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Standard**

ISO 10319

Geosynthetics — Wide-width tensile test

Géosynthétiques — Essai de traction des bandes larges

**Fourth edition
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Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principle	5
5 Reagents	5
6 Apparatus	5
7 Conditioning atmosphere	12
7.1 General	12
7.2 Conditioning for testing in wet condition	13
7.3 Conditioning for testing at lower or higher temperatures	13
8 Test procedure	13
8.1 Setting up the tensile testing machine	13
8.2 Insertion of the test specimen in the jaws	13
8.3 Installation of the extensometer	13
8.4 Measurement of tensile properties	13
8.5 Measurement of strain	14
9 Calculations	14
9.1 Strain	14
9.2 Tensile strength	15
9.3 Tensile strain at maximum tensile force	16
9.4 Tensile strain at nominal tensile strength	16
9.5 Secant tensile stiffness	16
10 Test report	16
Annex A (normative) Procedure for tests at low and elevated temperatures	18

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 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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This document was prepared by Technical Committee ISO/TC 221, *Geosynthetics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 189, *Geosynthetics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 10319:2015), which has been technically revised.

The main changes are as follows:

- the term “load” changed to “force” in all instances;
- difference between strain and elongation clarified in [Clause 3](#) and [Figure 1](#) modified accordingly;
- difference between tensile strength at first and second peak clarified in [Clause 3](#) and [9.2](#);
- illustration of suitable jaws and grips introduced in [Figure 3](#);
- testing of metallic products limited to woven steel wire meshes in [6.4.6](#);
- testing products narrower than 200 mm introduced in [6.4.7](#);
- testing at lower or higher temperatures introduced, with the related conditioning in [7.3](#) and the related procedure added in [Annex A](#);
- formulae for strain calculation introduced in [9.1](#);
- formulae for tensile strength of products narrower than 200 mm introduced in [9.2](#);
- test report requirements updated in [Clause 10](#).

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.

Geosynthetics — Wide-width tensile test

1 Scope

This document specifies an index test method for the determination of the tensile properties of geosynthetics (polymeric, glass and metallic), using a wide-width strip. This document is applicable to most geosynthetics, including woven geotextiles, nonwoven geotextiles, geocomposites, knitted geotextiles, geonets, geomats and metallic products. It is also applicable to geogrids and similar open-structure geotextiles, but specimen dimensions will possibly need to be altered. It is not applicable to polymeric or bituminous geosynthetic barriers, but it is applicable to clay geosynthetic barriers.

This document specifies a tensile test method that covers the measurement of tensile force, elongation characteristics and includes procedures for the calculation of secant stiffness, maximum load per unit width and strain at maximum force. Singular points on the tensile force-extension curve are also indicated.

Procedures for measuring the tensile properties of both conditioned and wet specimens are included in this document.

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 554, *Standard atmospheres for conditioning and/or testing — Specifications*

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

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 9862, *Geosynthetics — Sampling and preparation of test specimens*

ISO 9863-1, *Geosynthetics — Determination of thickness at specified pressures — Part 1: Single layers*

ISO 10318-1, *Geosynthetics — Part 1: Terms and definitions*

ISO 10321, *Geosynthetics — Tensile test for joints/seams by wide-width strip method*

EN 10223-3, *Steel wire and wire products for fencing and netting — Part 3: Hexagonal steel wire mesh products for civil engineering purposes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10318-1 and the following 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 nominal gauge length

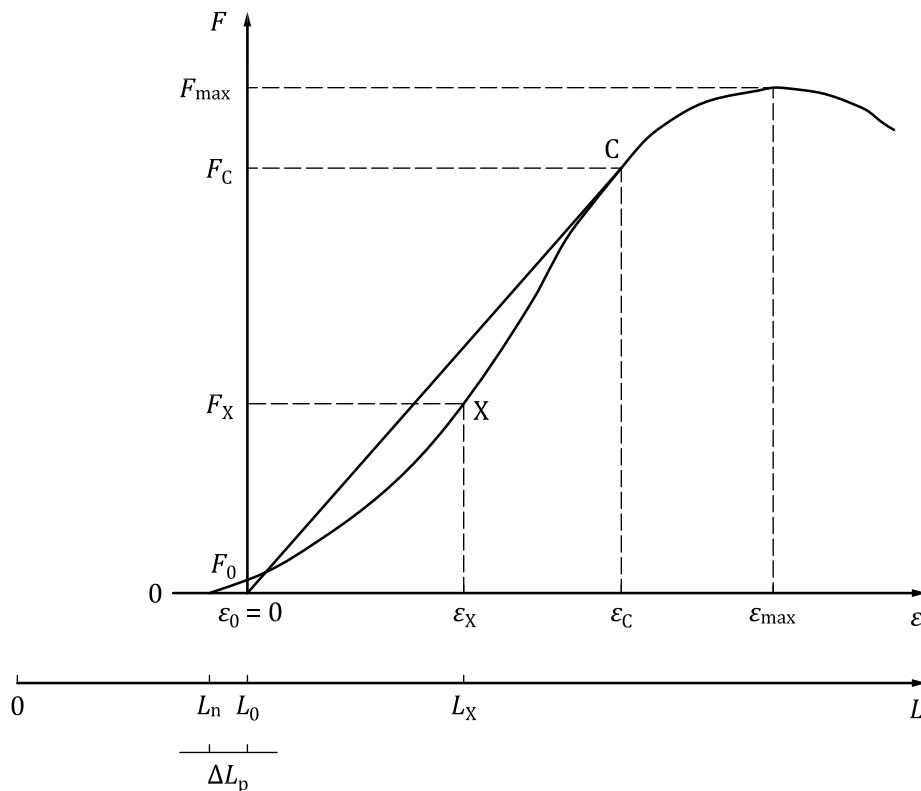
L_n
initial distance between two reference points located on the specimen parallel to the applied force direction

Note 1 to entry: The nominal gauge length is normally 60 mm (30 mm on either side of the specimen symmetrical centre).

3.2 elongation at pre-tension force

ΔL_p
measured increase in gauge length (mm) corresponding to an applied pre-tension force of 1 % of the expected *maximum tensile force* (3.4)

Note 1 to entry: The elongation at pre-tension force is indicated in [Figure 1](#).



Key

F	tensile force, in kN
$F_{\max}$	maximum tensile force, in kN
F_0	pre-tension force, in kN
F_c	tensile force for secant stiffness calculation at point C
F_x	tensile force at strain ϵ_x
C	selected point for the stiffness calculation
ϵ	tensile strain, in per cent
ϵ_0	tensile strain at pre-tension force set as the origin of the abscissa, in per cent
$\epsilon_{\max}$	tensile strain at maximum tensile force, in per cent
ϵ_x	tensile strain corresponding to the generic length L_x , in per cent
ϵ_c	tensile strain for secant stiffness calculation at point C, in per cent
L	length, equal to the distance between the two reference points measured during the test, in mm
L_n	nominal gauge length, in mm

L_0	true gauge length, in mm
L_x	generic length measured during the test, in mm
ΔL_p	elongation at pre-tension force, in mm

Figure 1 — Typical tensile force–strain curve

3.3 true gauge length

L_0
nominal gauge length (3.1) in millimetres plus the elongation at pre-tension force (3.2) in millimetres

3.4 maximum tensile force

$F_{\max}$
maximum value obtained during a test

Note 1 to entry: The maximum tensile force is expressed in kilonewtons (kN).

3.5 tensile strain

ε
increase in true gauge length (3.3) of a specimen during a test divided by true gauge length

Note 1 to entry: Tensile strain is expressed as a percentage of the true gauge length.

3.6 tensile strain at maximum tensile force

$\varepsilon_{\max}$
tensile strain (3.5) exhibited by the specimen under maximum tensile force (3.4)

Note 1 to entry: Tensile strain at maximum tensile force is expressed in per cent.

3.7 tensile strain at nominal tensile strength

ε_{nom}
value at the nominal tensile strength (3.9) as defined by the manufacturer

3.8 secant tensile stiffness

J
ratio of tensile force per unit width to an associated value of strain

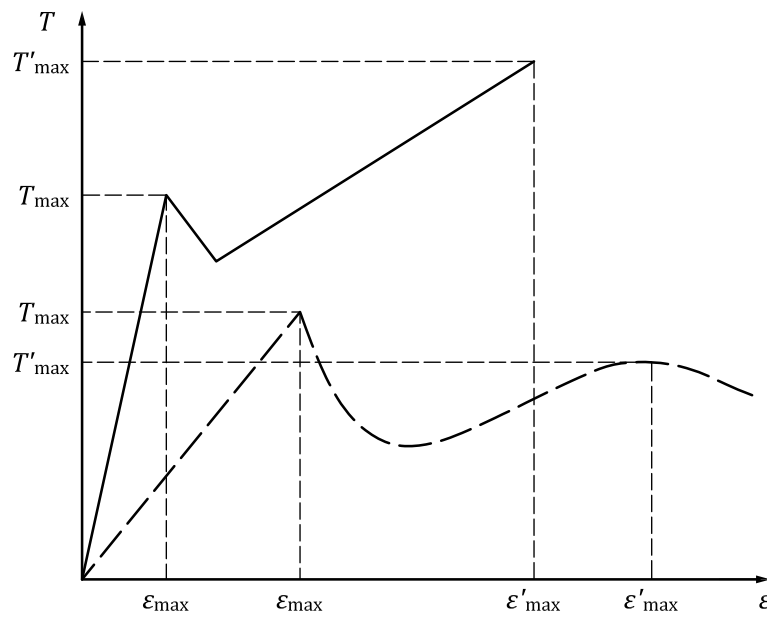
Note 1 to entry: Secant tensile stiffness is expressed in kilonewtons per metre (kN/m).

3.9 tensile strength

$T_{\max}$
maximum force per unit width observed during a test in which the specimen is stretched to rupture

Note 1 to entry: Tensile strength is expressed in kilonewtons per metre (kN/m).

Note 2 to entry: For products exhibiting a second peak on the tensile force per unit width-strain curves, the tensile strength is defined as the highest value between the two peaks, as shown in Figure 2.

**Key**

$T_{\max}$	tensile strength at first peak, in kN/m
$\epsilon_{\max}$	tensile strain at first peak, in per cent
$T'_{\max}$	tensile strength at second peak (kN/m)
$\epsilon'_{\max}$	tensile strain at second peak, in per cent

Figure 2 — Typical tensile force per unit width-strain curves of two geosynthetics showing a second peak

3.10**strain rate**

strain at maximum force, divided by the duration of the test, i.e. the time to attainment of *maximum tensile force* (3.4) from pre-tension force

Note 1 to entry: Strain rate is expressed in percentage per minute.

3.11**tensile strength at second peak**

$T'_{\max}$
maximum force per unit width observed during a test in which the specimen is stretched to rupture, at the second peak observed on the tensile force per unit width-strain curve, occurring at a higher strain than that corresponding to the first peak

Note 1 to entry: Tensile strength at second peak is expressed in kilonewtons per metre (kN/m).

3.12**tensile strain at second peak**

$\epsilon'_{\max}$
tensile strain (3.5) exhibited by the specimen at the second peak observed on the tensile force per unit width-strain curve, occurring at a higher strain than that corresponding to the first peak

Note 1 to entry: Tensile strain at second peak is expressed in per cent.

3.13**pre-tension force**

F_0
tensile force equal to 1 % of the expected *maximum tensile force* (3.4), applied at the beginning of the test

Note 1 to entry: The pre-tension force is expressed in kilonewtons (kN).