
Textiles — Tear properties of fabrics —
Part 3:
Determination of tear force of wing-shaped
test specimens (Single tear method)

Textiles — Propriétés de déchirement des étoffes —
Partie 3: Détermination de la force de déchirure des éprouvettes
croissants (Méthode de la déchirure unique)

ISO 13937-3:2000

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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 3.

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 member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 13937 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13937-3 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 38, *Textiles*, Subcommittee SC 24, *Conditioning atmospheres and physical tests for textile fabrics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

ISO 13937 consists of the following parts, under the general title *Textiles — Tear properties of fabrics*:

- Part 1: Determination of tear force using ballistic pendulum method (Elmendorf)
- Part 2: Determination of tear force of trouser-shaped test specimens (Single tear method)
- Part 3: Determination of tear force of wing-shaped test specimens (Single tear method)
- Part 4: Determination of tear force of tongue-shaped test specimens (Double tear test)

Annexes A, B and C of this part of ISO 13937 are for information only.

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Foreword

The text of EN ISO 13937-3:2000 has been prepared by Technical Committee CEN/TC 248 "Textiles and textile products", the secretariat of which is held by BSI, in collaboration with Technical Committee ISO/TC 38 "Textiles".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2000, and conflicting national standards shall be withdrawn at the latest by October 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

EN ISO 13937 has been prepared as a part of several test methods for the determination of certain mechanical properties of textiles using mainly tensile-testing machines, e.g. tensile properties, seam tensile properties, tear properties, seam slippage. Test requirements for these standards agree where appropriate. The results obtained by one of the methods should not be compared with those obtained by other methods. Annex D lists test methods standardized in this context.

EN ISO13937 specifies methods for the determination of tear force of fabrics. Part 1 describes a ballistic pendulum method, parts 2 to 4 describe methods using tensile-testing machines.

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1 Scope

This Part of EN ISO 13937 describes a single tear method to determine fabric tear force, known as the wing test using a test specimen cut to form two wings for clamping inclined at a defined angle to the thread direction. The tear force measured is the force required to propagate a previously started tear.

The test is mainly applicable to woven textile fabrics. It may be applicable to fabrics produced by other techniques. Due to the clamping of the specimen wings inclined to the threads to be torn the test can be used for most types of fabrics without causing a transfer of tear and it is less susceptible to withdrawal of threads than other tear tests.

In general the method is not applicable to knitted fabrics, woven elastic fabrics and nonwovens, to which the trapezoidal test method is preferably applied (Note 2).

The method only allows the use of constant-rate-of-extension (CRE) testing machines.

NOTE 1: For other tear test methods using tensile-testing machines part 2 of EN ISO 13937 describes a method known as the trouser test and part 4 the tongue test method. Part 1 of EN ISO 13937 describes the ballistic pendulum (Elmendorf) method.

NOTE 2: For trapezoidal test methods, see ISO 9073-4 for nonwovens or ISO 4674 for coated fabrics.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 139	Textiles - Standard atmospheres for conditioning and testing
ISO 7500-1	Metallic materials - Verification of static uniaxial testing machines - Part 1 - Tensile testing machines
ISO 10012-1	Quality assurance requirements for measuring equipment - Part 1: Metrological confirmation system for measuring equipment

3 Terms and definitions

For the purposes of this part of EN ISO 13937 the following terms and definitions apply:

3.1 constant-rate-of-extension (CRE) testing machine: Tensile-testing machine where one clamp is stationary whilst the other is moving with a constant speed throughout the test and where the entire testing system is virtually free from deflection.

3.2 gauge length: Distance between the two effective clamping points of a testing device.

NOTE: The effective clamping points (or lines) of jaws can be checked by clamping a test specimen under defined pretension with carbon copy paper to produce a gripping pattern on the specimen and/or jaw faces.

3.3 tear force: Force required to propagate a tear initiated under the specified conditions.

NOTE: The tear force is qualified as "across warp" or "across weft" according to whether the tear is made across the warp (warp threads are torn) or weft threads (weft threads are torn) respectively.

3.4 peak: Point on a force/extension curve where the gradient, relative to the force values recorded, changes from positive to negative.

NOTE: For tear recordings the peak to be used for calculation is defined by rising and falling of force of at least 10 % of the last decreasing or increasing force value respectively.-

3.5 length of tear: Measured distance propagated by a tearing force from the initiation of the force until its termination.

3.6 wing-shaped test specimen: Strip of test fabric, cut on one end to form a triangle with a specified slope, and cut in the centre to form two wings which are clamped parallel to the slope of the strip (see figures 1 and 2).

4 Principle

A specifically shaped test specimen cut to form two wings on one side is mechanically stressed so that the stress is concentrated at a cut in such a way as to cause tearing in the desired direction. The wings of the specimen are clamped inclined to the direction of the threads to be torn. The force to continue the tear over a specified length of tear is recorded. The tear force is calculated from force peaks of the autographic trace, or on-line by electronic means.

5 Sampling

Select samples either in accordance with the procedure laid down in the material specification for the fabric, or as agreed between the interested parties.

In the absence of an appropriate material specification an example of a suitable sampling procedure is given in annex A.

An example of a pattern for cutting test specimens from the laboratory sample is given in annex B. Avoid test areas with folded or creased places, selvages and areas not representative of the fabric.

6 Apparatus

6.1 General

The system for metrological confirmation of the tensile testing machine shall be in accordance with ISO 10012-1.

6.2 CRE machine, having the following characteristics:

- a) Capable of operating at a constant-rate-of-extension of (100 ± 10) mm/min;
- b) capable of gauge length to be set to (100 ± 1) mm;
- c) provided with means for recording the force applied to the test specimen during the tear test.
- d) under conditions of use, the accuracy of the apparatus shall be class 1 of ISO 7500-1. The error of the indicated or recorded maximum force at any point in the range in which the machine is used shall not exceed ± 1 %, and the error of the indicated or recorded jaw separation shall not exceed ± 1 mm.

e) if recording of force and extension is obtained by means of data acquisition boards and software, the frequency of data collection shall be at least 8 per second.

If a class 2 tensile testing machine has to be used, this shall be stated in the test report.

6.3 Clamping device, comprising the two jaws of the machine, the central points of which are in the line of pull, the front edges at right angles to the line of pull and the clamping faces in the same plane.

The jaws shall be fixed to prevent sideways movement during the tearing operation and shall be capable of holding the test specimen without allowing it to slip, designed so that they do not cut or otherwise weaken the test specimen.

The width of the jaws shall preferably be 100 mm, but shall not be less than 75 mm.

6.4 Equipment for cutting out test specimens, preferably a hollow punch or template to give test specimens of the dimensions shown in figure 1.

7 Atmosphere for conditioning and testing

The atmospheres for preconditioning, conditioning and testing shall be as specified in ISO 139.

8 Preparation of test specimens

8.1 General

From each laboratory sample two sets of test specimens shall be cut, one set in the warp direction and the other in the weft direction.

For other than woven fabrics use the relevant designation for direction, e.g. length and transverse.

Each set shall consist of at least five test specimens, or more if agreed. In accordance with clause 5 and annex B, no two test specimens shall contain the same longitudinal or transverse threads, and no specimen shall be cut within 150 mm of the edge of the fabric.

8.2 Dimensions

Cut out the test specimens in accordance with the shape and dimensions shown in figure 1 and mark the lines ab and cd on each test specimen. Mark the end of tear (25 ± 1) mm from the uncut end in the centre of the strip to indicate the position of the tear at the completion of the test.