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**Geosynthetics — Index test procedure  
for the evaluation of mechanical  
damage under repeated loading —  
Damage caused by granular material  
(laboratory test method)**

*Géosynthétiques — Mode opératoire d'essai pour évaluer  
l'endommagement mécanique sous charge répétée —  
Endommagement causé par des matériaux granulaires (méthode  
d'essai en laboratoire)*

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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](http://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](http://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](http://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 10722:2007), which has been technically revised. The main changes compared to the previous edition are as follows:

- the document has been technically revised in [5.2](#) (size of test specimens), [7.1](#) (applied pressures), [7.4](#) (standard granular material, now allowing the use of other granular materials for the test), [8.1](#) (standard granular material), [8.2](#) (visual assessment of the damage), [Clause 9](#) (results referred to the property in the reference test agreed upon by parties), [Clause 10](#) (results referred to the property in the reference test agreed upon by parties);
- [Annex A](#) has been added;
- the normative references have been updated.

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](http://www.iso.org/members.html).

# Geosynthetics — Index test procedure for the evaluation of mechanical damage under repeated loading — Damage caused by granular material (laboratory test method)

## 1 Scope

This document describes an index test procedure for simulating mechanical damage to geosynthetics, caused by granular material, under repeated loading. The damage is assessed visually and by the loss of tensile strength.

Other reference tests can be used to assess the damage caused by this test. The test method described is an index test procedure, using a standard granular material, and is not intended to be used for the derivation of a reduction factor for geosynthetic reinforcement.

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

ISO 10319, *Geosynthetics — Wide-width tensile test*

EN 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

## 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

#### reference test

test used to determine a particular property of the geosynthetic being damaged in this procedure

## 4 Principle

A geosynthetic specimen is placed between two layers of a standard granular material according to 7.4 and subjected to a period of dynamic loading. The geosynthetic specimen is then removed from the test apparatus, examined for any visual damage and subjected to a mechanical test, to measure the change in mechanical properties. The result is expressed as the change (in percent) of the reference property. The visual damage is also reported.

## 5 Test specimens

### 5.1 Sampling

Take specimens from the samples in accordance with ISO 9862.

### 5.2 Number and dimensions of test specimens

For tensile testing, cut five specimens at least 2,0 m long and at least 0,20 m wide from the test sample in machine direction (MD). Then cut each specimen into two test specimens at least 1,0 m long and at least 0,2 m wide, one to be used in the damage procedure, the other in the reference test.

Specimens prepared for this test, which are to be subsequently subjected to a tensile test, shall be dimensioned as required in ISO 10319. When other reference tests are used, the number and dimensions of specimens shall suit the particular reference test procedure.

## 6 Conditioning

Condition the test specimens and conduct the tests in the standard atmosphere for testing defined in ISO 554, i.e. at a relative humidity of  $(65 \pm 5) \%$  and a temperature of  $(20 \pm 2) ^\circ\text{C}$ , until the change in mass between successive readings made at intervals of not less than 2 h does not exceed 0,25 % of the mass of the test specimens.

The test shall be performed in the same atmosphere.

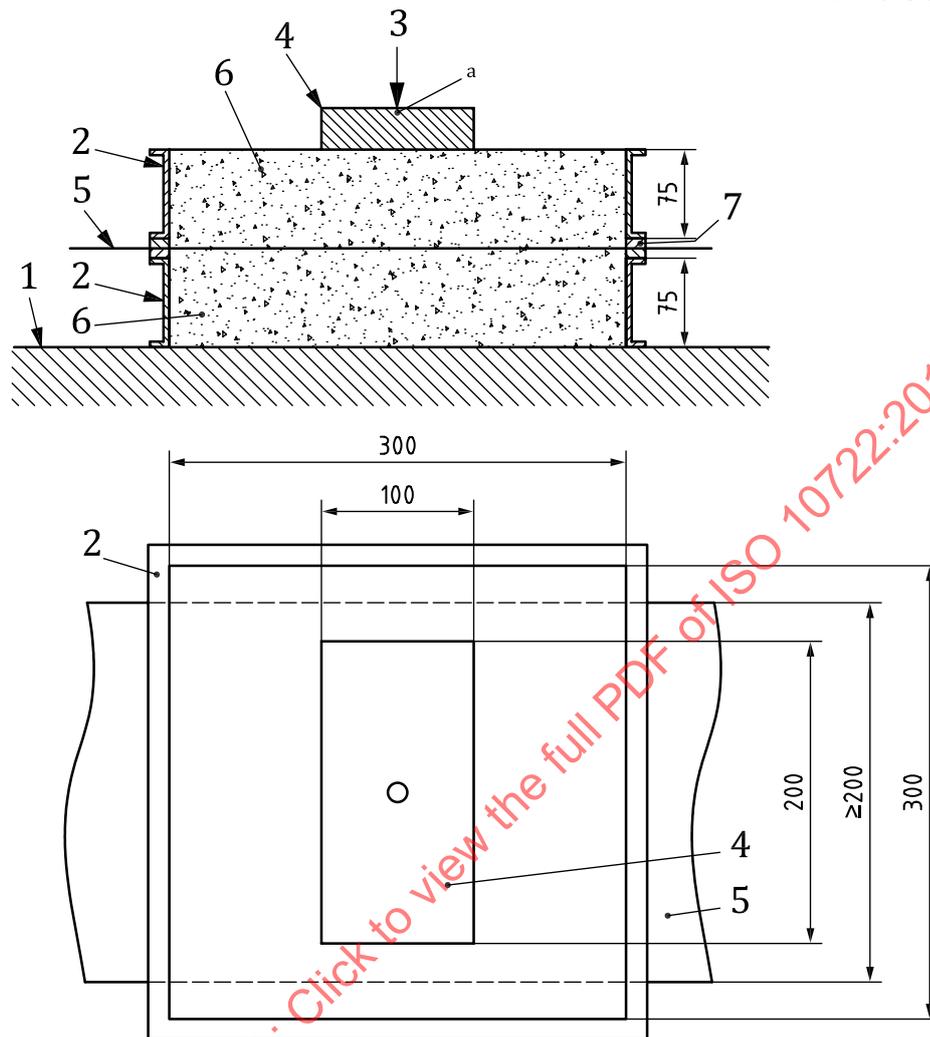
Conditioning and/or testing at a specified relative humidity may be omitted if it can be shown that the results are not affected by this omission.

## 7 Apparatus

**7.1 Compression machine**, which can be controlled to produce a sinusoidal pressure of between  $(10 \pm 1) \text{ kPa}$  and  $(500 \pm 10) \text{ kPa}$  on the loading plate, at a frequency of 1 Hz.

**7.2 Test container**. The test container shall be a rigid metal box of minimum 300 mm by 300 mm internal dimensions in the plane and shall consist of two parts, each 75 mm deep. The two parts of the box may be bolted or clipped together during the damage procedure. Shims of sufficient thickness to allow the specimen to be retained without generating any tension shall be fitted between the two parts. The lower part of the box shall be mounted on a rigid base which deflects less than 1 mm when the test load is applied directly to the base or shall be rigidly fixed to the hydraulic piston of the compression machine. [Figure 1](#) shows a typical arrangement of the apparatus.

Dimensions in millimetres

**Key**

- 1 rigid base support
- 2 rigid metal box [in two parts, 300 mm × 300 mm plan dimensions (minimum)]
- 3 applied load (pre-load 5 kPa and afterwards cyclic loading 10 kPa to 500 kPa at 1 Hz)
- 4 loading plate (100 mm × 200 mm)
- 5 geosynthetic specimen (surplus rolled up carefully outside the container during the test procedure)
- 6 aggregate (compacted in the lower box, loose in the upper box)
- 7 shims
- a Spherical seating.

**Figure 1 — Section through apparatus**

**7.3 Loading plate**, with dimensions 100 mm by 200 mm, made of steel or aluminium, with adequate stiffness to transmit the loading forces to the aggregate without deflection.

**7.4 Aggregate.** The standard granular material used in the damage procedure is a sintered aluminium oxide<sup>1)</sup>, with the following requirement on grain size: it shall be tested in accordance with EN 933-1, 100 % of the standard granular material shall pass a 10 mm sieve and 0 % shall pass a 5 mm sieve.

If necessary, the standard granular material shall be wet sieved on a 5 mm aperture sieve at the first use and after every three uses, and any material passing the sieve shall be discarded. The standard granular material shall be totally discarded after twenty uses.

The test may be performed with other granular materials. For more information on tests with other granular materials, see [Annex A](#).

## 8 Procedure

### 8.1 Damage procedure

Fill the lower part of the test container with the standard granular material. Place the standard granular material in two equal layers, each compacted with a flat plate loaded to a pressure of  $(200 \pm 2)$  kPa, for 60 s, over the whole area of the test container. Strike the top layer off level with the top of the lower part of the container.

Place the specimen across the top of the lower part of the container, the centre of the specimen aligned with the centre of the container and with the free edges equally spaced from each side of the container. If necessary, roll up the free ends of the specimen outside the container in such a way that the specimen is not damaged during the test. Position the upper part of the container and bolt or clip it into position making sure the specimen is smooth, free from wrinkles but not pre-tensioned. Then, loosely fill the upper part of the container with aggregate to a depth of 75 mm above the specimen.

Position the loading plate centrally in the container and apply a pre-load of  $(5 \pm 1)$  kPa. Set the loading apparatus to produce a cyclic loading between  $(10 \pm 1)$  kPa minimum and  $(500 \pm 10)$  kPa maximum, at a frequency of 1 Hz for 200 loading cycles. Determine the pressure using the area of the loading plate, not the area of the test container.

Remove the specimen carefully from the test container, ensuring that no additional damage occurs during removal.

Repeat the procedure for other specimens from the same sample.

### 8.2 Measurement of damage

Measure the damage by subjecting the reference specimen and the damaged specimen to the same reference test. The reference test shall normally be ISO 10319, but other mechanical reference tests may be selected.

The reference test method to be used shall be agreed between parties prior to the commencement of the test.

Optionally, the specimen is also visually examined for damage and an assessment of the damage is made. The examination includes making a record of the number of holes in the specimen and a qualitative assessment of any damage.

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1) A suitable aggregate can be obtained from: Explorer srl, Viale Regina Pacis, 11, I-41049 Sassuolo (MO), Italy; Kuhmichel Abrasiv GmbH, Asikos Strahlmittel GmbH, D-46535 Dinslaken, Germany. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these providers.

## 9 Calculations

Calculate the change in the reference property as

$$\Delta R = 100 \times \left( \frac{R_d}{R_0} \right)$$

where

$\Delta R$  is the percentage retained value of the property in the reference test;

$R_d$  is the mean value of the property in the reference test for the damaged specimens;

$R_0$  is the mean value of the property in the reference test for the reference specimens.

## 10 Test report

The test report shall include the following information:

- a) a reference to this document, including its year of publication, i.e. ISO 10722:2019;
- b) the identification of the sample, date of receipt and date of testing;
- c) the conditioning atmosphere;
- d) the temperature at which the test was carried out;
- e) the orientation of the sample and specimens cut from the material roll or sheet;
- f) the visual damage report;
- g) the test method used to measure the reference property;
- h) the percentage retained value of the property in the reference test;
- i) the standard deviation and coefficient of variation of the measured values of the property in the reference test for the reference and damaged specimens;
- j) the aggregate used in the test;
- k) any deviation from this procedure.