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Nonwovens — Test methods —

Part 18: Determination of tensile strength and elongation at break using the grab tensile test

Nontissés — Méthodes d'essai —

Partie 18: Détermination de la résistance à la traction et de l'allongement à la rupture par l'essai d'arrachement par traction

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 248, *Textiles and textile products,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 9073-18:2007), which has been technically revised.

The main changes are as follows:

— the title has been changed from "Determination of breaking strength and elongation of nonwoven material using the grab tensile test" to "Determination of tensile strength and elongation at break suing the grab tensile test";

— the Scope has been clarified and made precise;

— new terms have been added to the list of terms in Clause 3;

— new following new Clauses have been added and subsequent clauses have been renumbered:

  — Clause 7, Sampling;

  — Clause 8, Conditioning;

  — Clause 9, Preparation of specimens;

  — Clause 10, Preparation, calibration and verification of apparatus;

  — Clause 13, Expression of results;

— Clause 14, Precision and bias.

A list of all parts in the ISO 9073 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Nonwovens — Test methods —

Part 18: Determination of tensile strength and elongation at break using the grab tensile test

SAFETY WARNING — This document does not claim to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. It is expected that the person performing this test has been fully trained in all aspects of this procedure.

1 Scope

This document specifies a test method for the determination of the breaking force of nonwovens using a grab method in conditioned or wet state.

This test method is not applicable to materials which have a high percentage of stretch. Comparing test results from tensile testing machines operating on different principles is not applicable.

This document specifies methods using constant rate of specimen extension (CRE) tensile testers. Constant-rate-of-loading (CRL) instruments is covered, for information, in ISO 2062:2009, Annex A, in recognition of the fact that these instruments are still in use and can be used by agreement.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 139, *Textiles — Standard atmospheres for conditioning and testing*

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

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 3951-1, *Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptance quality limit (AQL) for lot-by-lot inspection for a single quality characteristic and a single AQL*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO 10012, *Measurement management systems — Requirements for measurement processes and measuring equipment*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
breaking force
maximum force applied to a material carried to rupture

Note 1 to entry: Materials that are brittle usually rupture at the maximum force. Materials that are ductile usually experience a maximum force before rupturing.

3.2
maximum force
force applied to a material carried to rupture

3.3
constant-rate-of-extension tensile testing machine
CRE machine
tensile-testing machine provided with one clamp which is stationary and another clamp which moves with constant speed throughout the test, the entire testing system being virtually free from deflection

3.4
constant-rate-of-load tensile testing machine
CRL machine
testing machine in which the rate of increase of the load being applied to the specimen is uniform with time after the first 3 s

3.5
grab test
tensile test in which only the centre part of the test specimen is gripped in the jaws of the testing machine

3.6
elongation
deformation in the direction of load caused by a tensile force, generally expressed as a ratio of the length of the stretched material to the length of the unstretched material

Note 1 to entry: Elongation may be determined by the degree of stretch under a specific load or the point where the stretched material breaks.

Note 2 to entry: Elongation is expressed as a percentage.

3.7
extension
change in length of a material due to stretchingNote 1 to entry: Extension is expressed in units of length.

Note 1 to entry: See *elongation* (3.6).

3.8
grab strength testing
measuring of the “effective strength” of a fabric, i.e. the strength of fibres in a specific width together with the additional strength contributed by adjacent fibres

Note 1 to entry: Typically, grab strength is determined on a 100 mm wide strip of fabric, with the tensile load applied at the midpoint of the fabric width through 25 mm wide jaw faces that are used to clamp the fabric.

3.9
sample
product or a portion of a product taken from a production lot for testing purposes, identifiable and traceable back to the origin

3.10
test specimen
specific portion of the identified sample upon which a test is performed

Note 1 to entry: Many specimens may be tested from the same sample, using different locations.

3.11
tensile strength
resistance of a material to breaking under tension

Note 1 to entry: Tensile strength is preferably expressed in Newton.

3.12
gauge length
distance between the two effective clamping points of a testing device

Note 1 to entry: The effective clamping points (or lines) of jaws can be checked by clamping a test specimen with carbon copy paper to produce a gripping pattern on the test specimen and/or the jaw faces.

4 Principle

A test specimen, gripped in its centre part by jaws of specified dimensions, is extended at constant rate until it ruptures. The maximum force is recorded. Values for the breaking force and the elongation of the test specimen are obtained from test instrument; scales, dials, autographic recording charts, or a computer interfaced.

Comparison of results from tensile testing machines operating on different principles is not recommended. When different types of machines are used for comparison testing, constant time-to-break at (20 ± 3) s is the established way of producing data. Even then the data can differ significantly. The constant-rate-of-extension tensile testing machine is preferred for this method.

5 Reagents and materials

5.1 Grade 3 water, according to ISO 3696, for wet testing.

5.2 Non-ionic wetting agent, for wet testing.

5.3 Blotting paper, two sheets required for the test on wet test specimens.

6 Apparatus

6.1 Tensile testing machine, can be any of the two types of tensile tester (CRE machine and CRL machine) and their results are not comparable. In ISO 1421 and the ISO 13934 series, the CRE machine is the only one considered.

If it is necessary to describe CRE machines, these alternative methods are described for information in ISO 2062:2009, Annex A.

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

The CRE machine shall have the general characteristics given in 6.1.1 to 6.1.4.

When different types of machines are used for comparison testing, constant time-to-break at (20 ± 3) s is the established way of producing data.

For metrological confirmation system of the tensile-testing machine, see ISO 10012 and for accuracy of the apparatus, see ISO 7500-1. The CRE machine shall have the general characteristics given in 6.1.1 to 6.1.4.

6.1.1 The tensile-testing machine shall be provided with means for indicating or recording the force applied to the test specimen in stretching it to rupture. 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.

6.1.2 If a class 2 tensile-testing machine according to ISO 7500-1 is used, this shall be stated in the test report.

6.1.3 If recording of force is obtained by means of data acquisition boards and software, the frequency of data collection shall be at least eight per second.

6.1.4 The machine shall be capable of a constant rate of extension of 300 mm/min, with an uncertainty of measurement of ±10 %.

6.2 Clamps and jaw faces, shall be positioned with the centre point of the two jaws in the line of applied force. The front edges shall be at right angles to the line of applied force and their clamping faces shall be in the same plane. The jaws shall be capable of holding the test specimen without allowing it to slip, so that they do not cut or otherwise weaken the test specimen.

The faces of the jaws shall be smooth, flat and metallic, or any other agreed upon gripping surface except when, even with packing, the test specimen cannot be held satisfactorily with flat-faced jaws. Then, engraved or corrugated jaws can be used to prevent slippage. Other auxiliary materials for use with either smooth or corrugated jaws to improve specimen gripping include paper, leather, plastics, or rubber.

The faces shall be parallel and have matching centres with respect to one another in the same clamp and to the corresponding jaw face of the other clamp.

For the grab test, the dimensional clamping area of the fabric shall be 25,0 mm ± 0,5 mm × 25,0 mm ± 0,5 mm. This area can be achieved by either 6.2.1 or 6.2.2.

6.2.1 One **clamp**, 25 mm × 40 mm minimum, preferably 50 mm, positioned with the wider direction of the clamp perpendicular to the line of application of the force; a second clamp of the same dimensions is positioned perpendicular to the first so that the wider direction of the clamp is parallel to the direction of application of the force.

6.2.2 One **clamp**, 25 mm × 40 mm minimum, preferably 50 mm, positioned with the wider direction of the clamp perpendicular to the line of application of the force; a second clamp, 25 mm × 25 mm.

6.3 Container, in which test specimens can be immersed in water preparatory to wet testing.

7 Sampling

7.1 Lot sampling

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

If provided in the customer specification, take random sample as directed. If no requirements are provided, use ISO 2859-1 or ISO 3951-1 and of themselves, these are not valid sampling plans by default.