

*Manual of Codes of Practice for the Determination of Uncertainties in
Mechanical Tests on Metallic Materials*

SECTION 5

Guidelines for reporting uncertainty

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Issue 1

September 2000

5. Reporting uncertainty

The extent of the information given when reporting the result of a test and its uncertainty should be related to the requirements of the client, the specification and the intended use of the result. The following information should be made available either in the report or in the records of the test [1]:

- (a) Description of the methods used to calculate the result and its uncertainty.
- (b) A list of all uncertainty components and documentation to show how they were evaluated, e.g. a record of any assumptions made and the sources of data used in the estimation of the components.
- (c) Sufficient documentation of the steps and calculations used in the analysis so that the reported result can be independently repeated if necessary.
- (d) All corrections and constants used in the analysis, and their sources.

The report should also include [1]:

- (i) A full description of the measurand.
- (ii) The test result as $Y = y \pm U$ and the units of y and U .
- (iii) The relative expanded uncertainty $U/|y|$, $|y| \neq 0$, when appropriate.
- (iv) The value of k used to obtain U .
- (v) The approximate level of confidence associated with the interval $y \pm U$ and a description of how it was determined.

When reporting the result and its uncertainty, the use of excessive numbers of digits should be avoided. In most cases the uncertainty need be expressed to no more than two significant figures (although at least one more figure should be used during the stages of estimation and combination of component uncertainties in order to minimise rounding errors).

Unless otherwise specified, the result of the measurement should be reported, together with the expanded uncertainty appropriate to the 95% level of confidence, in the following manner [2]:

Measured value	100.1 (units)
Uncertainty of measurement	± 0.1 (units)

The reported uncertainty is an expanded uncertainty based on a standard deviation of 0.05 (units) multiplied by a coverage factor of $k=2$, which provides a level of confidence of approximately 95%.

Special cases

In exceptional cases, where a particular factor or combination of factors can influence the results, but where the magnitude cannot be either measured or reasonably assessed, the statement will need to include reference to that fact, for example [2]:

The reported uncertainty is an expanded uncertainty based on a standard deviation of 0.05 (units) multiplied by a coverage factor of $k = 2$, which provides a level of confidence of approximately 95%, but excluding the effects of

Any uncertainty that results from the test sample not being fully representative of the whole should normally be identified separately in the evaluation of uncertainty. However, there may be insufficient information to do this, in which case this should be stated in the report of uncertainty.

References

1. BIPM, IEC, IFCC, ISO, IUPAC, OIML, “*Guide to the expression of uncertainty in measurement*”. International Organisation for Standardisation, Geneva, Switzerland, ISBN 92-67-10188-9, First Edition, 1993. (This *Guide* is often referred to as the GUM or the ISO TAG4 document after the ISO Technical Advisory Group that produced it.)

Identical documents:

- ENV 13005:1999 (English)
 - NF ENV 13005:1999 (French)
 - NEN NVN ENV 13005:1999 (Dutch)
 - “*Vocabulary of metrology, Part 3. Guide to the expression of uncertainty in measurement*”, PD 6461: Part 3: 1995, British Standards Institution.
2. NIS 80, “*Guide to the expression of uncertainties in testing*”, Edition 1, September 1994. NAMAS Executive, National Physical Laboratory, Teddington, Middlesex, TW11 0LW, England.