
**Textiles — Seam tensile properties of
fabrics and made-up textile articles —**

**Part 1:
Determination of maximum force to
seam rupture using the strip method**

*Textiles — Propriétés de résistance à la traction des coutures d'étoffes
et d'articles textiles confectionnés —*

*Partie 1: Détermination de la force maximale avant rupture des
coutures par la méthode sur bande*





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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.

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. 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 13935-1:1999), of which it constitutes a minor revision.

ISO 13935 consists of the following parts, under the general title *Textiles — Seam tensile properties of fabrics and made-up textile articles*:

- *Part 1: Determination of maximum force to seam rupture using the strip method*
- *Part 2: Determination of maximum force to seam rupture using the grab method*

Introduction

This part of ISO 13935 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, 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. See Bibliography for informative references.

Where it is intended to compare the seam maximum force values of sewn seams with the fabric maximum force, it is important to use the same type of test, test conditions and test specimens in the tests in this part of ISO 13935 and ISO 13934-1 (see Bibliography).

Textiles — Seam tensile properties of fabrics and made-up textile articles —

Part 1:

Determination of maximum force to seam rupture using the strip method

1 Scope

This part of ISO 13935 specifies a procedure to determine the seam maximum force of sewn seams when the force is applied perpendicularly to the seam. This part of ISO 13935 specifies the method known as the strip test.

NOTE ISO 13935-2 describes the method known as the grab test. For informative references see the Bibliography.

The method is mainly applicable to woven textile fabrics, including fabrics which exhibit stretch characteristics imparted by the presence of an elastomeric fibre, 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 (see Bibliography).

The sewn fabrics may be obtained from previously sewn articles or may be prepared from fabric samples, as agreed by the parties interested in the results.

This method is applicable to straight seams only and not to curved seams.

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 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, *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.

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]

3.2

Strip test

tensile test in which the full width of the test specimen is gripped in the jaws of the testing machine

[SOURCE: ISO 13934-1:2013]

3.3

maximum force to seam rupture

maximum force recorded when a test specimen with a seam perpendicular to the direction of extension is taken to seam rupture during a tensile test under the specified conditions

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 under defined pretension with carbon copy paper to produce a gripping pattern on the test specimen and/or the jaw faces

[SOURCE: ISO 13934-1:2013]

4 Principle

A fabric test specimen of specified dimensions having a seam in the middle is extended perpendicularly to the seam at a constant rate until the seam ruptures. The maximum force to seam rupture 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.

If preparation of seams prior to testing is required, avoid test specimens from folded or creased areas, selvages and areas not representative of the fabric.

For seams obtained from previously sewn articles ensure that the test specimens contain seams in straight line only and are representative for the relevant seam type of the textile article. Record any details in the test report.

6 Apparatus

6.1 CRE machine

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

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 $\pm 1\%$.

6.1.2 If a class 2 tensile testing machine according to EN 10002-2 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 constant rate of extension of 100 mm/min, with an accuracy of 10 %.

6.1.5 The machine shall be capable of setting the gauge length to (200 ± 1) mm.

6.1.6 The clamping device of the machine shall be positioned with the centre 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.

It is recommended that serrated metal faced jaws are used when testing fabrics with stretch properties. Different jaw face surfaces may lead to different elongation results

NOTE If jaw breaks or slippage cannot be prevented with flat jaws, capstan jaws have often been found suitable.

The jaws preferably should have a width of at least 60 mm but shall not be less than the width of the test specimen.

6.2 Equipment for sewing defined seams.

6.3 Equipment for cutting test specimens and for fraying them to obtain the required width.

7 Atmosphere for conditioning and testing

The atmospheres 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.

8 Preparation of seams and of test specimens

8.1 Preparation of seams, if required, before testing

Where the seams are to be prepared for testing, the interested parties shall agree on the conditions of sewing, including type of sewing threads, type of needle, type of seam, seam allowance and number of stitches per unit length.

The sewing machine shall be adjusted to give the correct conditions, using a spare piece of the fabric for testing. Cut a sample of the fabric 350 mm by at least 700 mm. Fold the sample in half with the fold parallel to the longer dimension, make the agreed seam in this direction, and cut to give the agreed seam allowance. Seams may be sewn for testing parallel to the warp or weft direction, or both, as agreed between the interested parties.

8.2 Dimensions and preparation of test specimens

From each laboratory sample with seams cut a set of at least five test specimens of width 100 mm, as shown in [Figure 1](#).

When using seams prepared as described in [8.1](#), do not cut samples within 100 mm of either end of the prepared seam (see [Figure 1](#)).

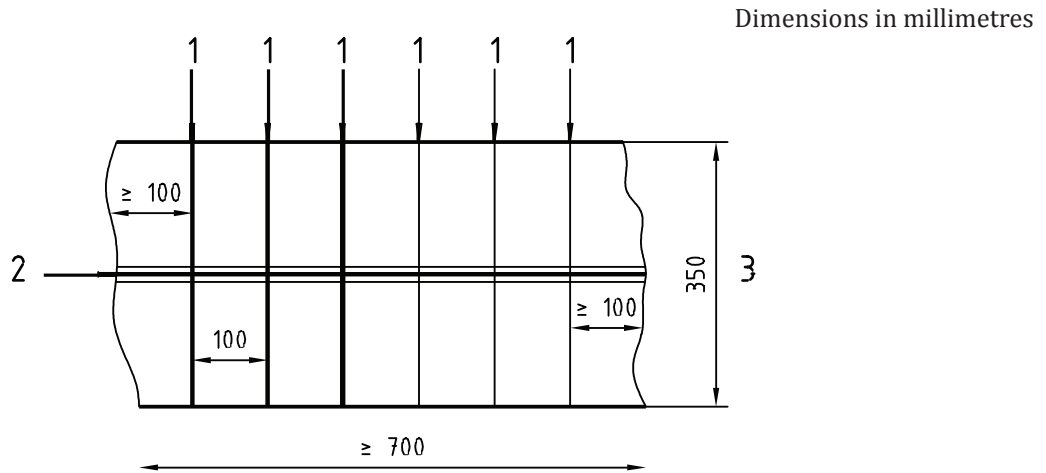
Make four cuts of 25 mm length at 10 mm distance from the seam as shown in [Figure 2](#). Fray down the area shown as shaded in [Figure 2](#), so that an effective sample width of 50 mm is obtained. In the area

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within 10 mm of the seam, the full width of 100 mm is maintained and the sample shape when ready for testing is as shown in Figure 3.

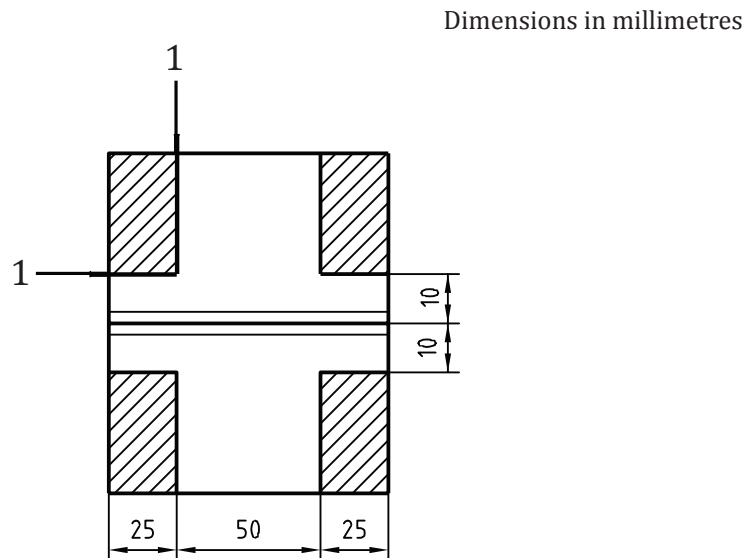
NOTE For many fabrics the width of 25 mm of the fringed area can be reduced by careful cutting before fraying.

For fabrics which cannot be frayed in this manner alternatively cut test specimens to the size required, taking care that no part of the effective test specimen size is cut.



- Key**
- 1 Cut
 - 2 Seam
 - 3 Length before seaming

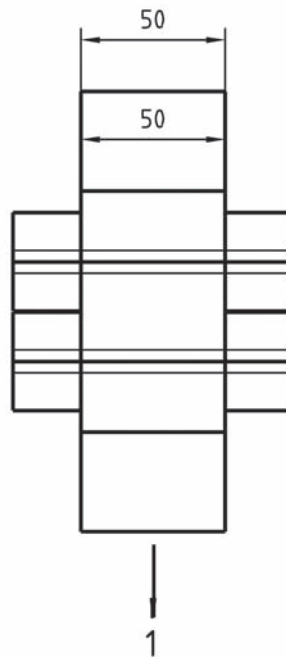
Figure 1 — Laboratory sample with seams and indication of test specimens



- Key**
- 1 Cut

Figure 2 — Test specimen: shaded areas to be frayed down

Dimensions in millimetres

**Key**

1 Direction of application of force

Figure 3 — Test specimen ready for testing**9 Procedure****9.1 Gauge length**

Set the gauge length of the tensile-testing machine to $200 \text{ mm} \pm 1 \text{ mm}$.

9.2 Rate of extension

Set the rate of extension of the tensile-testing machine to 100 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 the force is applied perpendicularly to the seam in the middle of the gauge length.

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

9.4 Operation

Engage any 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 and whether the rupture is caused by

- a) fabric tear;
- b) fabric tear at the jaws;

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- c) fabric tear at the seam;
- d) breakage of sewing threads;
- e) thread pull-out; or
- f) any combination of these.

If rupture occurs by a) or b), these results shall be excluded and further tests shall be carried out to enable five seam ruptures to be obtained.

If all breaks are fabric tear or fabric tear at the jaws, report the individual results without coefficient of variation or confidence limits. The results shall be indicated as fabric or jaw breaks in the test report [see [Clause 11 j](#)] and the results discussed between the interested parties.

10 Calculation and expression of results

For seams which ruptured as described in c) to f) of [9.4](#) calculate the arithmetic mean of the seam maximum force, in newtons, for each direction tested.

Round the result for values:

- < 100 N to the nearest 1 N;
- ≥ 100 N to < 1000 N to the nearest 10 N;
- ≥ 1000 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 13935 and the date of test;
- b) identification of test sample and sampling procedure, if required;
- c) seam information (see [8.1](#));
- d) number of test specimens, including the number of tests rejected and reasons for this;
- e) observation of seam rupture (see [9.4](#));
- f) any deviation from the given procedure;
- g) arithmetic mean of the seam maximum force, in newtons;
- h) if required, the coefficient of variation of the mean value, in percent;
- i) if required, the 95 % confidence limits of the mean value, in newtons;
- j) in the case of fabric tear or fabric tear at the jaws, the individual results (see [9.4](#)).

Bibliography

- [1] ISO 13934-1, *Textiles — Tensile properties of fabrics — Part 1: Determination of maximum force and elongation at maximum force using the strip method*
- [2] ISO 13934-2, *Textiles — Tensile properties of fabrics — Part 2: Determination of maximum force using the grab method*
- [3] 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*
- [4] EN 10002-2, *Metallic materials — Tensile testing — Part 2: Verification of the force measuring system of the tensile testing machines*

