INTERNATIONAL STANDARD

ISO 9073-4

Second edition
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Textiles — Test methods for nonwovens —

Part 4:
Determination of tear resistance

Textiles — Méthodes d'essai pour nontissés —

Partie 4: Détermination de la résistance à la déchirure

Reference number
ISO 9073-4:1997(E)

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.

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.

International Standard ISO 9073-4 was prepared by Technical Committee ISO/TC 38, *Textiles.*

This second edition replaces and cancels the first edition (ISO 9073-4:1989), clause 3, figure 1, subclause 6.2, subclause 7.2 and clause 8 of which have been technically revised.

ISO 9073 consists of the following parts, under the general title *Textiles — Test methods for nonwovens*:

— *Part 1: Determination of mass per unit area*

— *Part 2: Determination of thickness*

— *Part 3: Determination of tensile strength and elongation*

— *Part 4: Determination of tear resistance*

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Introduction

Although nonwovens are classified within the textile industry, it should be recognized that nonwovens technologically share characteristics not only with textile products but also with paper and/or plastic products. There is no current International Standard for determination of tear strength of textiles, but work is proceeding on determination of tear resistance (falling pendulum method, ISO 9290:1990, *Textiles — Woven fabrics — Determination of tear resistance by falling pendulum method*) and determination of tear resistance (tongue-tear method).

This method, which uses a trapezoidal tear, is a tension test in which the strength is determined primarily by the fibres of the composite structure and their bonding or interlocking. It is useful for estimating relative ease of tearing of nonwovens. In nonwovens, the mechanism of failure is affected by interfibre frictional forces and differs from that found for woven fabrics, where failure is essentially that of sequential rupture of yarns in tension.

There is evidence that this test may not be applicable to nonwovens above a certain mass per unit area and stiffness. Additional work on this problem is in progress.

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Textiles — Test methods for nonwovens —

Part 4:
Determination of tear resistance

1 Scope

This part of ISO 9073 specifies a method for the determination of tear resistance of nonwovens by the trapezoid method.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9073. 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 9073 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 139:1973, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 186:1994, *Paper and board — Sampling to determine average quality.*

3 Principle

Marking of a trapezoid on a test piece.

Clamping of the non-parallel sides of the trapezoid in the jaws of a tensile testing machine.

Application of a continuously increasing extension to the test piece in such a way that a tear propagates across its width.

Determination of the average maximum tear resistance in newtons.

4 Apparatus

4.1 Tensile testing machine, either constant rate of extension type or constant rate of traverse type, equipped with an autographic recorder to register applied force.

4.2 Clamps, of sufficient width to accommodate the full width of the test piece.

4.3 Template, with dimensions as shown in figure 1.

Dimensions in millimetres

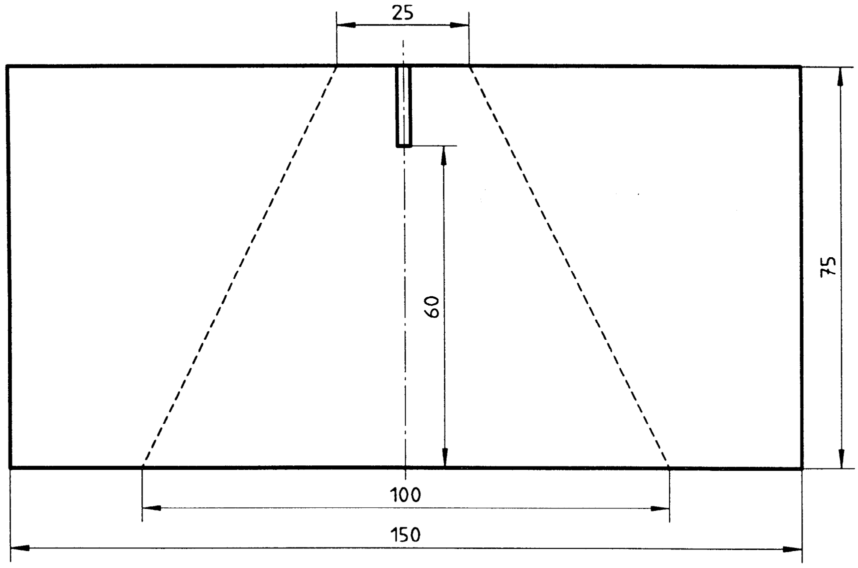

Figure 1 — Template for trapezoid tearing test

5 Sampling

Carry out sampling in accordance with ISO 186, ensuring that the areas from which the specimens are taken have no visible flaws and are not creased.

NOTE 1 This method of sampling recognizes and makes provisions for "anisotropy" (differences in properties along various directions, principally machine and cross direction) in the final specimens. However, these specimens are random representatives of the material and in some cases it may be desirable to investigate systematic variations of properties (including anisotropy), for example across the width, or in certain positions along the length of a given reel. In all such cases, special provisions should be agreed between purchaser and vendor and recorded in the test report. A procedure for more detailed examination of variability within a given batch of material is available in TAPPI T 11.05.74 and may be found helpful. This publication may be obtained from: The Technical Association of Pulp and Paper Industries, 1 Dunwoody Park, Atlanta, Georgia 30338, USA.

6 Preparation and conditioning of test pieces

6.1 Unless otherwise specified, cut five test pieces in the machine direction and five in the cross-machine direction.

NOTE 2 The edge of the specimen should not normally form part of the test piece.

6.2 Cut test pieces (75 ± 1) mm $\times$ (150 ± 2) mm. Mark each test piece with an isosceles trapezoid using the template. Make a preliminary cut as shown in figure 1.

NOTE 3 Other dimensions, respecting the general proportions of the original test piece, may be agreed between interested parties, especially in order to reproduce some in-use conditions of nonwovens, and should be noted in the test report. The values measured with different test piece dimensions cannot be compared.

6.3 Condition the test pieces as specified in ISO 139.

7 Procedure

7.1 Carry out the testing in the standard atmosphere for testing (see ISO 139).

7.2 At the start of the test, set the clamps (25 ± 1) mm apart and operate the machine at 100 mm/min. Select the force range of the testing machine so that the break occurs between 10 % and 90 % of full scale.

7.3 Secure the test piece in the machine, clamping along the non-parallel sides of the trapezoid with the cut halfway between the clamps. Hold the short edge taut and let the long edge lie in folds.

7.4 Start the machine with pawls disengaged, if appropriate, and record the tearing force, in newtons, on the autographic recorder. If the test piece does not tear at the cut, no result shall be registered.

NOTE 4 The tearing force will not usually be a single value but will generally appear as a series of maxima and minima.

8 Expression of results

Determine the average value of the series of significant load peaks (see note 5) represented on the autographic record for each individual test piece for both machine direction and cross direction. In the event that there is only one definite load peak on the autographic record, this value shall be taken as the result for that specimen.

Determine the mean and coefficient of variation of the results for the five test pieces in both the machine and cross directions.

NOTES

5 The displacement of the clamps is measured with the starting distance between the clamps at 25 mm.

The tear propagation resistance is recorded until the test piece breaks completely, but the results are only valid up to the displacement of the clamps reaching 64 mm. Beyond this value, the measured tear force is reduced by the proximity of the border of the test piece.

For this reason, the significant peak loads to be considered are those corresponding to the displacement of the clamps below the limit of 64 mm.

6 Where electronic recording machines are used, it is possible to obtain a mean force for each test piece, which is then averaged to give the final results.

For the same reason as expressed in note 5, the mean force should be calculated between the following two limits:

— the displacement of the clamps corresponding to the first load peak;

— the displacement of the clamps equal to 64 mm.

9 Test report

The test report shall include the following information:

a) a reference to this par of ISO 9073;

b) all details necessary for the identification of the material;

c) the results of the tests in both the machine direction and cross direction (see clause 8);

d) the conditioning atmosphere used;

e) any unusual features noted during the testing, or deviations from the standard procedure.

ICS 59.080.30

Descriptors: textiles, fabrics, non-woven fabrics, tests, tear tests, determination, tear strength.

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