INTERNATIONAL STANDARD

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Second edition
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Geosynthetics — Determination of compression behaviour —

Part 1: Compressive creep properties

Géosynthétiques — Détermination du comportement en compression —

Partie 1: Propriétés de fluage en compression

Reference number
ISO 25619-1:2021(E)

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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 (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*, 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 second edition cancels and replaces the first edition (ISO 25619-1:2008) which has been technically revised.

The main changes compared to the previous edition are as follows:

— normative references have been updated;

— dimension and shape of the specimen for different types of geosynthetics have been introduced;

— calculation of the correct area for structure in which loading is resisted at defined points or at defined lines have been introduced;

— the drawing of a test apparatus for compressive shear test that was not described in the test has been deleted.

A list of all parts in the ISO 25619 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.

Geosynthetics — Determination of compression behaviour —

Part 1: Compressive creep properties

1 Scope

This document specifies index test methods for determining the compressive creep properties of geosynthetic products. The test specimens are subjected either to normal compressive loading or to a combination of normal compressive loading and shear loading.

The test method with a normal load only (see Clause 5) is the standard method.

The test method in which combined normal and shear loads are applied (see Clause 6) is intended for products that are sensitive to shear failure, i.e. which have a columnar or cuspated structure.

The tests are carried out on dry specimens or on specimens immersed in water. The test is intended to be carried out with the specimen immersed in water when any part of the geosynthetic product contains a hydrophilic polymer.

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 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*

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 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
thickness
d
distance between the two rigid plates in contact with the specimen at any stage of the test

Note 1 to entry: See Figures 1 and 2.

Note 2 to entry: Thickness is measured in millimetres.

3.2
initial thickness
d_i
thickness (3.1) of the specimen under an applied normal stress of 2 kPa

Note 1 to entry: Initial thickness is measured in millimetres, in accordance with ISO 9863-1.

3.3
initial compressed thickness
d_0
thickness (3.1) measured 1 min after loading (normal loading) or 4 min after loading (combined normal and shear loading)

3.4
total compressive strain
ε
time-dependent change in *thickness* (3.1)

Note 1 to entry: Total compressive strain is expressed as a percentage of the initial thickness, d_i.

3.5
compressive creep strain
ε_{cc}
time-dependant change in *thickness* (3.1) of a material subjected to a constant compressive load (after reaching the *initial compressed thickness* (3.3), d_0, of the specimen)

Note 1 to entry: Compressive creep strain is expressed as a percentage of the initial compressed thickness, d_0.

3.6
compressive creep collapse
occurrence of a sudden increase in the speed of change of *thickness* (3.1) of a specimen subjected to a constant compressive load

3.7
machine direction
MD
direction of manufacture of a geosynthetic product (the warp direction for woven geotextiles)

3.8
cross-machine direction
CMD
direction perpendicular to the direction of manufacture of a geosynthetic product (the weft direction for woven geotextiles)

4 Test specimens

4.1 Sampling

Specimens shall be taken in accordance with ISO 9862.

4.2 Number and dimensions of test specimens

Cut two specimens from the test sample for each test load; a new specimen is required for each test.

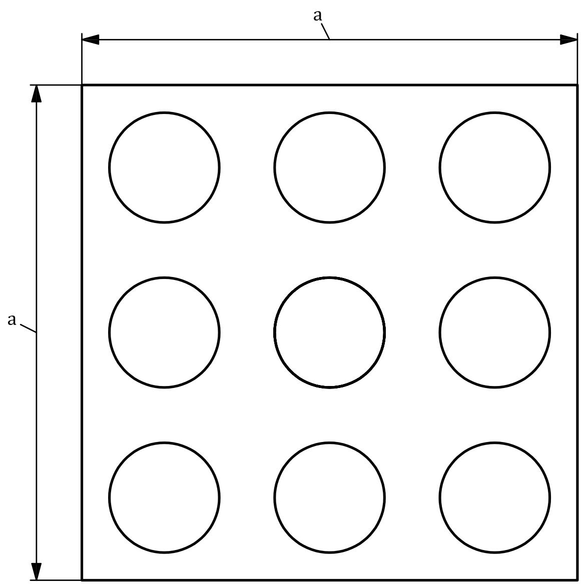
Each specimen shall satisfy the following criteria with regard to dimensions:

— the specimen shall be square and have a minimum size of 100 mm × 100 mm (see Figures 1 and 2);

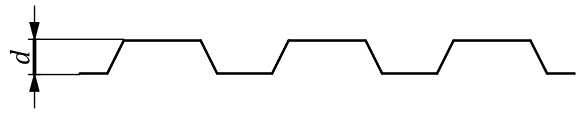
— if the specimen has a structure in which loading is resisted at defined points or areas, then the loading plate shall cover at least three complete points or areas in both directions (see Figure 1 and Figure 3 a);

— if the specimen has a structure in which loading is resisted at defined lines, then the specimen shall have a minimum of three contact lines on top loading plate and at least four complete lines on the fixed base plate(see Figure 2 and Figure 3 b);

— specimens shall be cut with the sides parallel in MD and CMD of the sample. MD and CMD direction shall be indicated on the sample.



a) Plan view of the specimen, with indication of defined points or areas where loading is resisted



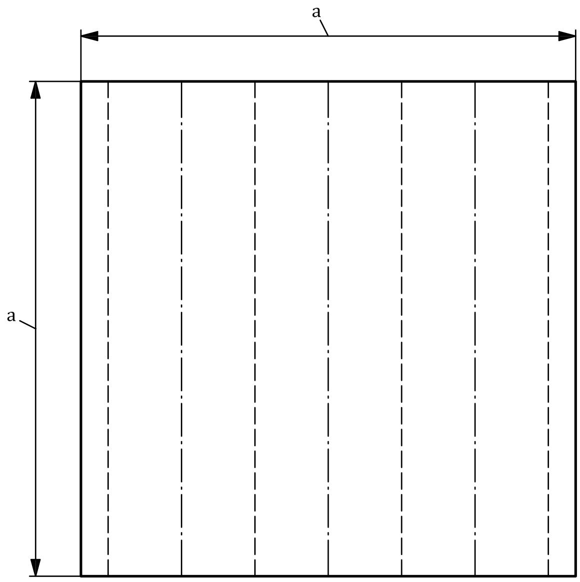
b) Cross-section of the specimen

Key

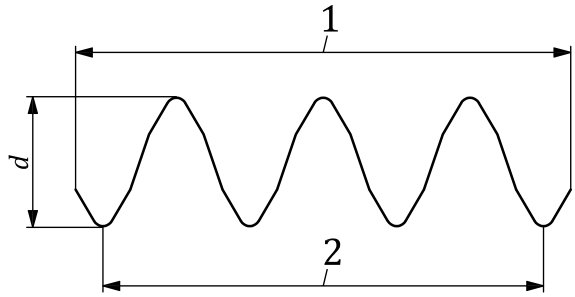
d thickness of the specimen, in millimetres

[a] 100 mm minimum, or at least three contact points in each direction.

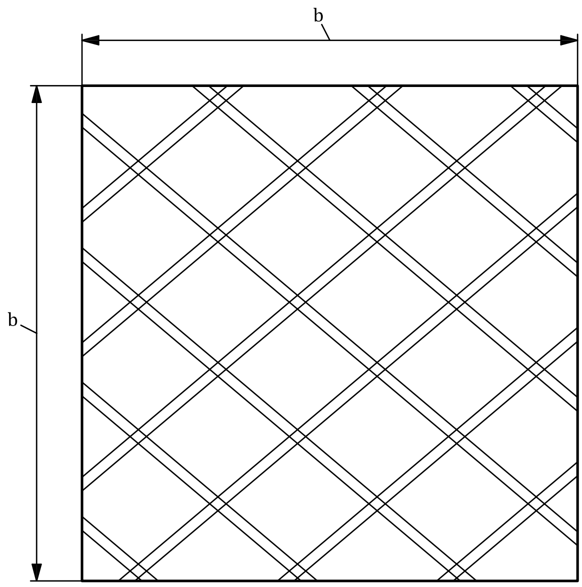
Figure 1 — Dimensions of general test specimen



a) Plan view of the specimen, with indication of defined lines where loading is resisted



b) Cross-section of the specimen



c) Plan view of the specimen, with structure in which loading is resisted at defined lines in diagonal directions

Key

1 specimen width

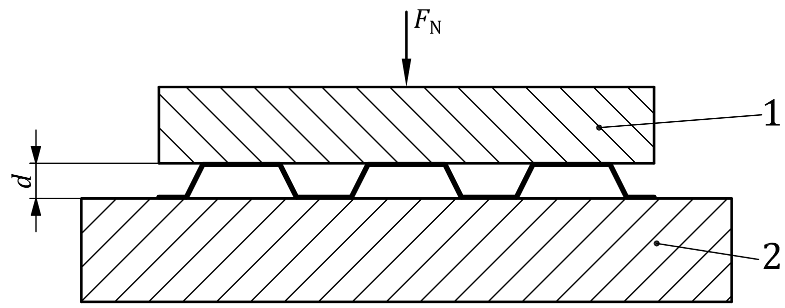
2 representative width of the specimen

d thickness of specimen, in millimetres

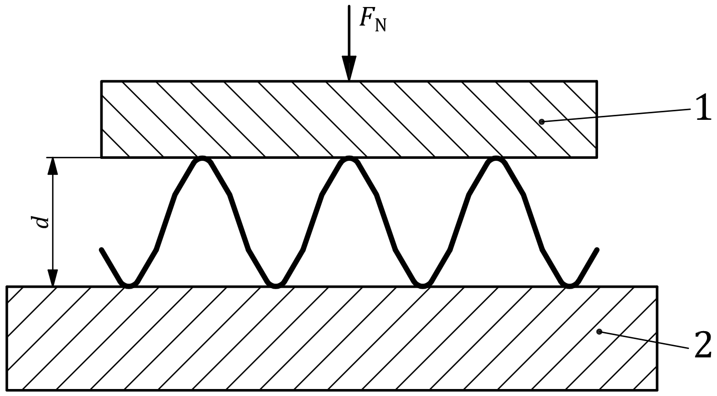
[a] 100 mm minimum, or a minimum of three contact lines on the top plate and a minimum of four contact lines on the base plate.

[b] 100 mm minimum, or a minimum of three ribs connecting each side to the perpendicular side, for each set of ribs.

Figure 2 — Size of specimen with a structure in which loading is resisted at defined lines in MD or CMD direction, or with a structure in which loading is resisted at defined lines in diagonal directions



a) Example for a specimen with a structure in which loading is resisted at defined points or areas



b) Example for a specimen with a structure in which loading is resisted at defined lines in MD or CMD direction

Key

1 metal top plate, smooth surface (same size as specimen or larger)

2 metal base plate, smooth surface (larger than top plate)

d thickness of specimen, in millimetres

F_N applied normal force, in kilonewtons

Figure 3 — Loading arrangements for structured cores

4.3 Conditioning

The test specimens shall be conditioned and tested 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 have been 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 the 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 the limits. This information shall be included in the test report.

The test shall be carried out with the specimen immersed in water when any part of the geosynthetic product contains a hydrophilic polymer (see Figure 5). Where the test is to be carried out with the specimen immersed in water, the specimen shall be soaked in water for 24 h prior to the test. Deionized water in accordance with ISO 3696 shall be used. The water shall be maintained at a temperature of (20 ± 2) °C.

5 Normal compressive load method

5.1 Principle

The geosynthetic specimen is placed on the fixed base plate of the compression testing equipment. With an upper loading plate, the vertical compressive load is applied and the change in thickness is recorded with time.

The vertical compressive load is applied to the specimen for a period of 1 000 h, or for a longer or shorter period by agreement.

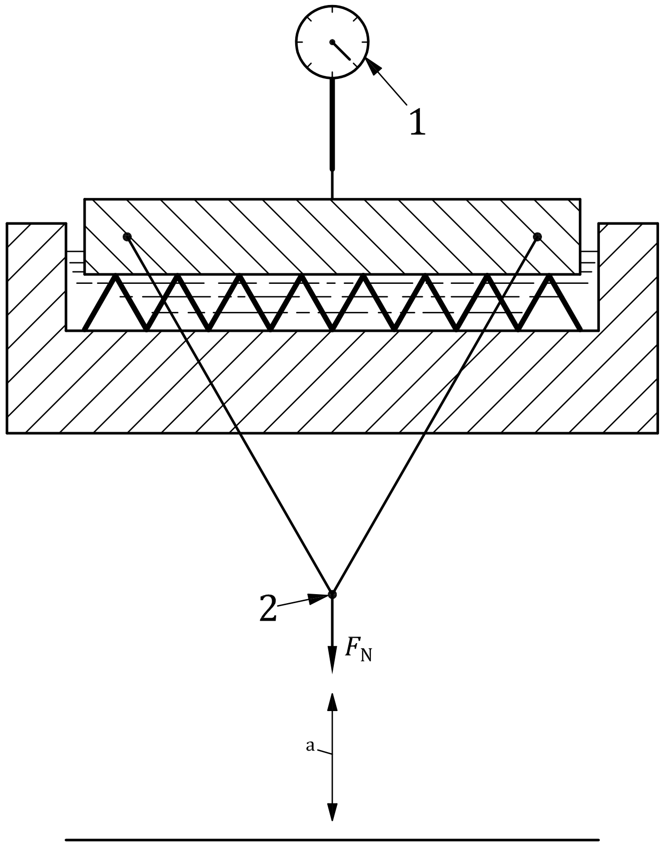
5.2 Apparatus

5.2.1 Compression testing equipment

Compression testing equipment with a vertical travel greater than the initial thickness of the specimen shall be used. It shall be capable of sustaining the applied stress to within 1 % accuracy for the duration of the test.

The compressive stress may be applied by a system capable to maintain a constant load for the duration of the test. The loading device, shall be capable of applying the full stress in one controlled step, i.e. without significant impact, within a period of 60 s.

In systems using dead weights, the loading system shall be fully supported while being assembled so that no forces are applied to the specimen until the support is smoothly released (see Figure 4).



Key

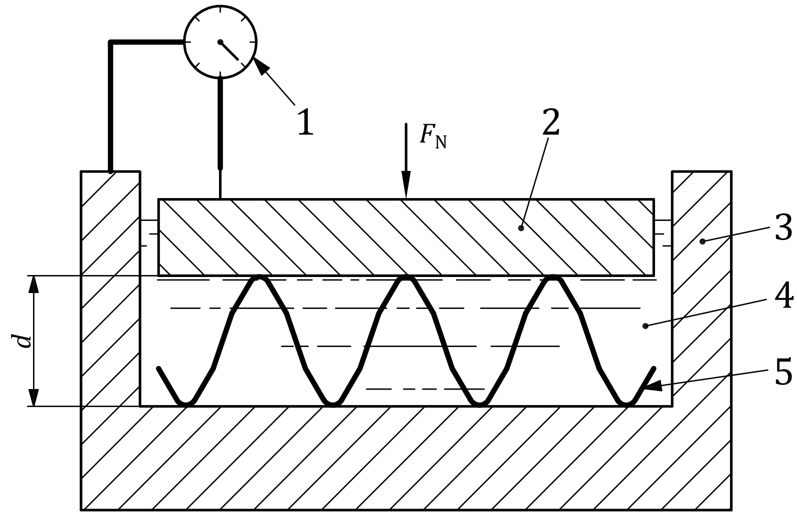
1 thickness measuring device

2 weights on hanger

F_N applied normal force, in kilonewtons

a Load supported prior to starting.

Figure 4 — Examples of typical arrangements for normal load tests



Key

1 measuring device(s), minimum of three if a single unit placed centrally is not used

2 metal top loading plate, smooth surface (same size as specimen or larger)

3 metal base plate, smooth surface (larger than top plate), with specimen container for water bath (if required)

4 water (if required)

5 specimen

d thickness of the specimen, in millimetres

F_N applied normal force, in kilonewtons

Figure 5 — Examples of typical arrangements for normal load test under water

The compression testing apparatus shall include a fixed base plate and a parallel moveable top loading plate, both with a flat and smooth metal surface. The dimensions of the top plate shall be at least equal to the dimension of the specimen and its thickness shall be such that it will result in a normal stress of not greater than 2 kPa being applied to the specimen (see Figure 3).

5.2.2 Specimen container

If the test is carried out with the specimen immersed in water, a container to keep the specimen immersed and at a constant temperature shall be used. The water level in the container shall cover the specimen but the height of water above the specimen shall not exceed 25 mm.

5.2.3 Thickness measurement device

A means of measuring the mean thickness of the specimen to an accuracy of 0,02 mm shall be used. Unless measurements are taken at the centre of the specimen, measurements shall be taken at a minimum of three equally spaced points. If three or more measurement points are used, the thickness is the mean of the values recorded.

5.2.4 Timer

Time shall be recorded throughout the test period.

5.3 Procedure

Measure the initial thickness of the specimen in accordance with ISO 9863-1, using a normal stress of 2 kPa. After measuring the initial thickness, install the same specimen in the compression testing equipment.

If the loading plate produce a normal stress of 2 kPa, the initial thickness can be measured directly using the test apparatus in accordance with ISO 9863-1.

Ensure that the specimen is placed symmetrically on the base plate and covered with the top plate.

Apply the load needed to give the required normal compressive stress in less than 60 s.

The normal stresses to be applied shall include at least four of the following: 20 kPa, 50 kPa, 100 kPa, 200 kPa and 500 kPa, to an accuracy of ±2 %.

A new specimen is to be used for each test; two specimens shall be tested at each of the specified stresses.

Record the thickness of the specimen at the following times after the application of the test stress:

— 1 min, 2 min, 4 min, 15 min, 30 min, 60 min;

— 2 h, 4 h, 8 h, 24 h;

— 2 d, 4 d, 7 d, 14 d, 28 d, 42 d.

Thickness at 1 min shall be recorded as the initial compressed thickness, $d_{0,}$

The test may be terminated when the recorded thickness of the specimen is less than 10 % of the initial thickness.

Repeat the test on the other specimens. Carry out calculations as indicated in 5.4.

5.4 Calculations

Applied normal stress is calculated using Formula (1):

$$\sigma = F_N / A \quad (1)$$

where

σ is the applied normal stress, in kilopascals;

F_N is the applied normal force, in kilonewtons;

A is the area of specimen, in square metres.

NOTE For wave-type structures (see Figure 2 b)), the representative width is used to calculate the area of the specimen.

The area of a specimen with a structure in which loading is resisted at defined points or areas shall be calculated by counting the number of contact points, $N_{s,MD}$ and $N_{s,CMD}$, in a 1,0 m width and length sample. The correct area of specimen, A, is then calculated using Formula (2):

$$A = \left(a \cdot N_{s,MD} / N_{u,MD}\right) \cdot \left(a \cdot N_{s,CMD} / N_{u,CMD}\right) \quad (2)$$

where

a is the size of the specimen, in metres;

$N_{s,MD}$, $N_{s,CMD}$ are the number of contact points in the specimen in longitudinal and transversal directions;

$N_{u,MD}$, $N_{u,CMD}$ are the number of contact points per metre specimen in longitudinal and transversal directions.

The area of a specimen with a structure in which loading is resisted at defined lines in MD or CMD roll direction shall be calculated by counting the number of lines, N_u, in a 1,0 m width or length sample (perpendicularly to the lines). The correct area of specimen, A, is then calculated using Formula (3):

$$A = \left(a \cdot N_s / N_u\right) \cdot a \tag{3}$$

where

a is the size of the specimen, in metres;

N_s is the number of contact lines in the specimen;

N_u is the number of contact lines per metre.

Compressive creep strain, in percent, is calculated using Formula (4):

$$\varepsilon_{cc} = 100 \cdot \left(d_0 - d_x\right) / d_0 \tag{4}$$

where

ε_{cc} is the compressive creep strain, in percent;

d_0 is the initial compressed thickness, in millimetres;

d_x is the thickness under load, in millimetres, at time x.

Total compressive strain is calculated at each time interval using Formula (5):

$$\varepsilon = 100 \cdot \left(d_i - d_x\right) / d_i \tag{5}$$

where

ε is the total compressive strain, in percent;

d_x is the thickness under load, in millimetres, at time x;

d_i is the initial thickness, in millimetres, at 2 kPa.

5.5 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 25619-1:2021;

b) identification of the sample shall be in accordance with ISO 10318-1, date of receipt and date of testing;

c) conditioning atmosphere;

d) whether the test was carried out dry or with the specimen immersed in water;

e) size of the specimen and the initial thickness, d_i, of the specimen at 2 kPa;

f) the initial compressed thickness, d_0, in millimetres, under a load of x kPa;

g) the stress levels used in the test;

h) the mean thickness, in millimetres, the compressive creep strain, ε_{cc}, in percent, and the total compressive strain, ε, in percent, of the specimens at 1 h and 1 000 h for each of the specified pressures;

i) any agreed deviation from the procedure;

NOTE Some possible deviations are listed in Annex A.

j) any unusual behaviour, e.g. compressive creep collapse of the core structure;

k) for specimens with a structure in which loading is resisted at defined points or areas, the number of points in contact with the loading plates; for specimens with a structure in which loading is resisted at defined lines in MD or CMD direction, the number of lines in contact with the loading plates;

l) for cuspated or columnar geocomposite products, the number of points in contact with the loading plates; for wave structures, the number of waves in contact with the loading plates;

m) a plot of the thickness, d, against log time, t, for each specimen and each of the normal pressures used in the test;

n) a plot of total compressive strain, ε, against log time, t, for each specimen and each of the normal pressures used;

NOTE Figure B.1 shows a typical response.

o) a plot of compressive creep strain, ε_{cc}, against log time, t, for each of the pressures used in the test.

6 Combined normal and shear load method

6.1 Principle

The geosynthetic specimen is placed on the fixed base of the compression testing equipment with an upper loading plate and base plate both of sufficient roughness to permit the development of any required shear forces.

The vertical compressive load and horizontal shear forces are applied to the geosynthetic specimen and the change in thickness and lateral displacement are recorded with time. The vertical compressive load and the shear force are to be applied for a minimum period of 1 000 h, or for a longer or shorter period by agreement.

6.2 Apparatus

6.2.1 Compression testing equipment

Compression testing equipment with a vertical travel greater than the nominal thickness of the specimen shall be used. It shall be capable of sustaining the applied stress to within 1 % accuracy for the duration of the test.

The compressive stress may be applied mechanically, pneumatically, or hydraulically. Where a hydraulic or pneumatic system is used, the stress applied shall be constant for the duration of the test. The loading device, however, shall be capable of applying the full magnitude of the vertical test load in one controlled step, i.e. no significant impact, within a period of 60 s.

Most systems use dead weights for the load which should be fully supported while being assembled such that no forces are applied to the specimen until the support is smoothly released. The horizontal force can be applied simultaneously with the normal load or may be applied separately but commencing not less than 60 s after the application of the full normal compressive load. The horizontal force is to be applied in one controlled step, i.e. no significant impact, within a period of 3 min after application of the full pressure.

The compression testing apparatus shall include a steel base plate and a steel top plate, one of which shall be fixed and the other with freedom of movement in both the vertical and horizontal directions. The plates shall have sufficient roughness to permit the development and transfer of the required shear forces, alternatively the normal pressure can be rotated to produce a horizontal component. The top plate shall have dimensions at least equal to those of the specimen and a thickness which will result in the application of a normal stress to the specimen of not more than 2 kPa (see Figure 3).

It is important when using dead loads to apply the horizontal shear force in such a way that the line of action of the horizontal load is in the same horizontal plane as the interface between the top plate and the specimen.

6.2.2 Specimen container

If the specimen is to be immersed in water, a container to keep the specimen immersed and at a constant temperature shall be used. The water level in the container shall cover the specimen, but the height of water above the specimen shall not exceed 25 mm.

6.2.3 Thickness measurement device

A means of measuring the mean thickness of the specimen to an accuracy of 0,02 mm shall be used. Unless measurements are taken at the centre of the specimen, measurements shall be taken at a minimum of at least three equally spaced points. If three measurement points are used, the thickness is the mean of the three values recorded.

6.2.4 Shear measurement device

A means of measuring the shear displacements of the specimen to an accuracy of 0,02 mm shall be used.

6.2.5 Timer

Time shall be recorded throughout the test period.

6.3 Procedure

Measure the initial thickness of the specimen in accordance with ISO 9863-1 using a normal stress of 2 kPa. After measuring the initial thickness, d_i, install the same specimen in the compression testing equipment.

If the loading plate produce a normal stress of 2 kPa, the initial thickness shall be measured directly using the test apparatus in accordance with ISO 9863-1.

Ensure that the specimen is placed symmetrically on the base plate and covered with the top plate.

Where independent loading for normal load and shear load are used, apply the load needed to give the required normal compressive stress in less than 60 s and the required shear stress in less than 3 min. Where the shear load is achieved by the use of angled plates, the load needed to give the required normal and shear stresses should be applied in less than 4 min.

The normal stresses to be applied shall include at least four of the following: 20 kPa, 50 kPa, 100 kPa, 200 kPa and 500 kPa, to an accuracy of ±2 %.

NOTE Some possible deviations from the method are listed in Annex A.

The shear force shall be equal to 20 % of the normal force.

A new specimen shall be used for each test; two specimens shall be tested at each of the specified stresses.

If a shear force is not only applied along the machine direction, then further specimens shall be tested with the shear force along the cross-machine direction of the specimen.

Record the thickness of the specimen and the shear displacement at the following time intervals after the application of the normal test stress:

— 4 min, 15 min, 30 min, 60 min;

— 2 h, 4 h, 8 h, 24 h;

— 2 d, 4 d, 7 d, 14 d, 28 d, 42 d.

Thickness at 4 min shall be recorded as the initial compressed thickness, d_0.

The test may be terminated when the recorded thickness of the specimen is less than 10 % of the initial thickness.

Repeat the test on the other specimens. Carry out calculations as specified in 6.4.

6.4 Calculations

Applied normal stress is calculated using Formula (6):

$$\sigma = F_N / A \tag{6}$$

where

σ is the applied normal stress, in kilopascals;

F_N is the applied force, in kilonewtons;

A is the area of specimen, in square metres.

NOTE For wave-type structures (see Figure 2 b)), the representative width is used to calculate the area of the specimen.

The area of a specimen with a structure in which loading is resisted at defined points or areas shall be calculated by counting the number of contact points, $N_{s,MD}$ and $N_{s,CMD}$, in a 1,0 m width and length sample. The correct area of specimen (A) is then calculated using Formula (7):

$$A = \left(a \cdot N_{s,\mathrm{MD}} / N_{u,\mathrm{MD}}\right) \cdot \left(a \cdot N_{s,\mathrm{CMD}} / N_{u,\mathrm{CMD}}\right) \tag{7}$$

where

a is the size of the specimen, in metres;

$N_{s,MD}$, $N_{s,CMD}$ are the number of contact points in the specimen in longitudinal and transversal directions;

$N_{u,MD}$, $N_{u,CMD}$ are the number of contact points per metre specimen in longitudinal and transversal directions.

The area of a specimen with a structure in which loading is resisted at defined lines in MD or CMD roll direction shall be calculated by counting the number of lines, N_u, in a 1,0 m width or length sample (perpendicularly to the lines). The correct area of specimen, A, is then calculated using Formula (8):

$$A = \left(a \cdot N_s / N_u\right) \cdot a \tag{8}$$

where

N_s is the number of contact lines in the specimen;

N_u is the number of contact lines per metre.

Compressive creep strain is calculated using Formula (9):

$$\varepsilon_{cc} = 100 \cdot (d_0 - d_x)/d_0 \quad (9)$$

where

ε_{cc} is the compressive creep strain, in percent;

d_0 is the initial compressed thickness, in millimetres;

d_x is the thickness under load, in millimetres, at time x.

Total compressive strain is calculated at each time interval using Formula (10):

$$\varepsilon = 100 \cdot (d_i - d_x)/d_i \quad (10)$$

where

ε is the total compressive strain, in percent;

d_x is the thickness, in millimetres, at time x;

d_i is the initial thickness of the specimen, in millimetres, at 2 kPa.

Calculate the shear stress applied to the specimen using Formula (11):

$$\tau = F_s / A \quad (11)$$

where

τ is the shear stress, in kilopascals;

F_s is the applied shear force, in kilonewtons;

A is the area of the specimen, in square metres.

Calculate the shear strain using Formula (12):

$$\gamma = 100 \cdot (\Delta s / d_i) \quad (12)$$

where

γ is the shear strain, in percent;

Δs is the displacement of one face relative to the other, in millimetres;

d_i is the initial thickness of the specimen, in millimetres.

6.5 Test report

The test report shall include the following information:

a) a reference to this document, i.e. ISO 25619-1:2021;

b) identification of the sample shall be in accordance with ISO 10318-1, date of receipt and date of testing;

c) conditioning atmosphere;

d) whether the test was carried out dry or with the specimen immersed in water;

e) size of specimen and the initial thickness, d_i, of the specimen at 2 kPa;

f) the initial compressed thickness, d_0, in millimetres, under a load of x kPa;

g) the stresses, σ, and the shear loads, τ, used in the test;

h) the mean thickness, in millimetres, the compressive creep strain, ε_{cc}, in percent, and the total compressive strain, ε, in percent, of the specimens at 1 h and 1000 h for each of the specified pressures and shear loads (and, if appropriate, in both directions);

i) any agreed deviation from the procedure;

NOTE Some possible deviations are listed in Annex A.

j) any unusual behaviour, e.g. compressive creep collapse of the core or shear failure of the interface between the filter and the core of the drainage geocomposite;

k) for cuspated or columnar geocomposite products, the number of points in contact with the loading plates; for wave structures, the number of waves in contact with the loading plates;

l) a plot of the thickness, d, against log time, t, for each specimen at each of the normal and shear loads used in the test;

m) a plot of total compressive strain, ε, against log time, t, for each specimen at each of the normal stresses applied;

NOTE Figures B.1 and B.2 show a typical response for a geocomposite.

n) a plot of compressive creep strain, ε_{cc}, against log time, t, for each of the normal and shear loads, τ, used in the test;

o) the shear displacements, Δs, of the specimens at 1 h and 1 000 h for each of the specified normal and shear loads;

p) the calculated shear strains, γ, at 1 h and 1000 h for each of the specified normal and shear loads;

q) a graph of shear displacements, Δs, versus log time, t;

r) a graph of shear strain, γ, versus log time, t.

Annex A
(informative)

Variations to the index test procedure for site-specific tests

This annex describes variations to the standard index test procedures which can be used to measure the properties of geosynthetic products in non-standard environments:

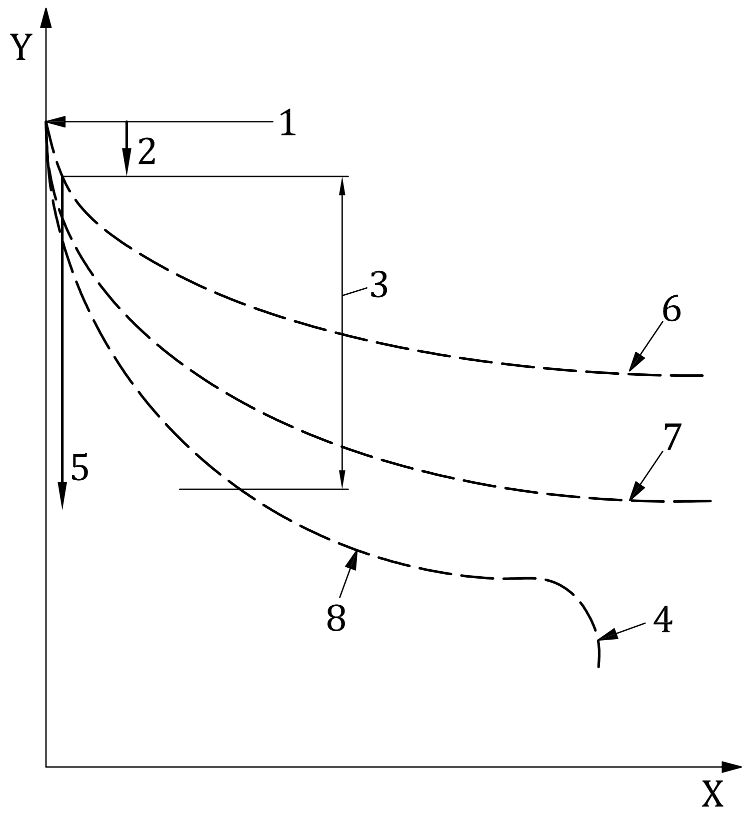
— Normal load and shear load can be chosen individually by agreement between the parties concerned.

— Other liquids may be used by agreement between the parties concerned.

— The test is normally carried out at a temperature of 20 °C. Other temperatures may be used by agreement between the parties concerned. If the test is carried out at a temperature other than 20 °C, the temperature (of conditioning atmosphere or water bath) should be maintained at the required temperature ±2 °C.

Annex B
(informative)

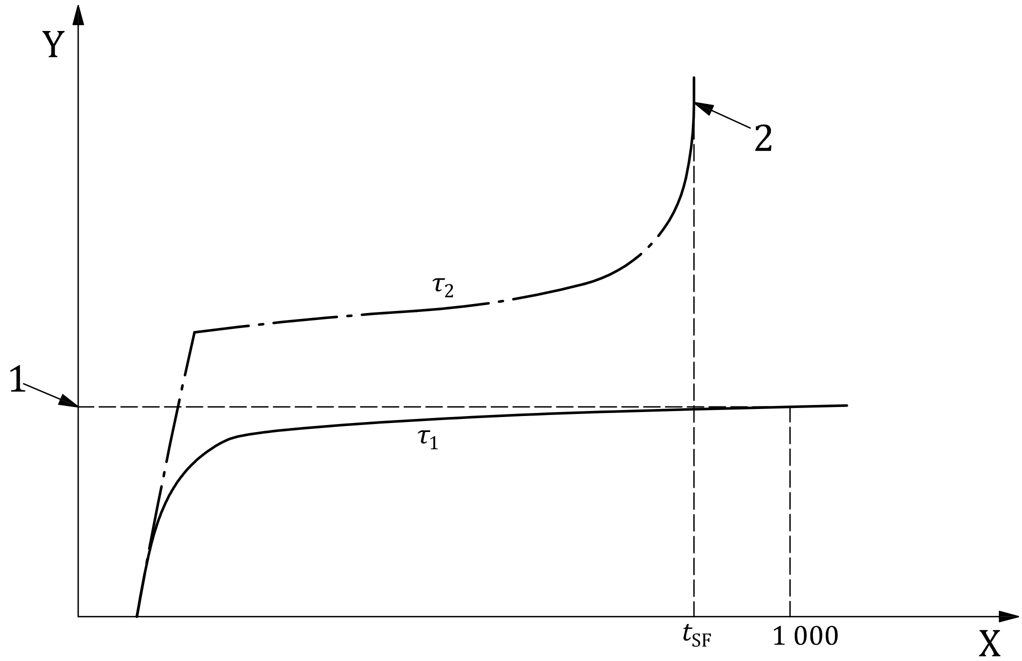
Typical curves



Key

X time, t (log scale)
Y thickness, d
1 initial thickness (at 2 kPa), d_i
2 initial compressed thickness, d_0
3 time-dependant change in thickness, d_x
4 creep collapse or rupture
5 time (t = 1 min or 4 min)
6 stress, σ_1
7 stress, σ_2
8 stress, σ_3

Figure B.1 — Typical response curves of thickness versus log time



Key

X time, t, in hours (log scale)

Y shear displacement, Δs, in millimetres

1 shear displacement after 1 000 h at τ_1

2 shear failure

t_{SF} time to shear failure

τ_1 shear stress at lowest normal stress used in test, in kPa

τ_2 shear stress at second normal stress used in test, in kPa

Figure B.2 — Typical curves of shear displacement versus log time

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