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Geotextiles and geotextile-related products — Determination of the characteristic opening size

Géotextiles et produits apparentés — Détermination de l'ouverture de filtration caractéristique

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 12956 was prepared by Technical Committee ISO/TC 221, *Geosynthetics*.

This second edition cancels and replaces the first edition (ISO 12956:1999), which has been technically revised.

Geotextiles and geotextile-related products — Determination of the characteristic opening size

1 Scope

This International Standard specifies a method for the determination of the characteristic size of the openings of a single layer of a geotextile or geotextile-related product using the wet-sieving principle.

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

ISO 10320, *Geotextiles and geotextile-related products — Identification on site*

ISO 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

ISO 2591-1, *Test sieving — Part 1: Methods using test sieves of woven wire cloth and perforated metal plate*

3 Symbols

For the purposes of this document, the following symbols apply.

3.1
d_n
particle size for which n % mass fraction is smaller than the mass of measured particles

3.2
O_{90}
size of opening which is equal to the particle of size d_{90} of the granular material which passes through the geotextile or geotextile-related product

3.3
C_u
coefficient of uniformity, defined as d_{60}/d_{10}

4 Principle

The particle size distribution of a graded granular material (usually soil) is determined after washing through a single layer of the geotextile or geotextile-related product used as a sieve, without load. The characteristic opening size corresponds to a specified size of the granular material passed.

5 Apparatus and materials

5.1 Sieving apparatus, composed of the following elements.

5.1.1 Sieving unit, allowing for the testing of a specimen with an exposed sieving area corresponding to a minimum diameter of 130 mm, complying with the following requirements:

a) sieving device, with a frequency of 50 Hz to 60 Hz;

b) predominantly vertical sieve motion capable of maintaining a 1,5 mm amplitude (3 mm swing height) over the period of test.

5.1.2 Water supply system.

5.1.3 Spray nozzle(s), to ensure even wetting of the test specimen, enclosed in a transparent cylinder or covering cap to avoid soil or granular material loss;

It is recommended that the nozzle(s) be capable of a water discharge of approximately 0,5 l/min at a working pressure of about 300 kPa.

5.1.4 Specimen clamping device.

5.1.5 Pan, affixed to the sieving apparatus, with a tube connection to the device for collection of the water and granular material passing through the specimen.

NOTE Typical sieving equipment is represented in Figure 1.

5.1.6 Grid, with wire of 1 mm in diameter and a mesh size of (10 ± 1) mm to support the specimen during the test, to avoid excessive deformation of the specimen under the weight of the granular material.

5.2 Granular material, complying with the following requirements:

a) It should be cohesion-less, i.e. particles shall not aggregate in water. If there is no visible agglomeration of particles during the test, the results are acceptable. If not, the test has to be performed again.

b) It shall not be gap-graded and the particles shall be essentially round, and sharp-edged flaky particles shall be avoided.

c) $3 \leqslant C_u \leqslant 20$.

d) To improve the accuracy of the characteristic opening size determination, the granular material shall be such that $d_{20} \leqslant O_{90} \leqslant d_{80}$; the zone for the graded granular material and the range of O_{90} values which are applicable are given in Figure 2.

5.3 Filter paper, to collect the passed granular material.

If the graded material contains a silt fraction, the filter paper used should have a maximum opening size of 10 µm.

5.4 Drying oven, capable of maintaining temperatures of between 50 °C and 110 °C.

5.5 Set of sieves, in accordance with ISO 565, size R 20 (see Annex A).

5.6 Balance, for determining the mass of the granular to an accuracy of 0,03 g.

5.7 Stopwatch, for measuring time to an accuracy of ±1 s.

6 Test specimens

6.1 Handling

The sample shall be handled as infrequently as possible and shall not be folded, in order to prevent disturbing its structure. Keep the sample in a flat position without any load.

6.2 Selection

Take specimens from the sample in accordance with ISO 9862.

6.3 Number and dimensions

Cut five test specimens from the sample, each of the dimensions suitable for the sieve apparatus to be used.

6.4 Specimen condition

The specimens shall be clean, free from surface deposits and without visible damage or folding marks.

7 Procedure

7.1 Determine and record the mass of the dry specimen to the nearest 0,1 g. The specimen is considered dry when there is a reduction in mass of less than 0,1 % between consecutive measurements with a time interval of 600 s. Drying should be carried out at a temperature of 70 °C or less, if the temperature affects the material.

7.2 Place the specimen under water containing a wetting agent at laboratory temperature and leave it to saturate for at least 12 h. The wetting agent used shall be an aryl alkyl sulfonate at 0,1 % volume.

7.3 Remove the specimen from the water and place it flat and without tension in the clamping device. Place the clamping device on the sieving apparatus. The specimen should be horizontal to avoid accumulation of granular material at one location on the specimen.

7.4 Determine the dry mass of the granular material to the nearest 0,1 g. Use enough granular material to achieve a mass per specimen equivalent to (7,0 ± 0,1) kg/m^2 of exposed sieving area. However, if the amount passing during the test is insufficient, the total amount can be adapted in such a way that enough material is passed to carry out a particle size analysis.

7.5 Spread the granular material evenly on the specimen.

7.6 Open the water supply and spray water uniformly over the whole specimen. Adjust the quantity of water with a regulating valve to ensure that granular particles are completely wetted, but do not allow the water level to rise above the granular material. There shall be no standing water on the specimen.

Maintain the water supply during the whole sieving operation.

7.7 Switch on the sieving device and slowly adjust the amplitude to 1,5 mm (3 mm swing height).

7.8 Collect the granular material which passes through the specimen.

7.9 After a sieving time corresponding to 600 s, switch off the sieving device and turn off the water supply.

7.10 Collect the specimen together with any retained granular material.

7.11 Dry, separately, the passed granular materials (see 7.8) and the specimen with the retained granular material (see 7.10).

7.12 Obtain the dry mass of the retained granular material by weighing the specimen containing the retained granular material and subtracting the dry mass of the specimen. Determine to an accuracy of 0,1 g the dry mass of the retained granular material. Determine, also, the dry mass of the passed granular material. If the combined mass of the retained and passed granular material deviates more than 1 % from the initial total dry mass, the test is invalid and shall be repeated.

7.13 Repeat 7.1 to 7.12 until three of the five specimens have been tested.

7.14 If any of the masses of granular materials passing through the specimen vary from the average by more than 25 %, then the two remaining specimens shall be tested.

7.15 Tabulate the initial amount of granular material, the material passed and retained, and calculate the percentages of material passed and lost as indicated in Table 1 or Table 2. Combine the granular material passed through the individual specimens and determine the particle size distribution.

NOTE After selection of the required successive sieves as given in ISO 565, size R 20 (see Annex A), guidance for the determination of the particle size distribution of the granular material, by sieving is given in ISO 2591-1. An example is given in Annex B.

7.16 If the amount of the passed granular material of three specimens is less than the amount required for sieving in accordance with ISO 2591-1, the two remaining specimens shall be tested and Table 2 completed. If the additional testing does not produce the required amount of passed granular material, the amount of granular material per square metre on the exposed sieving area is increased. If a greater granular material mass is chosen, the sieving time shall be increased in proportion to the increase in granular material.

NOTE If the range of O_{90} is known, it suffices for the determination of O_{90} to select the three nearest sieve sizes at either side of the O_{90}.

8 Calculation and expression of results

8.1 Plot the cumulative percentage of the passed granular material against the corresponding sieve size on a semi-logarithmic scale, (see Figure B.3). Determine d_{90} by either mathematical or graphical means.

8.2 The characteristic opening size, O_{90}, of the geotextile or geotextile-related product under examination is equal to the d_{90} of the particle size distribution curve, i.e. $O_{90} = d_{90}$.

9 Test report

The test report shall include the following information:

a) the number and year of publication of this International Standard, i.e. ISO 12956:—;

b) the test laboratory and, if required, the testing operator;

c) a description of the tested geotextile or geotextile-related product in accordance with ISO 10320;

d) details of apparatus used, including a diagram (if required);

e) the exposed specimen area;

f) the particle size distribution curve for the granular material used;

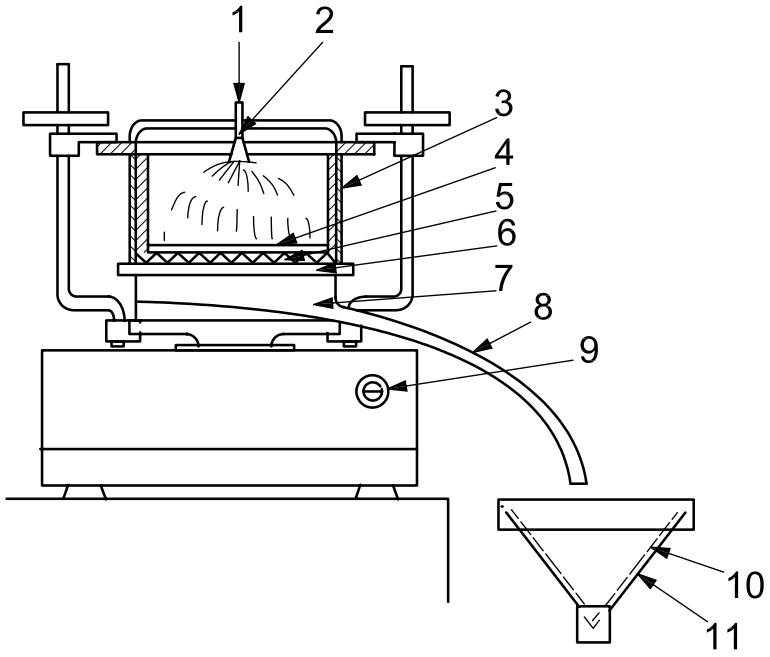
g) for each specimen, if required, the dry mass of initial granular material, of passed and retained granular material and the percentage lost and passed granular material (see Table 1 and/or Table 2);

h) the particle size distribution curve of the granular material passing the specimens according to the example in Annex B and, if required, the percentage of each fraction of the combined granular material analysis;

i) the characteristic opening size, O_{90}, of the specimens;

j) any deviation from the test method described in this International Standard;

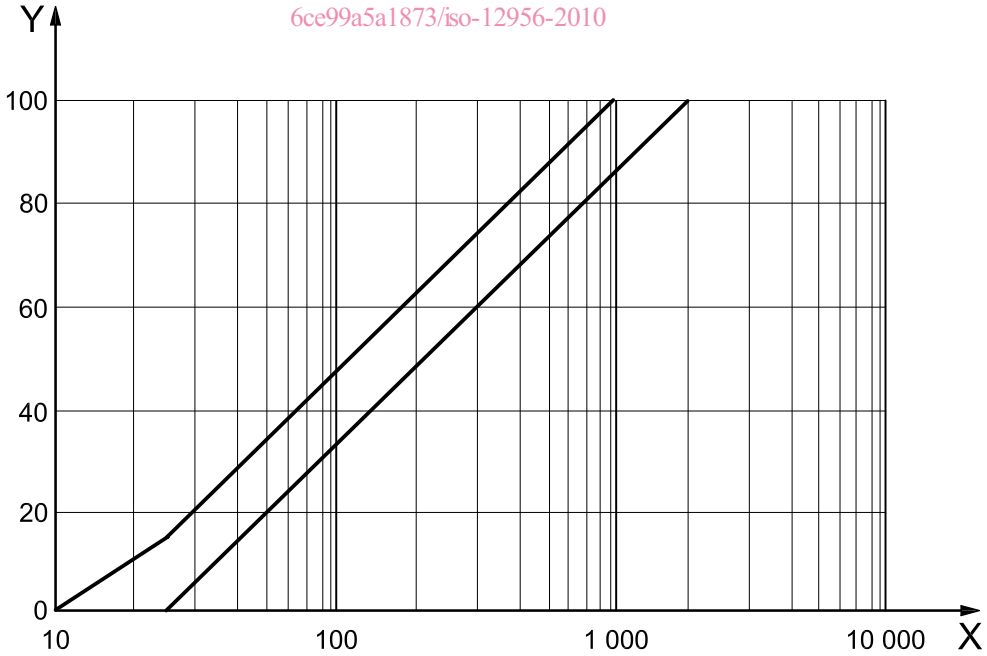
k) any anomaly in the behaviour of the specimens.



Key

1 water supply
2 spray nozzle(s)
3 clamping device
4 granular material
5 specimen
6 support grid
7 pan
8 connecting tube
9 amplitude regulator
10 filter paper
11 collection device

Figure 1 — Example of sieving device



Key

X grain diameter (µm)
Y % finer

Figure 2 — The required zone of the cumulative percentage of size distribution of the granular material used