

**MÕÕTMISMEETODITE JA TULEMUSTE  
MÕÕTETÄPSUS (TÕELINE VÄÄRTUS JA TÄPSUS)**  
**Osa 5: Alternatiivsed meetodid standardse  
mõõtmismeetodi kordustäpsuse kindlaks  
määramiseks**

Accuracy (trueness and precision) of measurement methods and results

Part 5: Alternative methods for the determination of the precision of a standard measurement method

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-ISO 5725-5:2002 "Mõõtmismeetodite ja tulemuste mõõtetäpsus (tõeline väärtus ja täpsus). Osa 5: Alternatiivsed meetodid standardse mõõtmismeetodi kordustäpsuse kindlaks määramiseks" sisaldab rahvusvahelise standardi ISO 5725-5:1998 "Accuracy (trueness and precision) of measurement methods and results - Part 5: Alternative methods for the determination of the precision of a standard measurement method" identset ingliskeelset teksti.</p> <p>Standard EVS-ISO 5725-5:2002 on kinnitatud Eesti Standardikeskuse 03.05.2002 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Standard on kättesaadav Eesti Standardikeskusest.</p>	<p>This Estonian Standard EVS-ISO 5725-5:2002 consists of the identical English text of the International Standard ISO 5725-5:1998 "Accuracy (trueness and precision) of measurement methods and results - Part 5: Alternative methods for the determination of the precision of a standard measurement method".</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 03.05.2002 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian Centre for Standardisation.</p>
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<p><b>Käsitlusala</b></p> <p>Käesolev ISO 5725 osa:</p> <ul style="list-style-type: none"> <li>– annab detailseid kirjeldused, millised on alternatiivid standardse mõõtmismeetodi korratavuse ja reprodutseeritavuse standardhälvete kindlaksmääramise põhimeetoditele; nimelt jagatud taseme disain ja disain heterogeensetele materjalidele;</li> <li>– kirjeldab robustsete meetodite kasutamist kordustäpsuse katsete tulemuste analüüsiks ilma väliseid katseid kasutamata, et välistada andmed arvutustest (eriti detailselt kirjeldatakse ühe sellise meetodi kasutamist).</li> </ul> <p>Käesolev ISO 5725 osa täiendab ISO 5725-2 standardit, pakkudes alternatiivseid disaine, mis võivad ISO 5725-2 standardis pakutud põhidisainist osades olukordades väärtuslikumad olla, ning pakkudes robustset analüüsimeetodit, mis annab hinnangud korratavuse ja reprodutseeritavuse standardhälvete osas, mis sõltuvad vähem andmete analüüsija otsusest kui need, mis on kirjeldatud ISO 5725-2 standardis.</p>	<p><b>Scope</b></p> <p>This part of ISO 5725</p> <ul style="list-style-type: none"> <li>— 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;</li> <li>— 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.</li> </ul> <p>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.</p>
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**ICS 03.120.30** Statistiliste meetodite rakendamine; **17.020** Metroloogia ja mõõtmise üldküsimumused

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## 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*.





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

### Part 5:

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

### TECHNICAL CORRIGENDUM 1

*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*

*RECTIFICATIF TECHNIQUE 1*

Technical Corrigendum 1 to ISO 5725-5:1998 was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 6, *Measurement methods and results*.

Page 17, Equations (25) and (26) in Subclause 5.4.2

Replace  $y_j = \sum_{i=1}^q y_{ij} / p'$  with  $y_j = \sum_{i=1}^q y_{ij} / p'$  in Equation (25).

Replace  $s_{yj} = \sqrt{\sum_{i=1}^q (y_{ij} - y_j)^2 / (p' - 1)}$  with  $s_{yj} = \sqrt{\sum_{i=1}^q (y_{ij} - y_j)^2 / (p' - 1)}$  in Equation (26).

Page 38, Equation (72) in Subclause 6.4.3

Replace  $s_L = \sqrt{s_d^2 - (s_r^2 / n)}$  with  $s_L = \sqrt{(s_d^2 - s_r^2) / n}$ .