International Standard

ISO 13426-2

Second edition
2024-06

Geotextiles and geotextile-related products — Strength of internal structural junctions —

Part 2: Geocomposites

Géotextiles et produits apparentés — Résistance des liaisons de structures internes —

Partie 2: Géocomposites

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Foreword

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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, *Geotextiles and geotextile-related 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 13426-2:2005), which has been technically revised.

The main changes are as follows:

— In Clause 9, the calculation of the junction strength for tests with multiple peaks has been modified.

A list of all parts in the ISO 13426 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.

Geotextiles and geotextile-related products — Strength of internal structural junctions —

Part 2: Geocomposites

1 Scope

This document describes index tests for determining the strength of the internal structural junctions under different loading conditions of all geocomposites and of clay geosynthetic barriers.

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

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
failure
point at which a geosynthetic ceases to be functionally capable of its intended use

Note 1 to entry: A material can be considered to have failed without rupture.

3.2
geocomposite
manufactured, assembled material using at least one geosynthetic product among the components, used in contact with soil and/or other materials in geotechnical and civil engineering applications

3.3
junction
point or line where two of the geosynthetics components are connected

3.4
junction strength
peak load attained during the test, reported to the unit width of the product

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

3.5
peel test
tensile test where two components of a *geocomposite* (3.2) are separately clamped and one component is peeled away from the other

3.6
rupture
breaking or tearing apart of a geosynthetic

3.7
shear test
tensile test where two components of a *geocomposite* (3.2) are separately clamped and the *failure* (3.1) occurs along the plane of the product

4 Principle

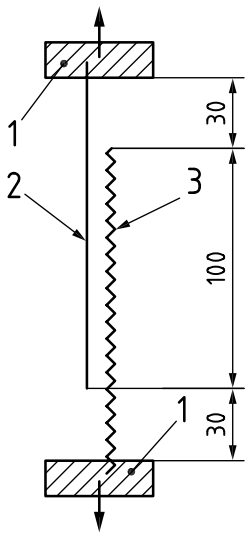
Specimens are tested to measure the resistance of the junctions to different states of stress.

The tests performed for geocomposites are as follows:

— **Method A (shear test):** After cutting a test specimen of wide width, one of the two geosynthetics making the junction is delaminated from the other for a certain length at each opposed edge, enough to ensure a good clamping (see Figure 1). The delaminated portion is mounted in a clamp of a tensile testing machine, while the other geosynthetic at the opposite edge of the specimen is mounted in the other clamp. The delaminated portion that is not inserted in the clamp shall not interfere with the clamp during the test, and it shall be cut in case it cannot be bent. The specimen is tested at a constant rate of extension, until shear failure of the junction or tensile failure of one of the geosynthetics occurs. The corresponding tensile shear resistance is measured and recorded.

— **Method B (peel test):** After cutting a test specimen of wide width, one of the two geosynthetics making the junction is delaminated from the other for a certain length at one edge, enough to ensure a good clamping (see Figure 2). The delaminated portions of the two geosynthetics are each mounted in one clamp of a tensile testing machine. The specimen is tested at a constant rate of extension, until failure occurs. The corresponding peeling resistance is measured and recorded.

Dimensions in millimetres

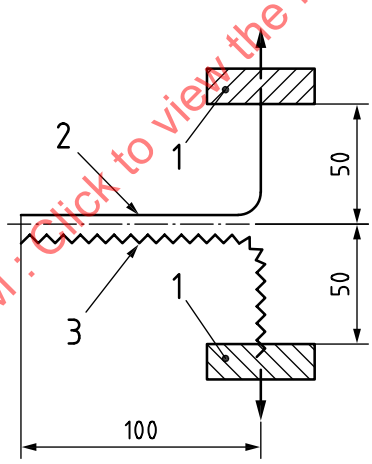


Key

1 clamp
2 first geosynthetic component
3 second geosynthetic component

Figure 1 — Clamping of test specimen in a shear test

Dimensions in millimetres



Key

1 clamp
2 first geosynthetic component
3 second geosynthetic component

Figure 2 — Clamping of test specimen in a peel test

5 Conditioning atmosphere

The test specimens shall be conditioned in the standard atmosphere for testing at (20 ± 2) °C and (65 ± 5) % relative humidity, as defined in ISO 554.

The specimens are considered to be conditioned when the change in mass in successive weighings made at intervals of not less than 2 h does not exceed 0,25 % of the mass of the test specimen.

Conditioning and/or testing in a standard atmosphere may only be omitted when it can be shown that results obtained for the same specific type of product (both structure and polymer type) are not affected by changes in temperature and humidity exceeding these limits. This information shall be included in the test report.

6 Test specimen

6.1 Number

Five specimens shall be tested for each product for each of the machine and cross-machine directions and for each structural junction (if the geocomposite is made up of three or more different layers of either geosynthetics or mineral materials, or both).

6.2 Sampling

Take specimens in accordance with ISO 9862.

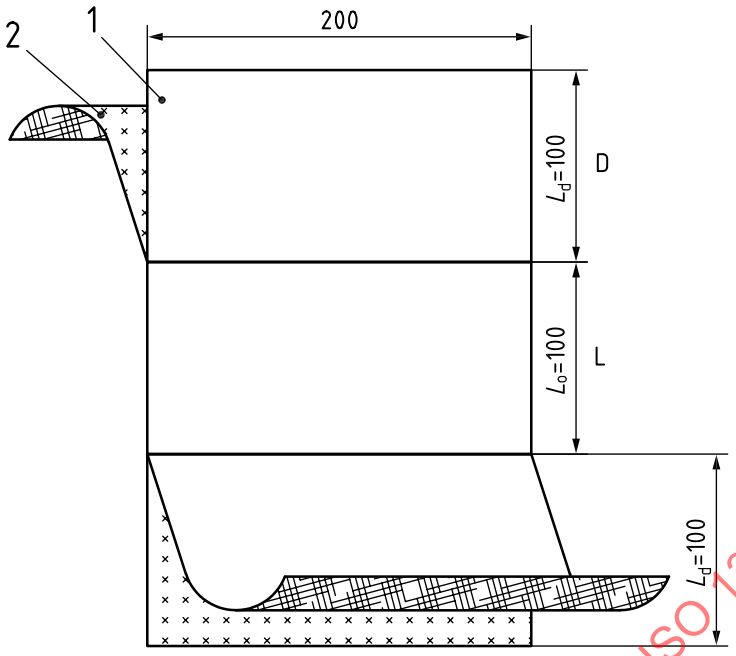
6.3 Dimension

Cut specimens according to the shapes and dimensions shown in Figures 3 and 4, respectively for Method A or Method B.

To monitor slippage and to make sure the applied force remains parallel to the longitudinal axis of the specimen, draw two lines on the full width of the test specimen. These lines shall be parallel to each other, perpendicular to the test direction and at equal distances from the edges of the specimen. Their distance from each other shall be (155 ± 2) mm for Method A and (95 ± 2) mm for Method B.

For specimens having discrete structural junctions (i.e. welded points, stitching), it may be necessary to increase the dimensions of the test specimen to include at least one complete junction. Care shall be taken, when delaminating one geosynthetic from the other, not to change or reduce the characteristics of the junction.

Dimensions in millimetres

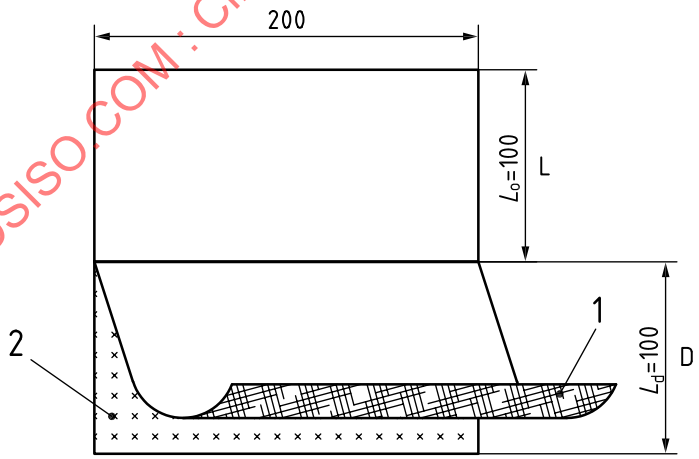


Key

1	first geosynthetic component	D	delaminated part
2	second geosynthetic component	L_o	length of the laminated part
L	laminated part	L_d	length of the delaminated part

Figure 3 — Dimensions of a shear test specimen

Dimensions in millimetres



Key

1	first geosynthetic component	D	delaminated part
2	second geosynthetic component	L_o	length of the laminated part
L	laminated part	L_d	length of the delaminated part

Figure 4 — Dimensions of a peel test specimen

7 Apparatus

7.1 Tensile testing machine

A tensile testing machine with a constant rate of extension, in accordance with ISO 7500-1, in which the rate of increase of specimen length is uniform with time, fitted with jaws which are sufficiently wide to hold the entire width of the specimen and equipped with appropriate means to limit slippage or damage.

7.2 Clamps

Compressive jaws should be used for most materials, but for materials where the use of these grips gives rise to excessive jaw breaks or slippage, capstan grips may also be used. It is essential to choose jaw faces that limit slippage of the test specimen, especially in the case of high-strength geotextiles.

8 Test procedure

8.1 Setting up the machine

Adjust the distance between the jaws at the start of the test to obtain the required test specimen length of ± 3 mm.

Select the force range of the testing machine such that rupture occurs between 10 % and 90 % of full-scale force.

Set the machine to the required speed of (100 ± 5) mm/min.

If capstan grips are used, the distance between the centres of the capstan grips is used as a reference. The distance between the centres of the capstans at the beginning of each test shall, as far as possible, be kept equal to 160 mm for a shear test and 100 mm for a peel test. The use of capstan grips shall be recorded in the test report.

8.2 Insertion of test specimen in the jaws

Mount the test specimen (Method A or Method B) centrally in the jaws.

Take care that the specimen length is parallel to the direction of the applied force by positioning the drawn lines described in 6.3, parallel and as close as possible to the inside edges of the jaws.

8.3 Procedure — Shear and peel tests

Start the tensile machine and continue until the specimen fails or ruptures or until a total run distance of 100 mm for the shear test and of 200 mm for the peel test is reached. Record the force-displacement plot (see Figure 5). The mode of failure shall also be recorded for each specimen (either peel or shear or break of one or two of the geosynthetics).

The decision to discard a test result shall be based on observation of the specimen during the test and on the inherent variability of the geosynthetic. In the absence of other criteria for rejecting jaw breaks, any rupture occurring within 5 mm of the jaws, which results in a value below 50 % of the average breaking strength, shall be discarded. No other results shall be discarded, unless the test is known to be faulty.

It is difficult to determine the precise reason why certain specimens break near the edge of the jaws. If a jaws break is caused by damage to the test specimen by the jaws, the result should be discarded. If, however, it is merely due to randomly distributed weaknesses in the test specimen, it is a legitimate result. In some cases, it may also be caused by a concentration of stress in the area adjacent to the jaws, because they prevent the test specimen from contracting in width as the load is applied. In these cases, a break near the edge of the jaws is inevitable and shall be accepted as a characteristic of the particular method of test.

Monitoring of slippage in the jaws shall be done by checking the position of the two lines described in 6.3 during the duration of the test.

Special procedures are required for the testing of specimens made from specific materials (e.g. glass fibre, carbon fibre) to minimize any damage that may be caused by the jaws. If a test specimen slips in the jaws, or if more than one quarter of the specimens breaks at a point within 5 mm of the edge of the jaw, then:

a) the jaws may be padded;

b) the test specimen may be coated under the jaw face area; or

c) the jaw face may be modified.

If any of the modifications listed above are used, the method of modification shall be stated in the test report.

9 Calculations

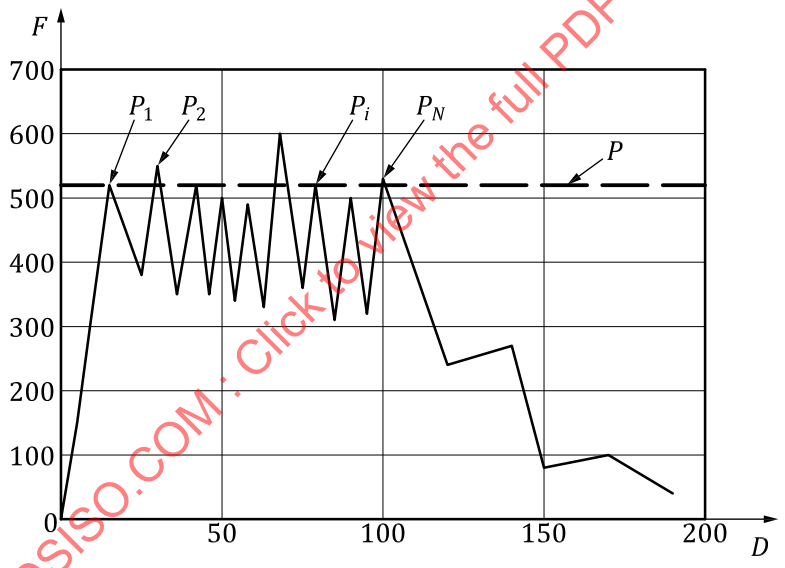
For both the shear and peel tests, the force-displacement plot of a specimen can show one of the following types of behaviour:

— multiple peak shear or peel strength (Figure 5);

— delamination (Figure 6);

— single peak shear or peel strength (Figure 7);

— tensile failure (Figure 8).



Key

D displacement

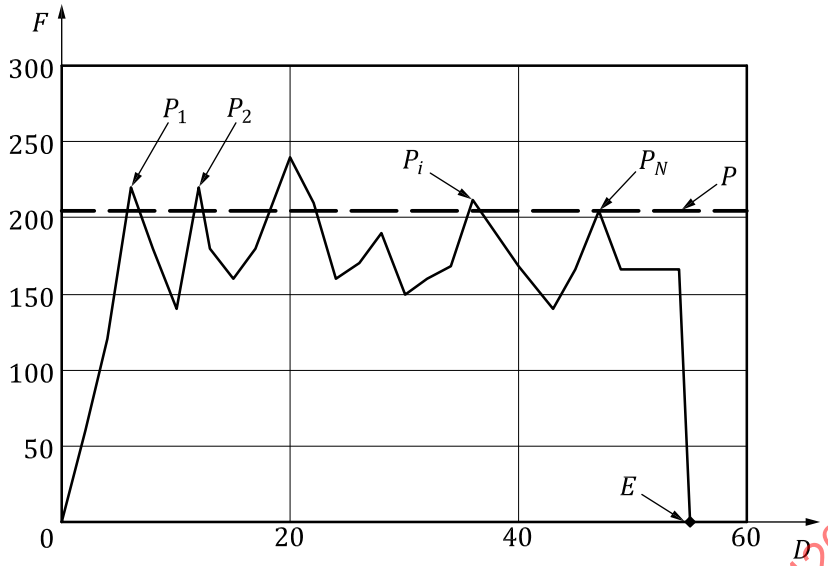
F force

P_i point of peak force

P average value of the P_i points of peak force

P_N peak force measured at the last measured peak before the end of the test or before failure

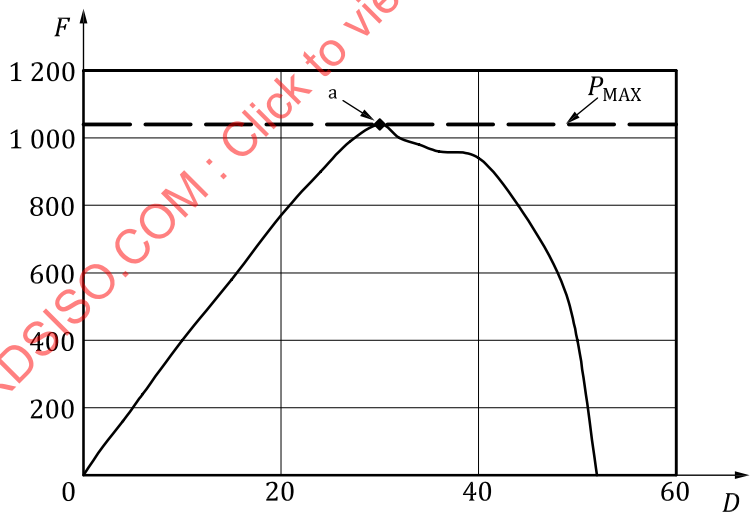
Figure 5 — Typical saw-tooth behaviour: the force F_{peel} or F_{shear} is the average P value



Key

D displacement
F force
E end of delamination test
P_i peak force measured at peak i
P average value of the P_i points of peak force
P_N peak force measured at the last measured peak before the end of the test or before failure

Figure 6 — Typical multipeak delamination behaviour: the force F_{peel} or F_{shear} is the average P value



Key

D displacement
F force
P_{MAX} force measured at point a
a Point of peak force.

Figure 7 — Typical single peak behaviour: the force F_{peel} or F_{shear} is P_{MAX}