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Textiles — Tensile properties of fabrics —

Part 2: Determination of maximum force using the grab method

Textiles — Propriétés des étoffes en traction —

Partie 2: Détermination de la force maximale par la méthode d'arrachement (Grab test)

Reference number
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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 documents 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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 38, *Textiles*, Subcommittee SC 24, *Conditioning atmospheres and physical tests for textile fabrics*.

This second edition cancels and replaces the first edition (ISO 13934-2: 1999), of which it constitutes a minor revision.

ISO 13934 consists of the following parts, under the general title *Textiles — Tensile properties of fabrics*:

— *Part 1: Determination of maximum force and elongation at maximum force using the strip method*

— *Part 2: Determination of maximum force using the grab method*

Introduction

This part of ISO 13934 has been prepared in the context of several test methods for determination of certain mechanical properties of textiles using mainly tensile testing machines, e.g. tensile properties, seam tensile properties, tear properties, and seam slippage. The procedure for these standards agrees where appropriate. The results obtained by one of the methods should not be compared with those obtained by the other methods.

Textiles — Tensile properties of fabrics —

Part 2:
Determination of maximum force using the grab method

1 Scope

This part of ISO 13934 specifies a procedure for the determination of the maximum force of textile fabrics known as the grab test.

NOTE ISO 13934-1 describes the method known as the strip test.

The method is mainly applicable to woven textile fabrics including fabrics which exhibit stretch characteristics imparted by the presence of an elastomeric fibre and mechanical or chemical treatment. It can be applicable to fabrics produced by other techniques. It is not normally applicable to geotextiles, nonwovens, coated fabrics, textile-glass woven fabrics, and fabrics made from carbon fibres or polyolefin tape yarns.

The method specifies the determination of the maximum force of test specimens in equilibrium with the standard atmosphere for testing and of test specimens in the wet state.

The method is restricted to the use of constant-rate-of-extension (CRE) testing machines.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 3696, *Water for analytical laboratory use — Specification and test methods*

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

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 document, the terms and definitions in ISO 13934 and the following apply.

3.1
constant-rate-of-extension (CRE) testing machine
tensile-testing machine provided with one clamp which is stationary and another clamp which moves with a constant speed throughout the test, the entire testing system being virtually free from deflection

[SOURCE: ISO 13934-1:2013, 3.1]

3.2
grab test
tensile test in which only the centre part of the test specimen is gripped in the jaws of the testing machine

3.3
maximum force
maximum force recorded when a test specimen is taken to rupture during a test under the specified conditions

[SOURCE: ISO 13934-1:2013, 3.11]

3.4
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.

[SOURCE: ISO 13934-1:2013, 3.3, modified — "under defined pretension" has been removed from the Note.]

4 Principle

A fabric 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.

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, the example of a suitable sampling procedure given in Annex A can be used.

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

6 Apparatus

6.1 CRE machine

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

The constant-rate-of-extension (CRE) machine shall have the general characteristics given in 6.1.1 to 6.1.6.

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 %.

6.1.2 If a class 2 tensile-testing machine according to ISO 7500-1 is to be 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 50 mm/min, with an accuracy of ±10 %.

6.1.5 The machine shall be capable of setting the gauge length to 100 mm or, if agreed, to 75 mm, to within ±1 mm.

6.1.6 The clamping device of the machine shall be positioned with the central 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 and designed so that they do not cut or otherwise weaken the test specimen.

The faces of the jaws shall be smooth and flat, except that when, even with packing, the test specimen cannot be held satisfactorily with flat-faced jaws, 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.

For the grab test, the dimensional clamping area of the fabric shall be 25 mm ± 1 mm × 25 mm ± 1 mm. This area can be achieved by either method a) or method b) described below and illustrated in Annex C.

a) 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 positioned perpendicular to the first so that the wider direction of the clamp is parallel to the direction of application of the force.

b) 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.

6.2 Equipment, for cutting test specimens.

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

6.4 Grade 3 water, in accordance with ISO 3696 for wetting test specimens.

6.5 Non-ionic wetting agent.

7 Atmosphere for conditioning and testing

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

It is recommended that samples be conditioned for at least 24 h in the relaxed state.

Preconditioning and conditioning are not required for tests in the wet condition.

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 (or in the machine and cross-machine directions, where applicable).

Each set shall consist of at least five test specimens, except that if a higher degree of precision is required, more test specimens shall be tested. In accordance with Clause 5 and Annex B, no test specimens shall be cut from within 150 mm of either edge of the laboratory sample. No test specimen taken from the warp direction shall contain the same longitudinal threads, and no test specimen taken from the weft direction shall contain the same picks.

8.2 Dimensions

The width of each test specimen shall be 100 mm ± 2 mm and its length shall be long enough to secure the gauge length of 100 mm.

8.3 Preparation of test specimens

On each test specimen, a line shall be drawn at a distance of 38 mm from one edge, parallel to either warp or weft threads or, where applicable, machine or cross-machine direction, running the full length of the test specimen.

8.4 Wet test specimens

8.4.1 General

When the maximum force of the wet fabric is required in addition to the maximum force when dry, test specimens of the appropriate width and at least twice as long as the test specimens required for a dry test shall be cut (see Annex B). Each end of each strip shall be numbered, and then each test specimen shall be cut crosswise into two parts, one for determining the dry maximum force and the other for determining the wet maximum force. This ensures that each pair of test specimens contains the same longitudinal yarns. For fabrics where it is suspected or known from previous experience that excessive shrinkage will occur when wet, the length of test specimens for the determination of wet maximum force shall be greater than that of test specimens for dry maximum force tests.

8.4.2 Wet test

For tests in the wet condition, immerse the test specimen for a period of 1 h in grade 3 water, in accordance with ISO 3696 at a temperature of 20 °C ± 2 °C. An aqueous solution containing not more than 1 g of a non-ionic wetting agent per litre can be used instead of water.

NOTE For tropical regions, the temperature according to ISO 139 can be applied.

9 Procedure

9.1 Gauge length

Set the gauge length of the tensile-testing machine to 100 mm or, if agreed, to 75 mm, to within ±1 mm.

9.2 Rate of extension

Set the rate of extension of the tensile-testing machine to 50 mm/min.

9.3 Mounting of test specimens

Clamp a test specimen centrally so that its longitudinal centre line passes through the centre point of the front edges of the jaws and becomes perpendicular to the edges of the jaws to have the line drawn on the test specimen coincide with one edge of the jaws.

After closing the upper jaw, avoid pretension when adjusting the specimen along the guide line in the lower jaw so that the fabric hangs under its own weight when the lower clamp is closed.

9.4 Operation

Engage the device for recording the maximum force. Put the movable clamp in motion and extend the test specimen to the point of rupture. Record the maximum force in newtons. Perform the test at least on five test specimens of each fabric direction.

Record any break which occurs within 5 mm of the clamping line of jaws and report the result as a jaw break. At the end of the five tests, examine the results obtained. If any of the jaw break results falls above the lowest "normal" break result, then it can be included. If any of the jaw break results falls below the lowest "normal" break result, then it shall be excluded and further tests should be carried out to obtain five "normal" breaks.

If all the results are jaw breaks, or if five "normal" breaks cannot be obtained, then the individual results shall be reported without the coefficient of variation or confidence limits. Jaw break results shall be indicated as such in the report, and the results discussed between the interested parties.

9.5 Tests on wet test specimens

Perform the test according to 9.1 to 9.4 immediately after removal of a test specimen from the liquid (see 8.4.2) and briefly placing it on blotting paper to remove excess water.

10 Calculation and expression of results

Calculate the arithmetic mean of the maximum force, in newtons, for each direction tested. Round the results for values

<100 N	to the nearest 1 N
≥100 N to <1 000 N	to the nearest 10 N
≥1 000 N	to the nearest 100 N

If required, calculate the coefficient of variation to the nearest 0,1 % and the 95 % confidence limits rounded to the same precision as the mean value.

11 Test report

The test report shall include the following information:

a) a reference to this part of ISO 13934 (i.e. ISO 13934-2) and the date of test;

b) the identification of the test sample and sampling procedure, if required;

c) the state of the test specimens (conditioned or wet);

d) the number of test specimens, including the number of tests rejected and reasons for this;

e) the gauge length, if not 100 mm;

f) any deviation from the given procedure;

g) the arithmetic mean of the maximum force, in newtons;

h) the coefficient of variation of the mean value, in percent, if required;

i) the 95 % confidence limits of the mean value, in newtons, if required.

Annex A
(informative)

Suggested procedure for sampling

A.1 **Bulk sample** (number of pieces from a shipment or lot)

The appropriate number of pieces should be taken at random from the shipment or lot as specified in Table A.1. No piece that shows signs of damage or dampness incurred during transit should be included in the sample.

Table A.1 — Bulk sample

Number of pieces in shipment or lot	Number of pieces in bulk sample minimum
3 or less	1
4 to 10	2
11 to 30	3
31 to 75	4
76 or more	5

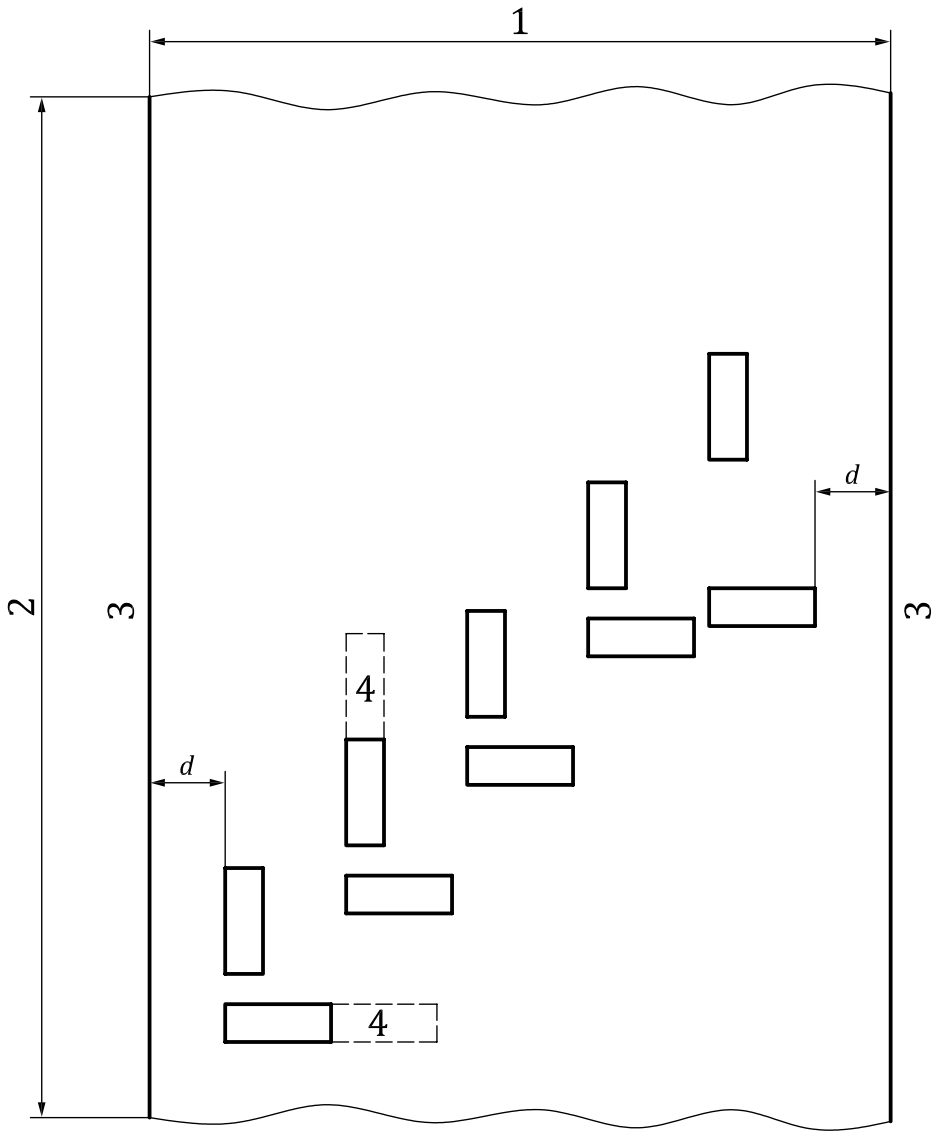
A.2 Number of laboratory samples

From each piece in the bulk sample, a laboratory sample of length at least 1 m and of full width should be cut (from a position taken at random but at least 3 m from an end of the piece). Areas that are creased or that have a visible fault should not be included in the sample.

Annex B
(informative)

Locations of test specimens cut from a laboratory sample

See Figure B.1.



Key

1 width of fabric
2 length of fabric
3 edge
4 additional length for wet tests, if required
d = 150 mm

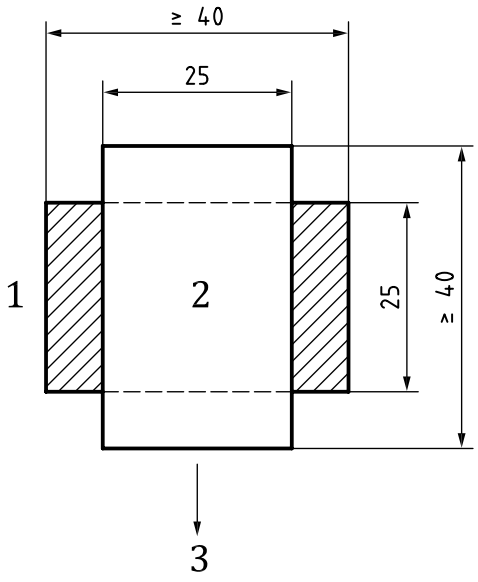
Figure B.1 — Locations of test specimens cut from a laboratory sample

Annex C
(informative)

Arrangements of jaws for the grab test

See Figure C.1.

Dimensions in millimetres



Key

1 back jaw face
2 front jaw face
3 direction of application of force

Figure C.1 — Arrangements of jaws for grab test

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[5] ISO 13935-1, *Textiles — Seam tensile properties of fabrics and made-up textile articles — Part 1: Determination of maximum force to seam rupture using the strip method*

[6] ISO 13935-2, *Textiles — Seam tensile properties of fabrics and made-up textile articles — Part 2: Determination of maximum force to seam rupture using the grab method*

[7] ISO 13934-1:2013, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*

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