SLOVENSKI STANDARD
SIST EN 13738:2005

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Geotekstilije in geotekstilijam sorodni izdelki ï Ugotavljanje odpornosti proti izvleļenju iz zemlje

Geotextiles and geotextile-related products - Determination of pullout resistance in soil

Geotextilien und geotextilverwandte Produkte - Bestimmung des Herausziehwiderstandes aus dem Boden

Géotextiles et produits apparentés aux géotextiles - Détermination de la résistance a l'arrachement du sol

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59.080.70 Geotekstilije Geotextiles

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Geotextiles and geotextile-related products - Determination of pullout resistance in soil

Géotextiles et produits apparentés aux géotextiles - Détermination de la résistance à l'arrachement du sol

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COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This document (EN 13738:2004) has been prepared by Technical Committee CEN/TC 189, “Geosynthetics”, the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This document specifies a method for determining the resistance of geotextiles and geotextile-related products to pullout from soil using a laboratory pullout box. The goal of the procedure is to provide data relating to the development of friction on materials used primarily for soil reinforcement.

The test method described is a performance test procedure to determine the fitness for use of geotextiles and geotextile-related products intended to be used in a given application.

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.

EN 963, *Geotextiles and geotextile-related products - Sampling and preparation of test specimens*

prEN ISO *10318:2000, Geosynthetics - Geotextiles, geotextile-related products, geomembranes and geosynthetic clay liners - Terms and their definitions (ISO/DIS 10318:2000)*

ISO 554, *Standard atmospheres for conditioning and/or testing - Specifications*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN ISO 10318:2000 and the following apply.

3.1
pullout force
force required to pull a geotextile or a geotextile-related product out of the soil during a pullout test

3.2
pullout resistance
pullout force per width of geotextile or geotextile-related product measured at a specified rate of displacement

3.3
peak pullout resistance
maximum pullout resistance measured during a pullout test

3.4
wire gauge
displacement gauge consisting of an inextensible wire attached to the geotextile or geotextile-related product and monitored by connection to a dial extensometer, or electronic displacement transducer

3.5
normal stress (σ_n)
vertical stress applied to the specimen

4 Principle

A horizontal force is applied to a specimen embedded between two layers of soil and the force required to pull the specimen out of the soil is recorded.

The pullout resistance is calculated by dividing the pullout force by the specimen width.

The test can be performed while applying vertical stress to the top soil layer.

A plot of maximum pullout resistance versus applied normal stress is obtained by conducting a series of such tests.

NOTE 1 The relationship between the pullout resistance and the normal stress obtained from the test is due in part to the pullout mechanism which occurs. The pullout resistance versus normal stress plot produced using data from this test is a function of soil grading, plasticity, as-placed density, moisture content, length and surface characteristics of the specimen and other test parameters. Therefore, results are expressed in terms of the actual test conditions. The test measures the net effect of a combination of pullout mechanisms which may vary depending on type of specimen, embedment length, relative opening size, soil type, rate of displacement and normal stress.

NOTE 2 For checking the type of failure (break of reinforcement or slippage) in a site specific soil, smaller boxes, e.g. a shear box (300 mm x 300 mm) according to prEN ISO 12957–1, may be used with a specimen width similar to the one defined in EN ISO 10319.

5 Test Specimens

5.1 Sampling

Take specimens in accordance with EN 963.

5.2 Number and dimensions of test specimens

Cut three specimens from the test sample, for each direction to be tested, the size of the specimens to suit the dimensions of the apparatus being used. The embedded length shall be equal to three times the width of the specimen. The specimens shall be narrower, by not less than 100 mm, than the inside width of the pullout box on each side and of sufficient length to facilitate clamping.

5.3 Conditioning

Condition the test specimens and conduct the tests in the standard test atmosphere, defined in ISO 554. The test specimens are considered to have been conditioned when the change in mass between two successive readings made at intervals of not less than two hours does not exceed 0,25% of the mass of the test specimens.

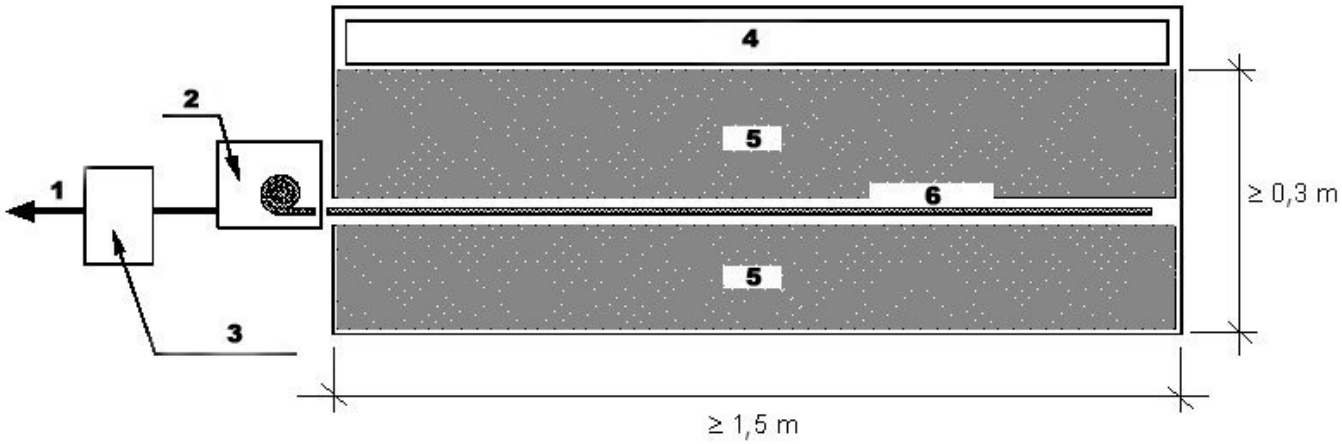
The test shall be performed in the same atmosphere.

NOTE 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.

6 Apparatus

6.1 Pullout box

An open rigid box consisting of two smooth parallel sides, a back wall, a horizontal split removable door and a bottom plate. The door is at the front of the apparatus as defined by the direction of applied pullout force. A typical apparatus is shown in Figure 1.



Key

1 Pullout device
2 Grip
3 Load cell
4 Air bag
5 Soil
6 Specimen

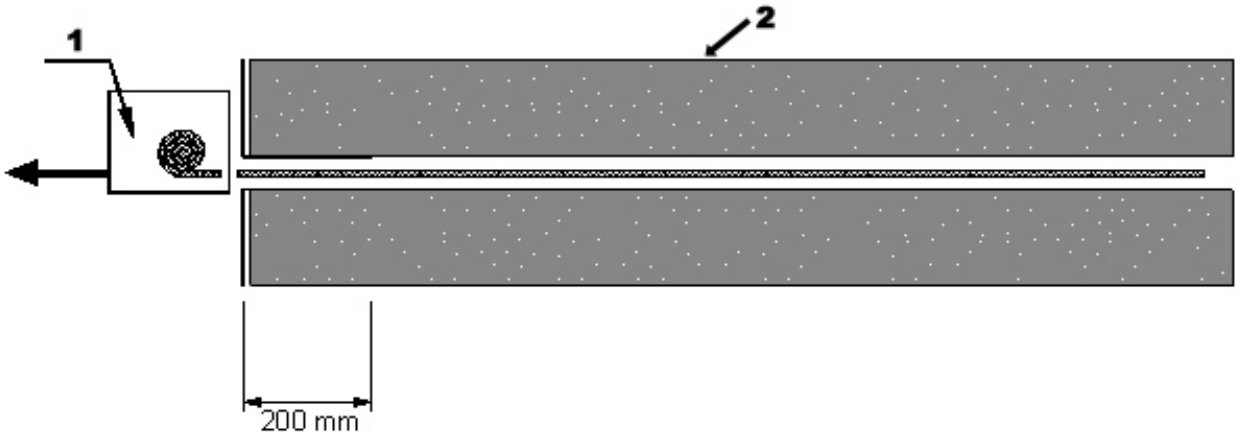
Figure 1 – Pullout box

A standard box should be rectangular with minimum dimensions of 1,5 m long by 0,6 m wide and 0,3 m deep.

Depth shall be increased to six times the maximum particle size of the soil if necessary. The apparatus shall allow the placing of the normal stress control device and a minimum loaded specimen length to width ratio of not less than three.

The apparatus shall be fitted with devices to ensure a constant normal stress on all surfaces of the specimen during the test.

NOTE During the test, the displacement of the specimen may create a load on the rigid front wall. This loading can also produce anomalous results as stress fields cannot develop fully. Vertical stress may also increase due to front wall friction and arching. A fixed metal sleeve fitted at the entrance of the box with a minimum length of 200 mm should be used for minimise these phenomena (Figure 2).



Key

1 Grip
2 Sleeve device

Figure 2 – Normal stress control devices

6.2 Normal stress loading device

The normal stress, applied to the upper layer of soil, shall be constant and uniform for the duration of the test. To maintain a uniform normal stress, a flexible pneumatic or hydraulic diaphragm loading device over the entire pullout box area should be used. Normal stresses applied will depend on testing requirements; however, stresses up to 200 kPa should be anticipated in the design of the apparatus. The applied normal stress shall be measured to a precision of 2 % of the applied stress.

6.3 Pullout force loading device

The pullout force shall be supplied by a device with the ability to pull the specimen horizontally out of the apparatus. The line of the force shall be coincident with the plane of the specimen. The pullout system shall be able to apply the pullout force at a constant rate of displacement. The rate of displacement shall be such that excess pore pressures are not developed in the soil.

When using free draining soils, where excess pore pressures will not be generated, the pullout force shall be applied to give a rate of displacement of (2,0 $\pm$ 0,2) mm/min and the rate of pullout shall be recorded during the test. A device to measure the pullout force, a load cell or proving ring, shall be incorporated into the system. The pullout force shall be measured to a precision of 2 % of the applied force.

6.4 Displacement indicators

Horizontal displacement of the specimen is measured at the clamp/geotextile position and if required at other positions on the embedded portion of the specimen. Measurements in front of the specimen are made using a dial extensometer or electronic displacement transducers, e.g. linear variable differential transformers (LVDT's), mounted to the apparatus frame to read against a plate attached to the specimen near the beginning of the embedded specimen (left side of section 1 in Figure 3)

To determine the displacement of the specimen at other positions a minimum of five gauges are spaced along the embedded portion of the specimen. A typical instrumentation setup is shown in Figure 3. Displacement measurements within the box may be made using any one of several methods using sensors or gauge connectors directly on the specimen. The movements are monitored and recorded remotely. For example: one such system utilises wire gauges, which are protected from normal stress by a surrounding tube which runs from a location