ACCREDITATION SCHEME FOR LABORATORIES

Technical Notes MET 002

General Requirements and Criteria for Documenting the Calibration and Measurement Capability

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1.0 INTRODUCTION

1.1 This technical note provides the general guidelines for documenting the Calibration and Measurement Capability (CMC).

2.0 DOCUMENTING THE CALIBRATION AND MEASUREMENT CAPABILITY

2.1 A laboratory applying for SAC-SINGLAS accreditation shall be consistent in documenting the CMC in the accreditation schedule.

2.2 The laboratory shall classify the type of calibration that it is pursuing during the submission of the application form or in subsequent annual surveillance or renewal assessment.

2.3 The attached tables serve as a general format on how the parameters to be calibrated will be classified. Where parameters are not shown in the attached tables, laboratory shall approach the SAC-SINGLAS staff officer for further discussion on how they can document those parameters.

2.4 The CMC is defined as the smallest uncertainty of measurement that a laboratory achieves within its scope of accreditation for one of the following conditions :

i) when performing routine calibrations of the best existing unit under test intended to define, realise, conserve or reproduce a unit of that quantity or one or more of its values.

ii) when performing routine calibrations of measuring instruments designed for the measurement of that quantity.

The assessment of CMC of accredited calibration laboratories has to be based on the method described in Appendix A but shall normally be supported or confirmed by actual evidence.

2.5 The estimation for the uncertainty of measurement that defines the CMC shall follow the text as laid down in the SAC-SINGLAS Technical Guide 1 “Guidelines on the Evaluation and Expression of the Measurement Uncertainty.” [1] The CMC shall be stated to the same level as required for calibration certificates, that is in the form of an expanded uncertainty of measurement, normally with coverage factor k = 2.

References: [1] SAC-SINGLAS Technical Guide 1, Guidelines on the Evaluation and Expression of the Measurement Uncertainty, second edition, 29 March 2019

APPENDIX A

1. CMC is one of the parameters that is used to define the scope of an accredited calibration laboratory, the others being physical quantity, calibration method or type of instrument to be calibrated and measurement range. CMC is normally stated in the accreditation schedule that supports the decision on accreditation. CMC is one of the essential pieces of information to be used by potential customers to judge the suitability of a laboratory to carry out particular calibration work at the laboratory or on-site.

2. For the purpose of comparing the capabilities of different calibration laboratories, in particular laboratories accredited by different accreditation bodies, the statement of CMC needs to be harmonised. To facilitate this, some explanations are given below to the term CMC.

3. The best existing unit under test is the device with the smallest measurement uncertainty contribution that a laboratory is capable of providing calibration service. The laboratory shall possess the experienced and competent personnel, required equipment, environment and methodology for calibration of the claimed best existing unit under test.

4. The definition of CMC implies that within its accreditation a laboratory is not entitled to claim a smaller uncertainty of measurement than the CMC. This means that the laboratory shall be required to state a larger uncertainty than that corresponding to the CMC whenever it is established that the actual calibration process adds significantly to the uncertainty of measurement. Typically, the equipment under calibration may give a contribution. To report uncertainty of measurement smaller than the CMC, the laboratory shall propose its revised capability during the next routine assessment. When stating the actual uncertainty, the laboratory shall be asked to apply the principles of the SAC-SINGLAS Technical Guide 1.

5. It shall be pointed out that according to the definition of CMC the concept is applicable only to results for which the laboratory claims its status as accredited laboratory. Thus, strictly speaking the term is of an administrative character and does not necessarily need to reflect the real technical capability of the laboratory. It should be possible for a laboratory to apply for accreditation with a larger uncertainty of measurement than its technical capability if the laboratory has internal reasons for doing so. Such internal reasons usually involve cases where the real capability has to be held in confidence to external customers, e.g. when doing research and development work or when providing service to special customers. The policy of the accreditation body shall be to grant accreditation on any applied level if the laboratory is capable of carrying out calibrations on that level. (This consideration refers not only to the CMC but to all parameters that define the scope of a calibration laboratory.)

6. Assessment of CMC is the task of the accreditation body. The estimation of the uncertainty of measurement that defines the CMC shall follow the procedure laid down in the present document, with the exception of the case covered in the previous sub-section. The CMC shall be stated to the same level as required for calibration certificates, i.e. in the form of an expanded uncertainty of measurement, normally with coverage factor k=2. (Only in those exceptional cases where the existence of a normal distribution cannot be assumed or the assessment is based on limited data, the CMC has to be stated to a coverage probability of approximately 95%)

7. All components contributing significantly to the uncertainty of measurement shall be taken into account when evaluating the CMC. The evaluation of the contributions that are known to vary with time or with any other physical quantity can be used on limits of possible variations assumed to occur under normal working conditions. For instance, if the used working standard is known to drift, the contribution caused by the drift between subsequent calibrations of the standard has to be taken into account when estimating the uncertainty contribution of the working standard.

8. In some areas the uncertainty of measurement may depend on some additional parameter, e.g. frequency of applied voltage when calibrating standard resistors. These additional parameters shall be stated together with the physical quantity in question and the CMC specified for the additional parameters. Often this can be done by giving the CMC as a function of these parameters.

9. The CMC shall normally be stated numerically. When the CMC is a function of the quantity to which it refers (or any other parameter) it should be given in analytical form but in this case, it may be illustrative to support the statement by a diagram. It should always be clear whether the CMC is given in absolute or relative terms. (Usually the inclusion of the relevant unit gives the necessary explanation but in case of dimensionless quantities a separate statement is needed.)

10. Although the assessment should be based on the procedures of the SAC-SINGLAS Technical Guide 1, there is the requirement that the assessment normally shall be ‘supported or confirmed by actual evidence. The meaning of this requirement is that the accreditation body should not rely on an evaluation of the uncertainty of measurement only. Inter-laboratory comparisons that substantiate the evaluation have to be carried out under the supervision of the accreditation body or on its behalf.

DOCUMENTING THE CALIBRATION AND MEASUREMENT CAPABILITY (CMC)

General format on how the parameters to be calibrated will be classified.

Measured Quantities/ Instruments/Range to be calibrated		Method	Calibration Measurement Capability (CMC)*
A.	**ELECTRICAL – DC/LF**		
1.	DC Resistance measuring instrument. (Lab/Site)	Examples Lab In-House procedure, SOP-XXX	
	0.1 Ω - 100 Ω		X %
	>100 Ω - 1000 Ω		X %
	>1 kΩ - 10 kΩ		X %
	>10 kΩ - 99 kΩ		X %
2.	AC voltage measuring instrument	Examples Lab In-House procedure, SOP-XXX	
	0.3 mV - 30 mV		
	10 Hz - 20 Hz		X %
	>20 Hz - 40 Hz		X %
	>40 Hz - 20 kHz		X %
	>20 kHz - 50 kHz		X %
	>50 kHz - 100 kHz		X %
	31 mV - 300 mV		
	10 Hz - 20 Hz		X %
	>20 Hz - 40 Hz		X %
	>40 Hz - 20 kHz		X %
	>20 kHz - 50 kHz		X %
	>50 kHz - 100 kHz		X %
3.	DC voltage measuring instrument	Examples Lab In-House procedure, SOP-XXX	
	0.1 mV – 30 mV		X %
	>30 mV – 300 mV		X %
	>0.3 V – 3 V		X %
	>3 V – 30 V		X %
	>30 V – 300 V		X %

Measured Quantities/ Instruments/Range to be calibrated		Method	Calibration Measurement Capability (CMC)*
4.	AC current measuring instrument	Examples Lab In-House procedure, SOP-XXX	
	10 µA - 110 µA		
	10 Hz - 20 Hz		X %
	>20 Hz - 40 Hz		X %
	>40 Hz - 1 kHz		X %
	>1 kHz - 5 kHz		X %
	3.1 mA - 30 mA		
	10 Hz - 20 Hz		X %
	>20 Hz - 40 Hz		X %
	>40 Hz - 1 kHz		X %
	>1 kHz - 5 kHz		X %
	>5 kHz - 10 kHz		X %
B.	**TEMPERATURE**		
1.	Liquid-In-Glass Thermometer	Examples Lab In-House procedure, SOP-XXX	
	<u>Total Immersion</u>		
	0 °C (Resolution 0.05 °C)		X °C
	-80 °C to 10 °C (Resolution 0.1 °C)		X °C
	>10 °C to 80 °C (Resolution 0.1 °C)		X °C
	>80 °C to 200 °C (Resolution 0.05 °C)		X °C
	<u>Partial Immersion</u>		
	-80 °C to 10 °C (Resolution 0.5 °C)		X °C
	>10 °C to 80 °C (Resolution 0.1 °C)		X °C
	>80 °C to 200 °C (Resolution 0.2 °C)		X °C
C.	**DIMENSIONAL**		
1.	Micrometer 0 - 50 mm	Examples BS 870 : 2008	X µm
2.	Vernier Caliper 0 - 300 mm	BS 887 : 2008	X µm
3.	Precision Square 0 - 150 mm	BS 939 : 2007	X µm

Measured Quantities/ Instruments/Range to be calibrated		Method	Calibration Measurement Capability (CMC)*
D.	**MECHANICAL**		
1.	Pressure gauge	Examples Lab In-House procedure, SOP-XXX BS EN 837-1:1998	
	-12 psi to 0 psi		X psi
	>0 to 30 psi		X psi
	>30 to 500 psi		X psi
	>500 psi to 1200 psi		X psi
2.	Tension & Compression & universal machine	Examples	
	2 kN to 1 MN	Up to class 0 as defined in ISO 7500/1 : 2018	X %
	1 kN to 4 MN	Up to grade 2 as defined in BS 1610 Pt 1 : 1992	X %

* A reported uncertainty will be that for the instrument itself during calibration plus the appropriate measurement capability of the laboratory. The uncertainties are based on an estimated confidence probability of approximately 95% unless otherwise stated.