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# Measurement uncertainties in mechanical tests on metallic materials — The evaluation of uncertainties in tensile testing

*Incertitudes de mesure dans les essais mécaniques sur matériaux métalliques — Évaluation des incertitudes pour les essais de traction*

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# Foreword

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This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 1, *Uniaxial testing*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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# Introduction

This document is based on a CEN Workshop Agreement which was issued in 2005 following a trilogy of documents concerned with measurement uncertainties in mechanical tests on metallic materials. The trilogy includes three documents, one concerned with the evaluation of uncertainties in low cycle fatigue testing, one with creep testing and this document focused on tensile testing.

For a meaningful estimate of uncertainty, all primary sources of uncertainty are to be included and their effects are to be properly quantified in the analyses. Reporting and interpreting the results of the calculations is also of utmost importance.

The calculations given in this document only capture the uncertainty associated with the uncertainty of the testing equipment's sensors over a short time scale. The uncertainty of a test result is dependent on much more than the uncertainty of the testing equipment's sensors.

Contributions to uncertainty due to misalignment, long-term environmental effects, and intermittent procedural errors, to name a few, are not included in these analyses. This is demonstrated by the results of the interlaboratory reproducibility in Annex C compared to the example given in Annex B.

A more realistic value of the uncertainty of the properties of material can be estimated using reproducibility data from laboratory intercomparisons involving several laboratories.

Results from reproducibility tests also include contributions to uncertainty from material inhomogeneity, different testing machines, controlling, and processing software together with the influence of different operators.

This document is based on CWA 15261-2[1)] and UNCERT CoP 07[1]. It describes a method for evaluating the uncertainty in tensile test results obtained from a series of tests that are performed in accordance with ISO 3534-3,[2] ISO 5725 series,[3] ISO 6892-1,[4] ISO 6892-2,[5] ISO 9513,[6] ISO Guides 33[7] and 35[8]. For a general introduction on the subject of uncertainty in measurement and testing refer to References [12] and [13].

1) Withdrawn

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# Measurement uncertainties in mechanical tests on metallic materials — The evaluation of uncertainties in tensile testing

## 1 Scope

This document describes how the evaluation of uncertainties in tensile tests can be obtained from tests at room temperature (ISO 6892-1) or elevated temperature (ISO 6892-2).

This document reports how it can be applied to tests performed at ambient and elevated temperatures under axial loading conditions with a digital acquisition of force and displacement.

NOTE 1 As CWA 15261-2[2)] and UNCERT CoP 07[1] reports, the tests are assumed to run continuously without interruptions on test pieces that have uniform gauge lengths.

NOTE 2 Annex C gives for information an indication of the typical scatter in tensile test results for a variety of materials that have been reported during laboratory inter-comparison exercises.

## 2 Normative references

There are no normative references in this document.

## 3 Terms, definitions and symbols

### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

**3.1.1**
**coverage factor**
number that, when multiplied by the combined standard uncertainty, produces the expanded uncertainty

Note 1 to entry: It is dependent on the confidence level (e.g., 95 % probability). It also depends on the effective degrees of freedom.

**3.1.2**
**level of confidence**
probability that the value of the measurand lies within the quoted range of uncertainty

**3.1.3**
**measurand**
specific quantity being reported as the measurement result

Note 1 to entry: A measurand can be a direct test reading or an estimate of a material property from other readings.

2) Withdrawn.

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