermal, Electrical (DC/Low Frequency), Time and Frequency, RF/Microwave and Electromagnetics, Optical Radiation.

3.3.2 Calibration Area

This column is used to describe either the type of calibration item, e.g. caliper, micrometer, timer/stopwatch, etc., or the measurement parameter in a more generic form, e.g. Voltage Measure, Current Generate or Current Source. The term “Generate” or “Source” may be used for electrical parameters, when the calibration is performed by generating or sourcing a known electrical quantity. While the two terms are considered equivalent, the laboratory should be consistent in using one or the other in their particular scope.

3.3.3 Expanded Uncertainty

The uncertainty stated on the scope of accreditation must be expressed as the expanded uncertainty with a coverage probability of approximately 95%. It is supposed to represent the smallest measurement uncertainty that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards.

The uncertainty should be stated in the same unit as the calibration quantity, or relative to that quantity, e.g. percent. Expressions such as ppm (parts per million) should be avoided when expressing uncertainty. Instead, ppm can be expressed as µV/V, µm/m, etc. However, if the term “ppm” has to be used, for example in the case of chemical scopes, an explanation of the abbreviation should be given at the end of the scope.

When uncertainty is expressed as a relative quantity, it usually is relative to the instrument reading or instrument output quantity. IAS has chosen to include the following footnote in its scope template: “When uncertainty is stated in relative terms (such as percent, a multiplier expressed as a decimal fraction or in scientific notation), it is in relation to instrument reading or instrument output, as appropriate, unless otherwise indicated.” This allows us to avoid repeated statements of “% of reading” or “% of output.” However, if a laboratory wishes to express the uncertainty as % of range or % of full scale, it will be specifically indicated on the scope.

3.3.4 Technique, Reference Standard, Equipment

This section of the scope is used to provide information about the method or equipment used to achieve the CMC. Note that if a published method is cited, it can be assumed that the latest published version of the method is applied, unless otherwise stated. If the laboratory uses a modified version of the method, this must also be indicated.

3.4 Unit symbols

Symbols for SI and non-SI units as indicated in NIST Special Publication 811 should be used. There should always be a space between the numerical value and the unit symbol. The only exceptions to this are for the unit symbols used for degree, minute and second for plane angle, º, ‘, “, respectively. This means that there should never be a space between the degree symbol (º) when it indicates a plane angle, e.g. 20º3’15’. However, there must always be a space between the number and the unit symbol for degree Celsius, e.g., “20 ºC” instead of “20ºC”, and between the numeric value and all other unit symbols.

When multiple or sub-multiple prefixes are used, there is no space between the prefix and the unit, e.g. kg, µV, mL, etc. Since lower case and upper case prefixes indicate different multipliers, it is imperative that the correct case for these prefixes be used, e.g. “kg”, not “Kg”, “mm”, not “MM”, etc.

3.5 Stating CMC uncertainty for a range

3.5.1 If the uncertainty applies to a range, the beginning and end of the range should be properly defined. Open ranges must be avoided, since they lead to ambiguity (e.g. range statements such as “above 500 ºC” are not allowed).

3.5.2 The CMC uncertainty can never be zero (e.g. if range includes zero, uncertainty cannot be expressed as percent of reading/output alone, since this would result in an uncertainty of zero).

3.5.3 In certain cases, where a negative or zero quantity is not physically possible, “up to” may be used as the beginning of a range.

3.5.4 When expressing ranges, use the word “to” rather than the symbol “-“

3.5.5 While it is preferable to express a range in the same units as uncertainties provided for the CMC, exceptions can be made. For example, while it is customary to express electric power ranges as a combination of voltage and current, but the uncertainty should still be expressed in units of watts or a multiple thereof.

3.5.6 For the specification of alternating current (AC) parameters on electrical scopes, they have to be accompanied by either a fixed frequency or frequency range for which the stated uncertainty is valid. While there are many ways to accomplish this in an unambiguous fashion, IAS chooses the following format:

CALIBRATION AREA	RANGE	EXPANDED UNCERTAINTY[3] (±)
AC Voltage Source	33 V to 329.999 V	
	(10 Hz to 45 Hz)	150 µV/V + 1.6 mV
	(45 Hz to 10 kHz)	160 µV/V + 4.7 mV
	(10 kHz to 20 kHz)	190 µV/V + 4.7 mV
	(20 kHz to 50 kHz)	230 µV/V + 4.7 mV
	(50 kHz to 100 kHz)	0.16 % + 39 mV

4. REFERENCES

ILAC-P14: 2013 ILAC Policy for Uncertainty in Calibration
NIST SP 811, 2008 ed.: Guide for the Use of the International System of Units (SI)
IEEE/ASTM SI 10-2018: American National Standard for Metric Practice
BIPM, The International System of Units (SI), 8^{th} ed.
BIPM, The International System of Units, Supplement 2014