1. Application

This Accreditation Regulation concerns evaluation of uncertainty on quantitative measurements for accredited testing according to DS/EN ISO/IEC 17025:2017 within the mechanical, physical and electrical area.

This Accreditation Regulation also applies to qualitative testing, where quantitative measurements are included.

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.

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*(VIM).

3. Estimation of measurement uncertainty

3.1 General

The laboratory shall identify contributions to the uncertainty of measurements and evaluate the measurement uncertainty as required in DS/EN ISO/IEC 17025:2017 clause 7.6.1 og 7.6.3.

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 JCGM 100:2008, *GUM 1995 with minor corrections, Evaluation of measurement data – Guide to the expression of uncertainty in measurement* (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 Measurement uncertainty determined from 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 implicit or explicit defined. In such cases it is sufficient for the laboratory e.g. can prove that the equipment complies with the specifications, that influence factors lies in defined intervals 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 Internal calibration

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

For determination of the uncertainty on the calibrations see DANAKs Accreditation Regulation AB 11 *Measurement uncertainty in calibration.*

4. Reporting uncertainty of measurement

4.1 Requirements for the reporting of measurement uncertainty

In accordance with DS/EN ISO/IEC 17025:2017, clause 7.8.3.1c, the uncertainty of measurement of the result shall 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.

The laboratory shall be aware that the need to evaluate the validity or use of the testing results including the measurement uncertainty can appear from the laboratories customers, from their customer, legal authorities, certification bodies and others. Examples can be:

- Compliance with specification limit, where the customer shall consider whether the test item complies with given specifications or where there is risk of not complying with legal requirements.
- Product tests where declaration of conformity is made and where the risk of a products missing compliance with a specification is critical to the customer.
- Comparison of testing results where objective evaluation of compliance only is possible if the measurement uncertainty is taken into consideration.

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%. The expanded uncertainty can normally be calculated by multiplying the estimated standard uncertainty *u* with a confidence factor *k*. When there is a sufficient quantity of freedom degrees is k = 2. An explanatory note can be added with the following content:

The reported expanded uncertainty is indicated as the standard uncertainty of the measurement multiplied med the coverage factor k=[the given value of k] such that the probability of coverage corresponds to approximately 95 %.

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).

5. Decision rules

If the laboratory issues declarations of conformity the relevant decision rule shall be applied and explicitly appear in the report, cf. DS/EN ISO/IEC 17025:2017, clause 7.8.6.
Examples on decision rules appear in ILAC-G8/2019 clause 5.1 og 5.2.

The Accreditation Regulation comes into force on 1 october 2021. 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.

DANAK, 16. september 2021

References

1) DS/EN ISO/IEC 17025:2017: General requirements for the competence of testing and calibration laboratories.

2) ILAC-G17:01/2021. ILAC Guidelines for Measurement Uncertainty in Testing.

3) ILAC-G8:09/2019 Guidelines on Decision Rules and Statements of Conformity.

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-4/02:2013. Expression of the Uncertainty of Measurement in Calibration.

7) JCGM 200:2012 International vocabulary of metrology – Basic and general concepts and associated terms (VIM).