TECHNICAL REPORT

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Textiles and textile products — Guidelines on the determination of the precision of a standard test method by interlaboratory trials

Textiles et produits textiles — Lignes directrices pour la détermination de la fidélité d'une méthode d'essai normalisée au moyen d'essais d'interlaboratoires

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Foreword

ISO (the International Organization for Standardization) is a worldwide 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 organizations, 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 24697 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 24, *Conditioning atmospheres and physical tests for textile fabrics*.

Introduction

It is well known that developing a standardized test method is not always an easy task. Most of the effort involves going through lots of details and trying to reach agreement between all the parties involved. As a consequence, it is wise to also dedicate part of the job to define what level of reliability the result of the standardized test method will have once it is applied.

The participation of interested laboratories is welcome, possibly those having a delegate in the commission in charge of developing the standardized test method.

Following this consideration, the aim of this Technical Report is to supply guidelines in case there is an intention to evaluate the uncertainty of that standardized test method by carrying out interlaboratory tests.

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Textiles and textile products — Guidelines on the determination of the precision of a standard test method by interlaboratory trials

1 Scope

This Technical Report can be applied to textiles and textile products and is concerned only with test methods which operate in a continuous scale to yield a single numerical figure as the test result. However, this single figure can be the outcome of a calculation from a set of measurements.

The distribution of test results is required to be unimodal and is assumed to be normal. With non-Gaussian distributions, other evaluation procedures will be necessary.

It does not cover methods which yield discrete values, 'pass/fail' (go/no go) type results, (accept/reject) tests or where a ranking scheme is in operation.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 5725-2, *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*

ISO 5725-6, *Accuracy (trueness and precision) of measurement methods and results — Part 6: Use in practice of accuracy values*

3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 3534-1, ISO 5725-2 and ISO 5725-6 and the following apply.

3.1
observed value
value of a characteristic obtained as a result of a single observation

3.2
test results
value of a characteristic obtained by carrying out a specified test method

NOTE   The test method should specify that a number of individual observations to be made and their average and other appropriate function (such as the median and the indication of the dispersion measured by a standard deviation) be reported as the test result.

3.3
level of the test in a precision experiment
general average of the test results from all laboratories for one particular material or specimen tested

3.4
cell in precision experiment
test results at a single level obtained by one laboratory

3.5
precision
closeness of agreement between independent test results obtained under stipulated conditions such that they are not influenced by any previous result on the same or similar material

NOTE   The measure of precision is usually expressed as, or derived from, a standard deviation, which is a measure of imprecision computed from the test data. Less precision is reflected by a larger standard deviation.

3.6
accuracy
closeness of agreement between a test result and the accepted reference value

3.7
trueness
closeness of agreement between the average value from a large series of test results and an accepted reference value

3.8
repeatability
measure of the dispersion of test results under conditions where test results are obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within short intervals of time

3.9
reproducibility
measure of the dispersion of test results under conditions where test results are obtained with the same method on the same test material in different laboratories with different operators using different equipment

3.10
outlier
member of a set of values which is inconsistent with the other members of that set

3.11
degree of freedom
number of independent observations

NOTE   In the evaluation of a test method, an absolute minimum of five laboratories should be used from at least three different countries.

4   Requirements for an interlaboratory precision trial

4.1   General

For a successful trial it is required that:

— The participating laboratories and personnel are given all the details before the start of the exercise;

— All participating laboratories keep to the instructions for carrying out the experiment;

— All operators are familiar with the test method;

— All measurements taken shall be reported;

— It is not acceptable to carry out more than the number of replicates specified;

— It is not acceptable to report the mean of a series of replicates as a single observed value.

4.2 Personnel requirements

4.2.1 The project manager

The working group or committee shall appoint a Project Manager by one of its members who will take full responsibility for the organization of the experiment, supervise its execution, collation the results and determination the precision of the test method.

The project manager should be fully familiar with the test method, and should have knowledge of statistical design and analysis. If necessary he may appoint a statistician to assist with the analysis of the results.

4.2.2 Laboratory contact person

A suitable contact person – the laboratory contact – shall be identified within each participating laboratory, to which the samples and information about the trial should be sent. This person is responsible for supervision of the testing by the operator(s) and for the reporting of results to the project manager.

4.2.3 The operator(s)

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In each of the participating laboratories the trial must be performed by an operator who is competent in carrying out this sort of measurement. (standards.iteh.ai)

4.3 Laboratory requirements

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In the evaluation of a test method, an absolute minimum of five laboratories should be used from at least three different countries.

The participation of interested laboratories is welcome; possibly those having a delegate in the commission in charge of developing the standardized test method.

4.4 Sample requirements

4.4.1   The number of types of material (levels) tested in each laboratory should be selected such that the total number of samples tested across all laboratories is not less than 30, preferably nearer to 60. Thus, if there are 5 participating laboratories, a minimum of 6 materials (levels) are needed.

4.4.2   The working group should agree on the types of materials required to cover the whole field of application of the test (different levels).

4.4.3   The quantity of material prepared shall be sufficient to cover the trial, and to allow a reserve.

4.5 Organization of the interlaboratory trial

The project manager is responsible for the organization of the trial as follows:

4.5.1   The design of the trial, based on ISO 5725-2, to include the number of levels required (see 4.4.1), a number of times that the test should be carried out, and the order in which samples should be tested.

4.5.2   The preparation of sufficient samples and their randomization to ensure that each laboratory receives as nearly as possible homogeneous samples. Additional samples shall be prepared for the replacement of any lost or damaged samples if necessary.

4.5.3 Labelling of samples

Each sample should be labelled preferably with a three or five digit random number. The allocation of random numbers to the samples should be known only to the Project Manager.

Preparation of an instruction sheet for the participating laboratories to include, at least, the following:

— the test method to be used;

— the number of repeat measurements to be made;

— the number of operators to be used;

— to specify how the samples are to be conditioned prior to the test;

— the order in which the samples should be tested;

— the deadline for completion of tests;

— the questionnaire for feed-back;

— the standard sheet for the reporting of the results (see Annex A, for an example).

4.5.4 Distribution of the samples and instructions to the laboratories.

4.6 Conducting the interlaboratory trial

4.6.1 Testing should be carried out by the participating laboratories according to the instructions provided by the Project Manager.

4.6.2 Results should be sent back to the Project Manager within the required time-scale. Any deviations from the required procedure or any problems experienced should be reported.

4.7 Analysis of the results

4.7.1 Data correction

4.7.1.1 Missing data

Unless these are so excessive as to hazard the validity of the study, they should be ignored in the analysis apart from necessary procedural adjustments.

4.7.1.2 Outliers

Experience has taught that outliers cannot be avoided and have to be taken into consideration. As a general rule no readings should be rejected unless either, there is evidence for a definite source of error or, they fail some statistical criteria. It should be noted that not only individual results but data from a source (i.e. a laboratory) may be subject to this procedure. Under no circumstances, after rejection of outliers, may be a further analysis be undertaken to detect further outliers inconsistent with the adjusted data set. For an extensive treatment on the subject see ISO 5725-2.

4.7.2 When the standards deviation for both repeatability and reproducibility do not show any dependence on the level of tests it is permissible to average the values before calculation of the precision. Otherwise, following suitable statistical test to check for homogeneity (see ISO 5725.2:1994, Clause 7.3.3 - Cochran's test) separate precision values may be assigned to each level.

4.7.3 Calculation of precision

See Annex B.

Annex A
(informative)

Form examples

Form A - Recommended form for the collation of the original data						
Laboratory	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
1	n_1 n_k					
2						
3						
4						
5						
p						

n_k: total number of replicates per cell

Form B - Recommended form for collation of calculated averages						
Laboratory	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
1						
2						
3						
4						
5						
p						