

1. Application

This Accreditation Regulation concerns evaluation of uncertainty of measurements for accredited testing of mechanical, physical and electrical items.

This Accreditation Regulation applies to quantitative testing, which is understood as testing that comprises quantitative measurements.

The Accreditation Regulation does not concern evaluation of measurement uncertainty in connection with the laboratories' internal calibrations of the measurement equipment used in testing. With regard to internal calibrations in accordance with DS/EN ISO/IEC 17025, paras. 7.6.2, the calibration uncertainty of equipment should be determined in the same manner as if it was carried out externally by an accredited calibration laboratory unless the calibration uncertainty contributes only slightly to the total uncertainty of the test result.

With regard to determination of the uncertainty of calibrations, see JCGM 100:2008 GUM 1995 with minor corrections, Evaluation of measurement data - Guide to the expression of uncertainty in measurement (GUM), which is implemented in DANAK Accreditation Regulation AB 11 Measurement uncertainty in calibration. AB 11 comprises parts of EA-4/02 Expression of the Uncertainty of Measurement in Calibration.

The requirements for evaluation and reporting measurement uncertainty are further described in ILAC-G17 and EA-4/16, which forms the basis for the present Accreditation Regulation.

Where for specific testing fields legislative requirements have been laid down concerning the uncertainty of measurements that deviate from the present Accreditation Regulation, these shall apply.

The goal is to obtain a harmonised interpretation of the requirements in DS/EN/ISO/IEC 17025 and to be in accordance with the requirements for the signatories of EA's multilateral agreement (MLA).

2. Definitions

For definitions of metrological terms used in the present Accreditation Regulation, see JCGM 200:2012 *International vocabulary of metrology – Basic and general concepts and associated terms* and GUM.

3. Estimation of measurement uncertainty

3.1 General

The laboratory must have and use procedures for evaluating the uncertainty of measurements. The testing laboratory must therefore consider when and how the measurement uncertainty shall be evaluated and indicated in test reports and how the laboratory complies with the clients' needs accordingly.

The uncertainty of a test result may be determined in different ways depending on, among other things, the technical area and the individual method which may range from the use of conventionally fixed values to an actual calculation by the setting up of a mathematical model and an uncertainty budget.

3.2 Setting up an uncertainty budget on the basis of a model function

In a number of cases, especially in connection with less complicated testing of materials, it is possible to set up a mathematical model for the uncertainty of measurements and thereby establish an uncertainty budget according to the same principles as those used for calibration, see GUM, Accreditation Regulation AB 11 and EA 4/02.

The input from the equipment used will often be significant or crucial. The size of these contributions is obtained from the calibration certificates for the equipment, however with addition of the contribution from operation of the equipment.

Other contributions – for instance caused by uncertainty regarding the effects on the item, for example, conditioning, adaptation and the testing itself – may be determined in different ways. It could, for instance, be by analysis of the method, repetition of the measurements or comparative testing.

3.3 Comparisons between laboratories

The spread of the participants' results in comparative testing may be used wholly or partly as an estimate of measurement uncertainty.

3.4 Uncertainty of measurement established in standardised methods or by convention

For some test methods the values for uncertainty of measurements may have been defined. In such cases it is sufficient for the laboratory to prove that the equipment complies with the specifications and that, moreover, the testing is carried out in accordance with the method. The laboratory may with reference to the method indicate the measurement uncertainty in accordance herewith.

In some technical areas there may on the basis of testing experience and international cooperation among the laboratories in the area be consensus on the degree of uncertainty for various types of testing. If it is not practically possible to determine uncertainties in other ways, the laboratories may decide to apply such conventionally established uncertainties.

3.5 Special conditions

Contributions from the test item are normally not included in the evaluation of the uncertainty of measurements. This is contrary to the practice of calibration where the items are typically far less variable than in testing.

4. Reporting uncertainty of measurement

4.1 Requirements for the reporting of measurement uncertainty

In accordance with DS/EN ISO/IEC 17025, para. 7.8.3.1c, the uncertainty of measurement of the result should be indicated in the test report in the following cases:

- It is relevant for the validity or use of the testing results,
- It is required by a customer's instructions or
- The measurement uncertainty has an influence on compliance with a specification limit.
-

4.2 Indication of measurement uncertainty

The measurement uncertainty should be indicated in test reports as the expanded uncertainty U , corresponding to a level of confidence of 95%, see EA 4/16, para 7.1. The expanded uncertainty can normally be calculated by multiplying the estimated standard uncertainty u with a confidence factor of $k = 2$. This presupposes a sufficient quantity of freedom degrees. The uncertainty of a measurement result should be indicated unambiguously in the report, and it must be shown what the indicated measurement uncertainty represents.

The measurement uncertainty should be indicated by, at the most, two significant figures, and the measurement result rounded off to the smallest significant figure in the reported uncertainty. If the uncertainty of measurements is not stated, the result of the measurement must not be indicated by so many figures that it may be considered as an expression of an unrealistically small degree of uncertainty. This means that the laboratory must in all cases be able to make a reasonable estimate of the measurement uncertainty.

There may be areas in which conventionally a different level of confidence is used, or where the uncertainty of measurement and its reporting is stated in the test method.

4.3 Special conditions

In the testing of unhomogeneous materials or non-uniform items from a batch production the measurement uncertainty may be considerably smaller than the variation of the items. This may also apply to measurement uncertainty in connection with sampling from an item. If the measurement uncertainty is stated, the laboratory must be aware that the reports must not give a misleading impression of the items being homogeneous or uniform. For instance, the reports should contain a declaration to the effect that the results only apply to the tested items, cf. DS/EN ISO/IEC 17025, para 7.8.2.1.1).

The Accreditation Regulation comes into force on 15 December 2020. Any differences between the Danish and the English version of this document are not intended, but in case of doubt with respect to the correctness the version in Danish should be consulted.

**Evaluation and reporting of uncertainty of measurement
for testing in the mechanical, physical and electric area**

No : AB 12
Date : 2020.12.04
Page : 4/4

References

- 1) DS/EN ISO/IEC 17025:2017: General requirements for the competence of testing and calibration laboratories
- 2) EA 4/16:2013. EA guideline on the expression of uncertainty in quantitative testing. 2003
- 3) ILAC-G17:2002. Introducing the Concept of Uncertainty of Measurement in Testing in Association with the Application of the Standard ISO/IEC 17025
- 4) JCGM 100:2008, *GUM 1995 with minor corrections, Evaluation of measurement data*: Guide to the expression of uncertainty in measurement (GUM).
- 5) Accreditation Regulation AB 11. Measurement uncertainty in calibration.
- 6) EA-4/02. Expression of the Uncertainty of Measurement in Calibration.2013.
- 7) JCGM 200:2012 International vocabulary of metrology – Basic and general concepts and associated terms (VIM).