INTERNATIONAL STANDARD

ISO 13426-1

Second edition
2019-11

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

Part 1: Geocells

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

Partie 1: Géosynthétiques alvéolaires

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

Reference number
ISO 13426-1:2019(E)

© ISO 2019

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

© ISO 2019 – All rights reserved

Contents

Page

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

© ISO 2019 – All rights reserved

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 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 221, *Geosynthetics*.

This second edition cancels and replaces the first edition (ISO 13426-1:2003), which has been technically revised. The main changes compared to the previous edition are as follows:

— Clauses 2, 5, 6, 7, 8 and all the figures have been technically revised.

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.

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

 © ISO 2019 – All rights reserved

Introduction

Geocells are geotextile-related products composed of single strips interconnected in several possible ways (extrusion, thermal bonding, gluing, hot melt, stitching, etc.) to form a panel of adjacent cells, where generally the contact between two elements occurs along lines or in specific points, and not uniformly on the whole surface. These lines or points are referred to as "junctions".

A geocell junction can fail in four different ways:

1) by shear (see Figure 1): when failure is caused by a force parallel to the junction itself;

2) by peeling or delamination (see Figure 2): when failure is caused by a force, normal to the junction, which separates the cells from each other at one edge of the junction;

3) by splitting (see Figure 3): when a force, normal to the junction, pulls away the two cells adjacent to the junction;

4) by local overstressing (see e.g. Figure 4: geocells secured with pins): when the fixation element locally overstresses the junction, leading to a compression, shear or peel failure.

NOTE This can be considered as a performance property, in the same way as a tensile test on seams/joints.

It is therefore impossible to define one single testing method for measuring the junction strength of geocells. Hence this document includes the principles for testing the four failure mechanisms explained above. These principles should be adapted to each single product. In order to avoid confusion about the interpretation of figures, reference should be made to the exact test method in test reports and data sheets, e.g. ISO 13426-1:2019, 4.1.

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

© ISO 2019 – All rights reserved

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

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

Part 1: Geocells

1 Scope

This document describes index test methods for the determination of the strength of internal structural junctions of geocells under different loading conditions.

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 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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
geocell
three-dimensional, permeable, polymeric (synthetic or natural) honeycomb or similar cellular structure, made of linked strips of geosynthetics

3.2
junction
point, line or area where two strips are connected to form the unit cells of a *geocell* (3.1) structure

3.3
fastening system
system (staples, pegs, U-shaped bars, etc.) used to fix the *geocells* (3.1) to the ground at single points

3.4
nominal cell size
nominal length L_c (in the direction of the strips, or machine direction, MD) and nominal width B_c (perpendicular to the direction of the strips, or cross-machine direction, CMD) of the cell when opened according to the specification

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

© ISO 2019 – All rights reserved

4 Principle

4.1 General

Specimens of geocells are tested in accordance with one or more of the following four test methods representing different stress modes.

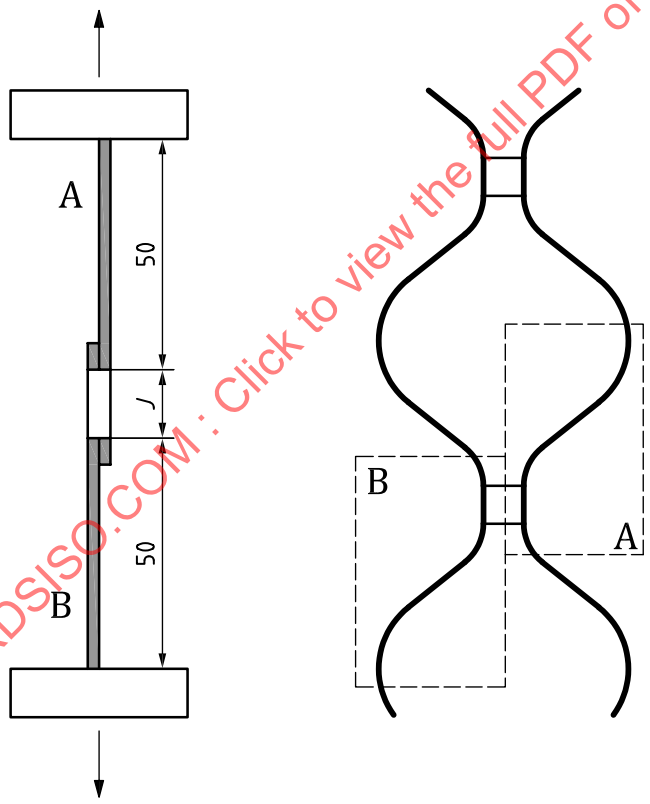
NOTE 1 It is possible that, for some products, not all four test methods can be applied.

NOTE 2 In order to perform the tests correctly, information about the nominal open cell sizes (L_c, B_c) and the direction of installation of the geocells panels, e.g. with the machine direction down the slope or parallel to the contour lines, can be provided.

4.2 Method A — Tensile shear test (Figure 1)

This test is performed on a X-shaped specimen cut from a geocell panel. The junction forms the centre of the "X". The left upper leg and the right lower leg of the "X" are trimmed close to the junction. The two remaining legs are mounted in the clamps of a tensile testing machine. The specimen is tested at constant tensile shear speed and peak tensile shear force is measured and recorded.

Dimension in millimetres



STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

Key

J junction surface

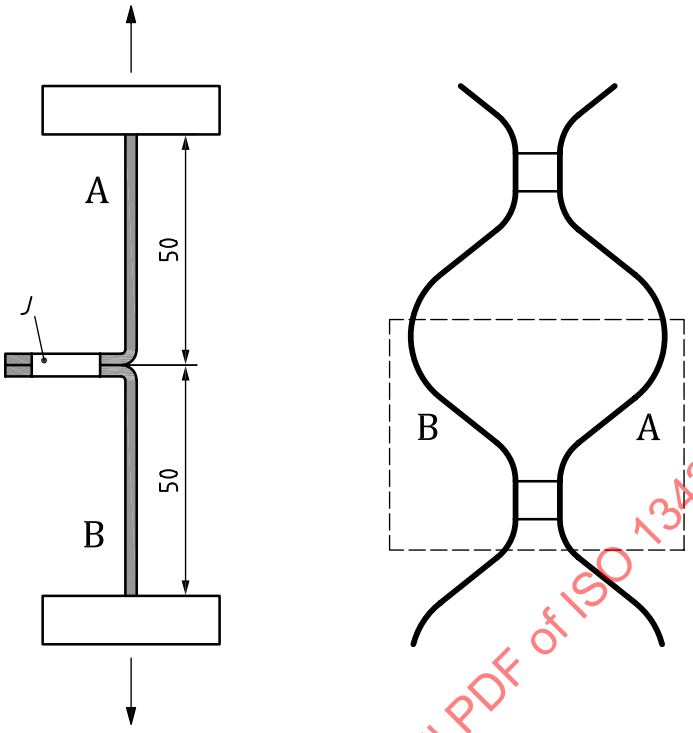
Figure 1 — Schematic representation of the tensile shear test for geocells (Method A)

4.3 Method B — Peeling test (Figure 2)

This test is performed on a X-shaped specimen cut from a geocell panel. Both upper legs of the "X" are mounted in the clamps of a tensile testing machine and tested at constant peel speed until peel failure of the junction occurs. The peak peel force is measured and recorded. For products having a non-symmetric junction, the peel test shall be performed on the upper legs and on the lower legs.

© ISO 2019 – All rights reserved

Dimension in millimetres



Key

J junction surface

Figure 2 — Schematic representation of the peeling test for geocells (Method B)

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

4.4 Method C1 and C2 — Splitting test (Figure 3 a and b)

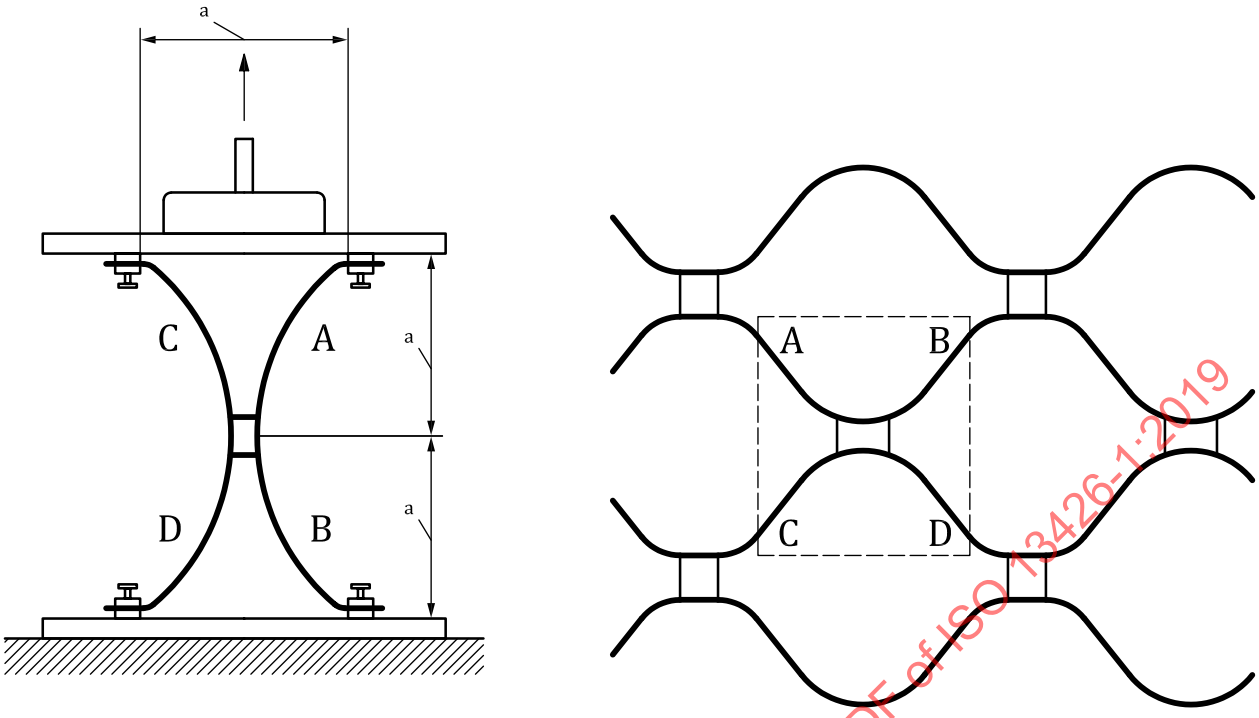
This test is performed on a X-shaped specimen cut from a geocell panel. The left legs of the "X" are mounted in a special clamp keeping the edges of the legs apart at a specified distance.

NOTE 1 The right legs are mounted in a similar way. This simulates the aperture of the cells when installed with the machine direction parallel to the contour lines of the slope.

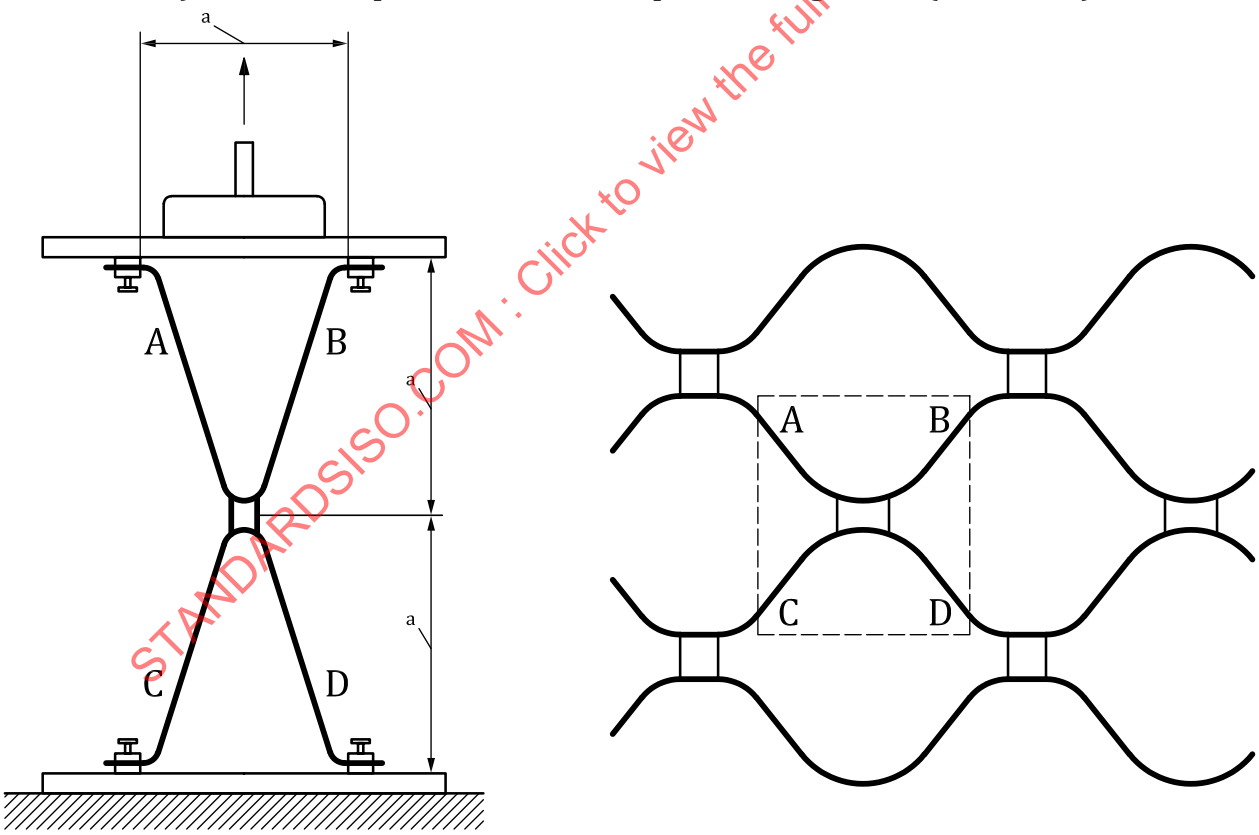
NOTE 2 For products where the strips of the closed GCE are oriented in MD, Method C1 is relevant when the GCE is installed with MD parallel to the contour line of a slope. For products where the strips of the closed GCE are oriented in CMD, Method C2 is relevant when the GCE is installed with MD parallel to the contour line of a slope.

The specimen shall be placed in the clamps at the same cell aperture as indicated by the nominal cell size (L_c, B_c). The specimen shall be mounted slightly in tension, i.e. without any slack. The two clamps are inserted in a tensile testing machine and tested at constant splitting speed until a tensile split failure of the junction occurs. The peak splitting force is measured and recorded.

© ISO 2019 – All rights reserved



a) Schematic representation of the split test for geocells (Method C1)



b) Schematic representation of the split test for geocells (Method C2)

Key

[a] Variable.

Figure 3 — Schematic representation of the split test for geocells

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

© ISO 2019 – All rights reserved

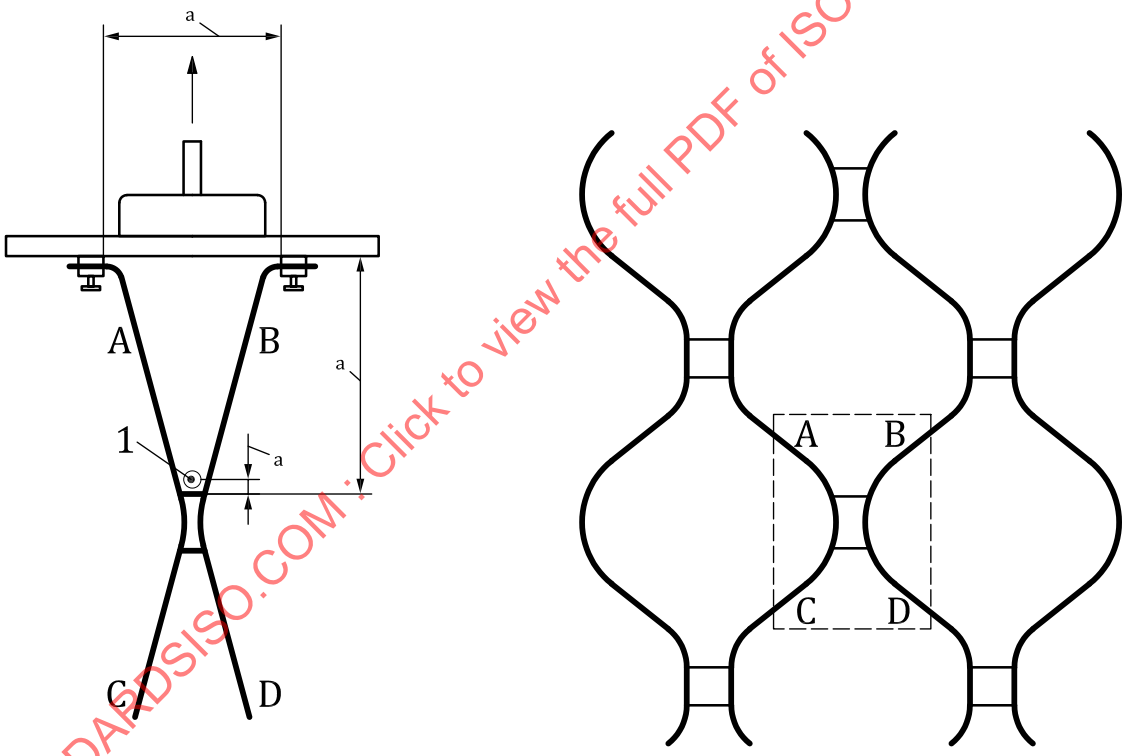
4.5 Method D1 and D2 — Local overstressing test [Figure 4 a) and b)]

This test is performed on a X-shaped specimen cut from the geocell panel, the upper and lower legs being oriented in the production direction. The upper legs of the "X" are mounted in a special clamp keeping the edges of the two legs apart at a specified distance. The lower legs are mounted in a similar way.

NOTE 1 This simulates the aperture of the cells when installed.

NOTE 2 For products where the strips of the closed GCE are oriented in MD, Method D1 is relevant when the GCE is installed with MD parallel to the contour line of a slope. For products where the strips of the closed GCE are oriented in CMD, Method D2 is relevant when the GCE is installed with MD parallel to the contour line of a slope.

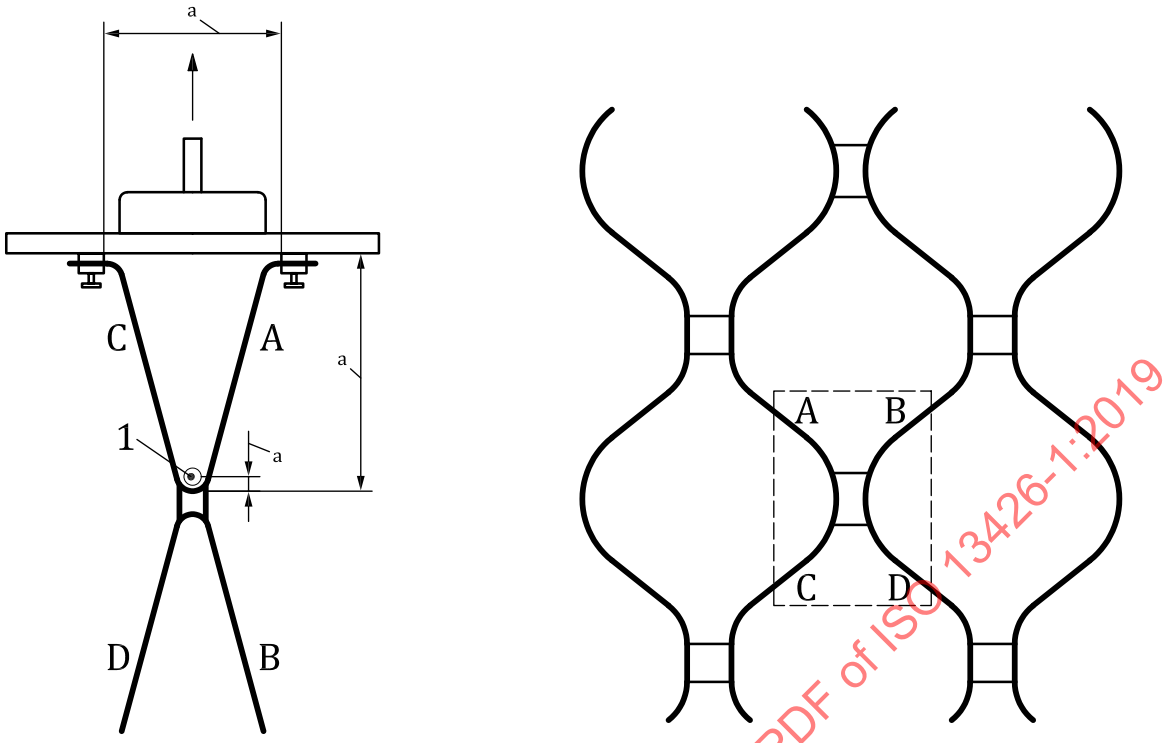
The two clamps are mounted in a tensile testing machine. A smooth steel rod 10 mm, or any other means simulating a real fastening system, is placed across and over the junction, and fixed to the base of the testing machine. The specimen is tested at a constant rate of strain until failure occurs due to plasticization of the junction by the fastening system. The maximum tensile strength is measured and recorded. When geocells are installed with the machine direction along the contour lines, the specimen shall be mounted in the clamps as shown in Figure 3. For products having a non-symmetric junction, this test shall be performed twice, i.e. by mounting the upper legs in the moving clamp.



a) Schematic representation of the local overstressing test for geocells (Method D1)

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

© ISO 2019 – All rights reserved



b) Schematic representation of the local overstressing test for geocells (Method D2)

Key

1 fixed steel rod

a Variable.

Figure 4 — Schematic representation of the local overstressing test for geocells

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

5 Conditioning of specimens

Test specimens shall be conditioned and the tests conducted in the standard atmosphere for testing, i.e. at a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) % (see ISO 554).

Conditioning and/or testing at a specified relative humidity may be omitted if it is shown that results are not affected.

6 Test specimens

Take specimens in accordance with ISO 9862.

At least five specimens shall be tested for each of the relevant directions of the product. If junctions are not symmetrical, five specimens for each side of the junction shall be tested.

Cut specimens always such that clamping occurs at equal distance between junctions.

7 Apparatus

7.1 Tensile testing machine

A constant rate of extension tensile testing machine, in accordance with ISO 7500-1 class 2 or better, shall be used. The strain should be measured with the crosshead movement.

 © ISO 2019 – All rights reserved

7.2 Clamps

The clamps shall be sufficiently wide to hold the entire width of the specimen. They shall be equipped with appropriate means to prevent specimen slippage or damage.

NOTE Compressive jaws can be used for most products.

8 Test procedure

All test methods are carried out at a constant rate of strain of 20 mm/min.

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

Mount the test specimen centrally in the jaws. Take care that the specimen length is parallel to the application direction of the force.

Start the tensile machine and continue until specimen rupture occurs. Stop the machine, record and report the maximum load to an accuracy of 2 % of the full-scale reading. Report the related displacement in millimetres to the first decimal.

Reset to the initial gauge position.

The decision to discard a test result shall be based on observation of the specimen and on the inherent variability of the product. If a specimen is damaged by the jaws, the test result shall be carefully evaluated. If the failure is merely due to randomly distributed weaknesses in the test specimen, the test result can be accepted. If failure is caused by a concentration of stress in the area adjacent to the jaws because they prevent the test specimen from contracting laterally when the load is applied, rupture near the edge of the jaws is inevitable and can be accepted as characteristic for that particular method of test. In the absence of other criteria for rejecting a jaw break, any failure occurring within 5 mm of the jaws, which results in a value below 50 % of the average value of all other tests, shall be discarded. No other break results shall be discarded, unless the test is known to be invalid.

NOTE Special precautions can be taken for the testing of specimens made of specific materials to minimize damage by the jaws. If slippage occurs or if more than 25 % of the specimens break in the jaws or less than 5 mm from the edge of the jaws, then one or more of the following actions can be taken:

— padding of the jaws;

— applying a coating to the test specimen under the jaw face area;

— modification of the jaw surface.

These modifications can be stated in the test report.

9 Measurements

9.1 General

In case of non-symmetric junctions, tests A, B, C, D shall be performed on both sides of the junctions and the minimum values shall be recorded.

In case one or more of the tests yields a saw-tooth load-deformation plot, the peak of the peaks shall be recorded as test result.

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

© ISO 2019 – All rights reserved

9.2 Method A — Tensile shear

The tensile shear force F_{ts}, expressed in newtons, is the recorded maximum load in kN (recorded to three decimal digits).

NOTE Depending on the construction of the GCE, the tensile shear force can be declared for either MD or for CMD.

9.3 Method B — Peeling

The peel force F_p, expressed in newtons, is the recorded maximum load in kN (recorded to three decimal digits).

NOTE Depending on the construction of the GCE, the peel force can be declared for either MD or for CMD.

9.4 Method C — Splitting

The splitting force F_{split}, expressed in newtons, is the recorded maximum load in kN (recorded to three significant digits) and is calculated directly from the test results, using Formula (1).

$$F_{split} = F_{max} \times n_j \quad (1)$$

where

F_{max} is the recorded maximum load, in kN (recorded to three significant digits);

n_j is the minimum number of junctions within a 1 m width of the product when opened to nominal cell size (L_c, B_c) according to the recommendations of the manufacturer.

9.5 Method D — Local overstressing

The force to local overstressing F_{lo}, expressed in newtons, is the recorded maximum load in kN (recorded to three significant digits).

10 Test report

The test report shall include the following information (for each method A, B, C, D):

a) reference to this document and to the specific test method used (e.g. ISO 13426-1:2019, 9.2);

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

c) the mean tensile force, in newtons, recorded to three significant digits; if required, in both specimen positions for methods C and D and, if required, the individual values, expressed as in Clause 9;

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

e) the number of specimens tested;

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

g) the type of jaw, including the dimensions of the jaws and the type of jaw faces used, type of deformation measuring system and initial jaw separation; for method D), details of the fastening system used;

h) a typical load-displacement curve with the yield points, if required;

i) details of any deviations from the specified procedure;

j) the test speed, in mm/min;

STANDARDSISO.COM : Click to view the full PDF of ISO 13426-1:2019

 © ISO 2019 – All rights reserved