ACCREDITATION SCHEME FOR LABORATORIES

Technical Notes MET 002

General Requirements and Criteria for Documenting the Calibration and Measurement Capability

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The SAC Accreditation Programme is managed by Enterprise Singapore

1.0 INTRODUCTION

1.1. Under the directive.[1] of the International Laboratory Accreditation Cooperation (ILAC) and the Regional (Accreditation) Cooperation Bodies with the conclusion made by ILAC, Bureau International des Poids et Mesures (BIPM) and the Regional Metrology Organisations (RMOs), the definition of Best Measurement Capability (BMC) has been now been changed to Calibration and Measurement Capability (CMC).

1.2. SAC-SINGLAS has adopted the computation of CMC to include the contribution from the best existing device on the scopes of accreditation. The "best existing device" is the best device with the smallest uncertainty contribution that the laboratory is capable of providing the calibration service.

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, when performing routine calibrations of the best existing unit under test intended to define, realize, conserve or reproduce a unit of that quantity or one or more of its values, or 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."[2] 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] ILAC 2009-08-20 BMC to CMC Circular
[2] SAC-SINGLAS Technical Guide 1, Guidelines on the Evaluation and Expression of the Measurement Uncertainty, second edition, March 2001

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.

11. The official deadline for the migration is September 2011. For the laboratories which could not complete the migration within the deadline due to insufficient time and big scopes of accreditation, a superscripted delta sign ($^{\Delta}$) will be marked at the unconverted scopes to inform the users of calibration services.

DOCUMENTING THE CALIBRATION AND MEASUREMENT CAPABILITY

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

Measured Quantities/ Range/Instruments to be calibrated	Method / Frequency (#)	Calibration and Measurement Capability Expressed as an Uncertainty (*)
1. Resistance Resistance measuring instrument. 2. Resistance Resistance box/resistance source 3. AC Voltage AC voltage measuring instrument 4. AC Voltage AC voltage source/calibrator 5. DC Voltage DC voltage measuring instrument 6. DC Voltage DC voltage source/calibrator 7. AC Current AC current measuring instrument 8. AC Current AC current source/calibrator		

Measured Quantities/ Range/Instruments to be calibrated	Method / Frequency (#)	Calibration and Measurement Capability Expressed as an Uncertainty (*)
9. <u>Frequency</u> Frequency measuring instrument		
10. <u>Frequency</u> Frequency source/ Calibrator		
11. <u>Temperature</u> - Temperature recorder - Temperature sensor & thermostat - thermometer		
12. <u>Dimensional</u>	Examples	
a). Micrometer 0 - 50 mm	BS 870 : 2008	XX µm $^{\Delta}$
b) Vernier Caliper 0 - 300 mm	BS 887 : 2008	XX µm $^{\Delta}$
c) Precision Square 0 - 150 mm	BS 939 : 1977	XX µm $^{\Delta}$
13. <u>Mechanical</u>		
1. Pressure gauge 10 kPa - 120 MPa		

Measured Quantities/ Range/Instruments to be calibrated	Method / Frequency (#)	Calibration and Measurement Capability Expressed as an Uncertainty (*)
2. Tension & Compression & universal machine		
2 kN to 1 MN	Up to class 0 as defined in ISO 7500/1 : 1986	
1 kN to 4 MN	Up to grade 2 as defined in BS 1610 Pt 1 : 1992	

(#): Where applicable.

* 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.

Δ The contribution from best existing Unit Under Test was not included as the migration from Best Measurement Capability (BMC) to Calibration and Measurement Capability (CMC) has not been completed.