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**Accuracy (trueness and precision) of  
measurement methods and results —**

**Part 5:**

Alternative methods for the determination of  
the precision of a standard measurement  
method

*Exactitude (justesse et fidélité) des résultats et méthodes de mesure —*

*Partie 5: Méthodes alternatives pour la détermination de la fidélité d'une  
méthode de mesure normalisée*



## Contents

	Page
1 Scope .....	1
2 Normative references .....	1
3 Definitions .....	2
4 Split-level design .....	2
4.1 Applications of the split-level design .....	2
4.2 Layout of the split-level design .....	2
4.3 Organization of a split-level experiment .....	3
4.4 Statistical model .....	4
4.5 Statistical analysis of the data from a split-level experiment .....	5
4.6 Scrutiny of the data for consistency and outliers .....	6
4.7 Reporting the results of a split-level experiment .....	7
4.8 Example 1: A split-level experiment — Determination of protein .....	7
5 A design for a heterogeneous material .....	13
5.1 Applications of the design for a heterogeneous material .....	13
5.2 Layout of the design for a heterogeneous material .....	14
5.3 Organization of an experiment with a heterogeneous material .....	15
5.4 Statistical model for an experiment with a heterogeneous material .....	16
5.5 Statistical analysis of the data from an experiment with a heterogeneous material .....	17
5.6 Scrutiny of the data for consistency and outliers .....	20
5.7 Reporting the results of an experiment on a heterogeneous material .....	21
5.8 Example 2: An experiment on a heterogeneous material .....	21
5.9 General formulae for calculations with the design for a heterogeneous material .....	29
5.10 Example 3: An application of the general formulae .....	30
6 Robust methods for data analysis .....	33
6.1 Applications of robust methods of data analysis .....	33
6.2 Robust analysis: Algorithm A .....	35
6.3 Robust analysis: Algorithm S .....	36
6.4 Formulae: Robust analysis for a particular level of a uniform-level design .....	38
6.5 Example 4: Robust analysis for a particular level of a uniform-level design .....	38
6.6 Formulae: Robust analysis for a particular level of a split-level design .....	42
6.7 Example 5: Robust analysis for a particular level of a split-level design .....	42
6.8 Formulae: Robust analysis for a particular level of an experiment on a heterogeneous material .....	45
6.9 Example 6: Robust analysis for a particular level of an experiment on a heterogeneous material .....	45
<b>Annexes</b>	
A (normative) Symbols and abbreviations used in ISO 5725 .....	50
B (informative) Derivation of the factors used in algorithms A and S .....	53
C (informative) Derivation of equations used for robust analysis .....	55
D (informative) Bibliography .....	56

## Foreword

ISO (the International Organization for Standardization) is a world-wide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organisations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International standard requires approval by at least 75 % of the member bodies casting a vote.

ISO 5725-5 was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 6, *Measurement methods and results*.

ISO 5725 consists of the following parts, under the general title *Accuracy (trueness and precision) of measurement methods and results*:

- Part 1: *General principles and definitions*
- Part 2: *Basic method for the determination of repeatability and reproducibility of a standard measurement method*
- Part 3: *Intermediate measures of the precision of a standard measurement method*
- Part 4: *Basic methods for the determination of the trueness of a standard measurement method*
- Part 5: *Alternative methods for the determination of the precision of a standard measurement method*
- Part 6: *Use in practice of accuracy values*

Parts 1 to 6 of ISO 5725 together cancel and replace ISO 5725:1986, which has been extended to cover trueness (in addition to precision) and intermediate precision conditions (in addition to repeatability conditions and reproducibility conditions).

Annex A forms an integral part of this part of ISO 5725. Annexes B, C and D are for information only.

## Introduction

**0.1** This part of ISO 5725 uses two terms *trueness* and *precision* to describe the accuracy of a measurement method. *Trueness* refers to the closeness of agreement between the average value of a large number of test results and the true or accepted reference value. *Precision* refers to the closeness of agreement between test results.

**0.2** General consideration of these quantities is given in ISO 5725-1 and so is not repeated here. This part of ISO 5725 should be read in conjunction with ISO 5725-1 because the underlying definitions and general principles are given there.

**0.3** ISO 5725-2 is concerned with estimating, by means of interlaboratory experiments, standard measures of precision, namely the repeatability standard deviation and the reproducibility standard deviation. It gives a basic method for doing this using the uniform-level design. This part of ISO 5725 describes alternative methods to this basic method.

- a) With the basic method there is a risk that an operator may allow the result of a measurement on one sample to influence the result of a subsequent measurement on another sample of the same material, causing the estimates of the repeatability and reproducibility standard deviations to be biased. When this risk is considered to be serious, the split-level design described in this part of ISO 5725 may be preferred as it reduces this risk.
- b) The basic method requires the preparation of a number of identical samples of the material for use in the experiment. With heterogeneous materials this may not be possible, so that the use of the basic method then gives estimates of the reproducibility standard deviation that are inflated by the variation between the samples. The design for a heterogeneous material given in this part of ISO 5725 yields information about the variability between samples which is not obtainable from the basic method; it may be used to calculate an estimate of reproducibility from which the between-sample variation has been removed.
- c) The basic method requires tests for outliers to be used to identify data that should be excluded from the calculation of the repeatability and reproducibility standard deviations. Excluding outliers can sometimes have a large effect on the estimates of repeatability and reproducibility standard deviations, but in practice, when applying the outlier tests, the data analyst may have to use judgement to decide which data to exclude. This part of ISO 5725 describes robust methods of data analysis that may be used to calculate repeatability and reproducibility standard deviations from data containing outliers without using tests for outliers to exclude data, so that the results are no longer affected by the data analyst's judgement.

# Accuracy (trueness and precision) of measurement methods and results —

## Part 5:

## Alternative methods for the determination of the precision of a standard measurement method

### 1 Scope

This part of ISO 5725

- provides detailed descriptions of alternatives to the basic method for determining the repeatability and reproducibility standard deviations of a standard measurement method, namely the split-level design and a design for heterogeneous materials;
- describes the use of robust methods for analysing the results of precision experiments without using outlier tests to exclude data from the calculations, and in particular, the detailed use of one such method.

This part of ISO 5725 complements ISO 5725-2 by providing alternative designs that may be of more value in some situations than the basic design given in ISO 5725-2, and by providing a robust method of analysis that gives estimates of the repeatability and reproducibility standard deviations that are less dependent on the data analyst's judgement than those given by the methods described in ISO 5725-2.

### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 5725. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5725 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3534-1:1993, *Statistics — Vocabulary and symbols — Part 1: Probability and general statistical terms*.

ISO 3534-3:1985, *Statistics — Vocabulary and symbols — Part 3: Design of experiments*.

ISO 5725-1:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*.

ISO 5725-2:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*.