

ISO 5725-2:2019-12 (E)

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

Contents	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	2
3 Terms and definitions	2
4 Symbols	2
5 Estimates of the parameters in the basic model	4
6 Requirements for a precision experiment	5
6.1 Layout of the experiment	5
6.2 Recruitment of the laboratories	6
6.3 Preparation of the materials	6
7 Personnel involved in a precision experiment	7
7.1 Panel	7
7.2 Statistical functions	8
7.3 Executive functions	8
7.4 Supervisors	9
7.5 Operators	10
8 Statistical analysis of a precision experiment	10
8.1 Preliminary considerations	10
8.2 Tabulation of the results and notation used	11
8.2.1 Cells	11
8.2.2 Redundant data	11
8.2.3 Missing data	11
8.2.4 Outliers	11
8.2.5 Outlying laboratories	11
8.2.6 Erroneous data	11
8.2.7 Balanced uniform-level test results	11
8.2.8 Collation of data and intermediate values	12
8.2.9 Original test results	12
8.2.10 Cell means (Form B of Figure 2)	12
8.2.11 Measures of cell spread (Form C of Figure 2)	12
8.2.12 Corrected or rejected data	13
8.3 Scrutiny of results for consistency and outliers	13
8.3.1 Approaches for scrutiny of data	13
8.3.2 Graphical consistency technique	13
8.3.3 Numerical outlier technique	16
8.3.4 Cochran's test	16
8.3.5 Grubbs' tests	18
8.3.6 Repeated testing for outlying means or outlying data points	20
8.3.7 Alternative outlier inspection and test methods	20

8.4	Calculation of the general mean and variances	20
8.4.1	Method of analysis	20
8.4.2	Basic data	21
8.4.3	Non-empty cells	21
8.4.4	Calculation of the general mean, $\bar{m}$	21
8.4.5	Calculation of variances	21
8.4.6	Alternative calculation methods for variances	22
8.4.7	Dependence of the variances upon m	23
8.5	Establishing a functional relationship between precision values, s, and the mean level, m	23
8.5.1	Choice of functional relationship	23
8.5.2	Fitting relationships I and II	24
8.5.3	Fitting relationship III	25
8.5.4	Fitting relationship IV	26
8.6	Statistical analysis as a step-by-step procedure	28
8.7	Report to the panel and decisions to be taken by the panel	30
8.7.1	Report by the statistical expert	30
8.7.2	Decisions to be taken by the panel	32
8.7.3	Full report	33
9	Statistical tables	33
Annex A (informative) Number of laboratories required for an estimate of precision		38
Annex B (informative) Alternative calculations of variance components		41
Annex C (informative) Examples of the statistical analysis of precision experiments		44
Annex D (informative) Calculation of critical values and indicators		66
Bibliography		69