INTERNATIONAL STANDARD

**ISO 13426-2**

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# 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

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.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13426-2 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 189, *Geosynthetics*, in collaboration with Technical Committee ISO/TC 221, *Geosynthetics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

ISO 13426 consists of the following parts, under the general title *Geotextiles and geotextile-related products — Strength of internal structural junctions*:

— *Part 1: Geocells*

— *Part 2: Geocomposites*

— *Part 3: Geogrids*

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

# Part 2:
# Geocomposites

## 1 Scope

This part of ISO 13426 describes index tests for determining the strength of the internal structural junctions of all geocomposites and of clay geosynthetic barriers.

## 2 Normative references

The following referenced documents are indispensable for the application 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 9862, *Geosynthetics — Sampling and preparation of test specimens*

ISO 10318, *Geosynthetics — Terms and definitions*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10318 and the following apply.

**3.1**
**failure**
point at which a geosynthetic ceases to be functionally capable of its intended use

NOTE A material may 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 The junction strength is expressed in kilonewtons per metre (kN/m).

**3.5**
**peel test**
tensile test where two components of a geocomposite 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 are separately clamped and the failure occurs along the plane of the product

# 4 Principle

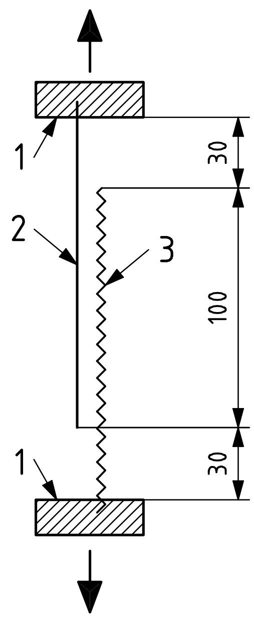
Specimens are tested to measure the resistance of the junctions to different states of stress.

The tests performed for geocomposites are as follows:

— Shear test (Test A — Figure 1): 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. 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 specimen is tested at a constant rate of strain, until shear failure of the junction or tensile failure of one of the geosynthetics occurs. The corresponding tensile shear resistance is measured and recorded.

— Peel test (Test B — Figure 2): After cutting a 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. The delaminated portions of the two geosynthetics are each mounted in one clamp of a tensile testing machine. The specimen is tested until failure occurs. The corresponding peeling resistance is measured and recorded.

Dimensions in millimetres




**Key**

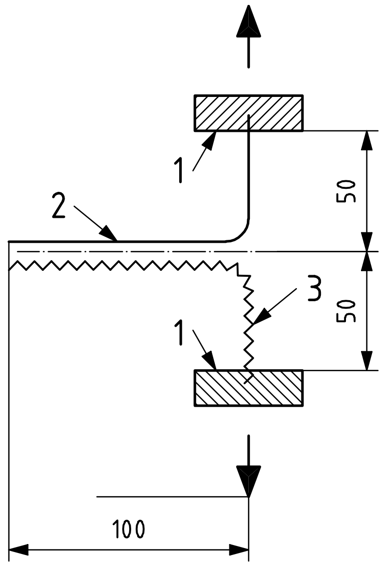
1 clamp

2 first geosynthetic component

3 second geosynthetic component

**Figure 1 — Shear test**

Dimensions in millimetres




**Key**

1 clamp

2 first geosynthetic component

3 second geosynthetic component

**Figure 2 — 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 can be 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 Number of specimens to be tested

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 geosynthetics and/or mineral materials).

## 7 Test specimens

### 7.1 Selection of test specimens

Take specimens in accordance with ISO 9862.

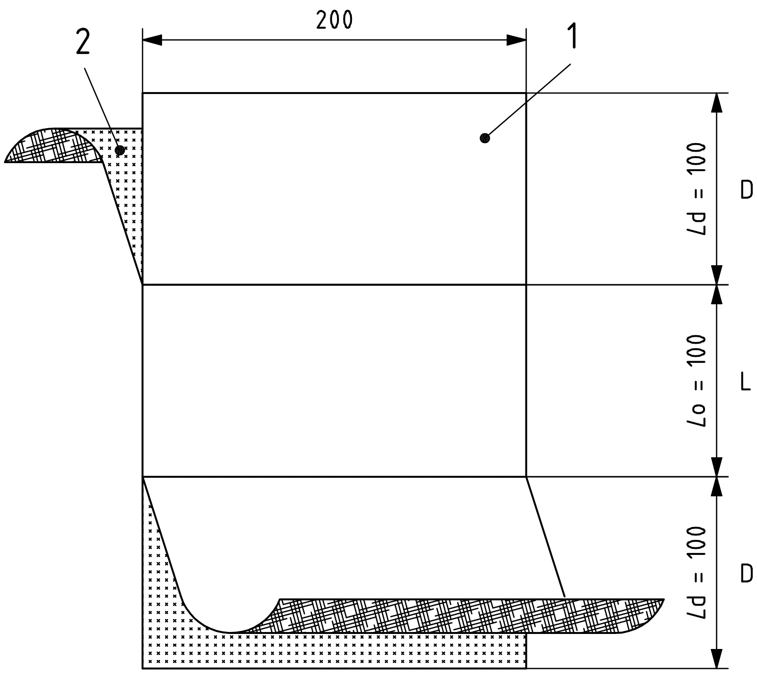
### 7.2 Dimension of test specimens

Cut specimens according to the shapes and dimensions shown in Figures 3 and 4, respectively for Tests A or 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 Test A and (95 ± 2) mm for Test 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

2 second geosynthetic component

L is the laminated part

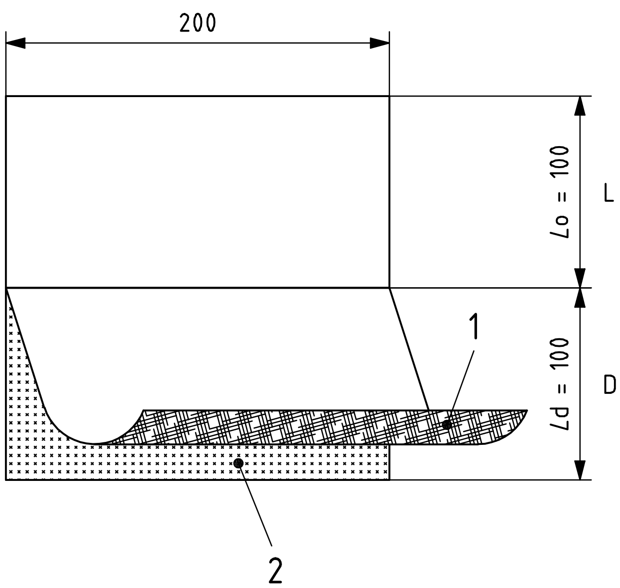
D is the delaminated part

*L*o is the length of the laminated part

*L*d is the length of the delaminated part

**Figure 3 — Shear test specimen**

Dimensions in millimetres




**Key**

1 first geosynthetic component

2 second geosynthetic component

L is the laminated part

D is the delaminated part

*L*o is the length of the laminated part

*L*d is the length of the delaminated part

**Figure 4 — Peel test specimen**

# 8 Apparatus

## 8.1 Tensile testing machine

This is 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.

## 8.2 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.

# 9 Test procedure

## 9.1 Setting up the machine

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

## 9.2 Insertion of test specimen in the jaws

Mount the test speciment (Test A or Test B type) centrally in the jaws.

Take care that the specimen length is parallel to the direction of the applied force by positioning the drawn lines (see 7.2) parallel and as close as possible to the inside edges of the jaws.

## 9.3 Measurement of tensile properties

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-deformation 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 should be accepted as a characteristic of the particular method of 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 should be stated in the test report.

## 10 Calculations

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

— multiple peaks (Figure 5);

— delamination (Figure 6);

— single peak (Figure 7);

— tensile failure (Figure 8).

The force $F_{peel}$ or $F_{shear}$ for each specimen is determined directly from the force-deformation plot. The procedure is graphically demonstrated in Figures 5 to 8.

Determine the $F_{peel}$ or $F_{shear}$ values for all specimens.

Calculate the mean value $\bar{F}_{shear}$ or $\bar{F}_{peel}$ of the $F_{peel}$ or $F_{shear}$ values.

Calculate the junction strength per unit width $T_{peel}$ or $T_{shear}$ (in kN/m):

$$T_{shear} = F_{shear}/b_{shear} \quad (1)$$

$$T_{peel} = F_{peel}/b_{peel} \quad (2)$$

where $b_{peel}$, $b_{shear}$ are the specimen widths, in metres, for peel and shear tests.

For products with discrete junctions (example stitching every 300 mm), the following equations shall be used:

$$T_{shear} = F_{shear} \times N_j/n_j \quad (3)$$

$$T_{peel} = F_{peel} \times N_j/n_j \quad (4)$$

where

$N_j$ is the minimum number of junctions per metre;

$n_j$ is the number of junctions within the specimen.

## 11 Test report

The test report shall include the following information:

a) a reference to this part of ISO 13426;

b) all relevant data for complete identification of the specimens tested;

c) the test method used, i.e. “Test A: shear” or “Test B: peel” or both; specify whether tests were performed on dry or wet specimens, or both;

d) for each type of test (A or B), the mean junction strength $T_{peel}$ or $T_{shear}$, for each face, in both machine direction and cross-machine direction, and the individual values for each specimen, if required;

e) the number of specimens tested in each direction;

f) the standard deviation or coefficient of variation of any of the properties determined;

g) the manufacturer and model of the tensile testing machine;

h) the type of jaw, including the dimensions of the jaws and the type of jaw faces used, type of load measuring system;

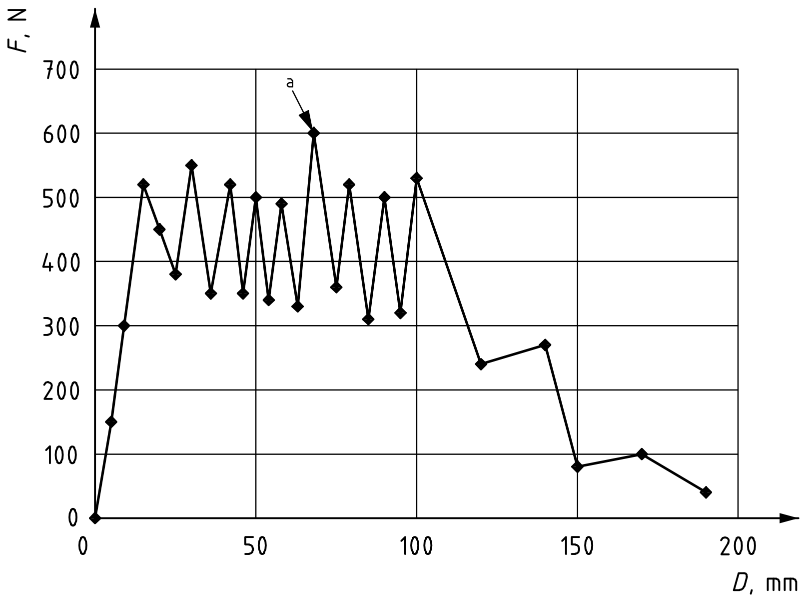
i) the initial distance between the jaws (from centre to centre for capstan grips);

j) a typical complete force-displacement curve, if required;

k) details of any deviations from the specified procedure;

l) crosshead speed, in millimetres per minute;

m) the standard atmosphere used.



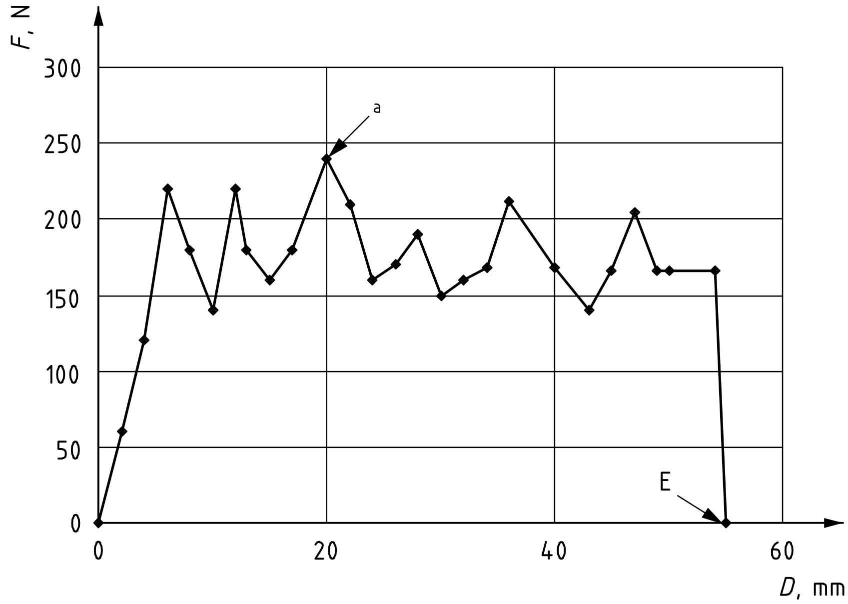

**Key**

*D* displacement

*F* force

[a] $P_{max}$ is the point of peak force.

**Figure 5 — Typical saw-tooth behaviour: the force $F_{peel}$ or $F_{shear}$ is obtained from point $P_{max}$**




**Key**

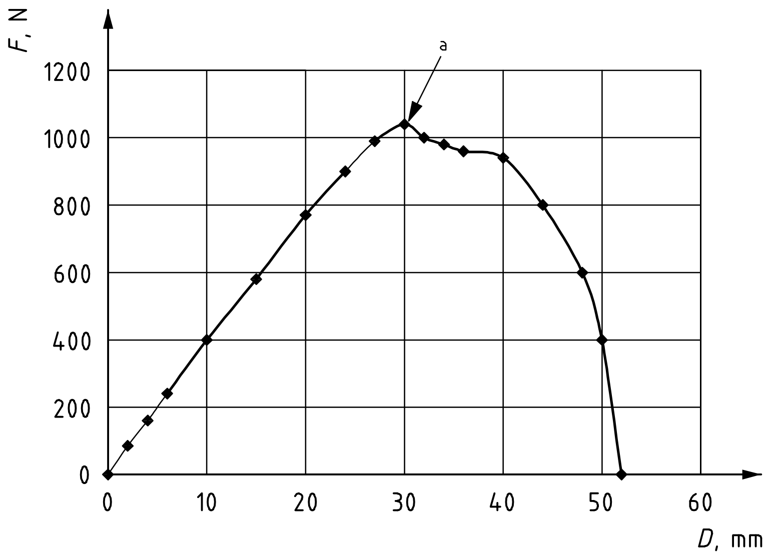
*D* displacement

*F* force

E end of delamination test

[a] $P_{max}$ is the point of peak force.

**Figure 6 — Typical delamination behaviour: the force $F_{peel}$ or $F_{shear}$ is obtained from point $P_{max}$**



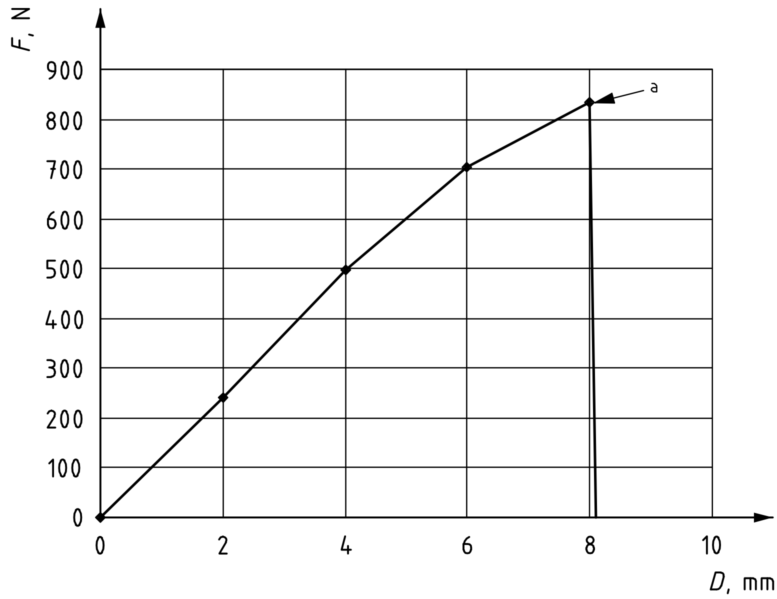

**Key**

*D* displacement

*F* force

[a] $P_{max}$ is the point of peak force.

**Figure 7 — Typical single peak behaviour: the force $F_{peel}$ or $F_{shear}$ is obtained from point $P_{max}$**




**Key**

*D* displacement

*F* force

[a] $P_{max}$ is the point of peak force.

**Figure 8 — Typical tensile failure behaviour: the force $F_{peel}$ or $F_{shear}$ is obtained from point $P_{max}$**

# Bibliography

[1] 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*

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