INTERNATIONAL STANDARD

ISO 12956

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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

Reference number
ISO 12956:1999(E)

Foreword

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International Standard ISO 12956 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 21, *Geotextiles*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read “...this European Standard...” to mean “...this International Standard...”.

Annex A forms an integral part of this International Standard. Annex B is for information only.

Annex ZZ provides a list of corresponding International and European Standards for which equivalents are not given in the text.

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Foreword

The text of EN ISO 12956:1999 has been prepared by Technical Committee CEN/TC 189 "Geotextiles and geotextile-related products", the secretariat of which is held by IBN, in collaboration with Technical Committee ISO/TC 38 "Textiles".

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of an identical text or by endorsement, at the latest by August 1999, and conflicting national standards shall be withdrawn at the latest by August 1999.

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

1 Scope

This European 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

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of, any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 963	Geotextiles and geotextile-related products - Sampling and preparation of test specimens
EN 30320	Geotextiles - Identification on site (ISO 10320 : 1991)
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 (Revision of ISO 2591-1:1988)

3 Symbols

For the purposes of this European Standard, the following symbols apply:

d_n : particle size for which n % by mass is smaller than the mass of measured particles;

O_{90} : size of opening which allows particles of size d_{90} to pass through the geotextile or geotextile-related product;

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 Apparatus

The apparatus comprises a sieving unit, which allows 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;

c) water supply system;

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

NOTE : 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.

e) specimen clamping device;

f) pan, fixed on the sieving apparatus, with a tube connection to the device for collection of the water and granular material passing through the specimen. Typical sieving equipment is represented in figure 1;

g) grid with 1 mm diameter wire 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

The granular material shall comply with the following requirements:

a) it shall be cohesionless ($d_o \geq 0{,}010$ mm), i.e. particles shall not aggregate in water;

b) it shall not be gap-graded and the particles shall be essentially round, sharp-edged flaky particles to be avoided;

c) $3 \leq C_u \leq 20$;

d) to improve the accuracy of the characteristic opening size determination, the granular material shall be such that $d_{20} \leq O_{90} \leq d_{80}$; 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.

NOTE : 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 between 50°C and 110°C .

5.5 Set of sieves in accordance with ISO 565/R20 (see annex A).

5.6 Balance for determining the mass of the granular material to an accuracy of ± 0,01 g.

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

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 EN 963.

6.3 Number and dimensions

Cut five test specimens from the sample, each of 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 % (V/V).

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/m² of exposed sieving area. However, if the amount passing during the test is insufficient then 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.

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 : Guidance for the determination of the particle size distribution of the granular material, by sieving, is given in ISO 2591-1, after selecting the required successive sieves as given in ISO 565/R 20 (see annex A). 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, then 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, then the amount of granular material per square metre on the exposed sieving area is increased. If a greater granular material mass is chosen then 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 semilogarithmic scale, (see figure B.3). Determine O_{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 standard;

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

c) a description of the tested geotextile or geotextile-related product in accordance with EN 30320;

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;

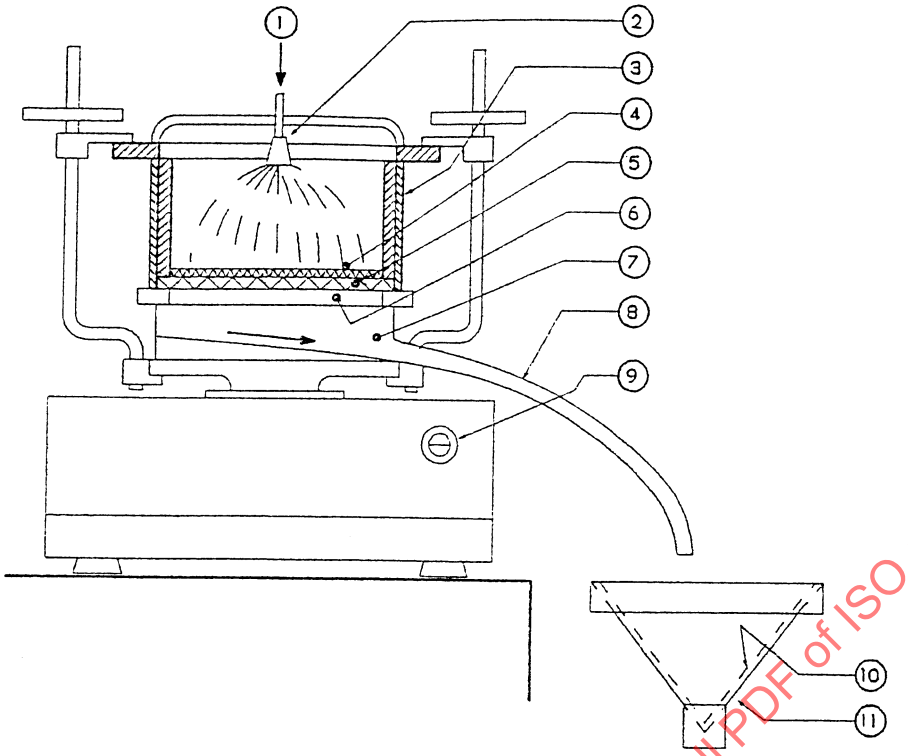
g) for each specimen, if required, the dry mass of initial granular material, of passed and retained granular material and the percentage lost and passed granular material (see table 1 and/or table 2);

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 European standard;

k) any anomaly in the behaviour of the specimens.



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

Figure 1 - Example of sieving device

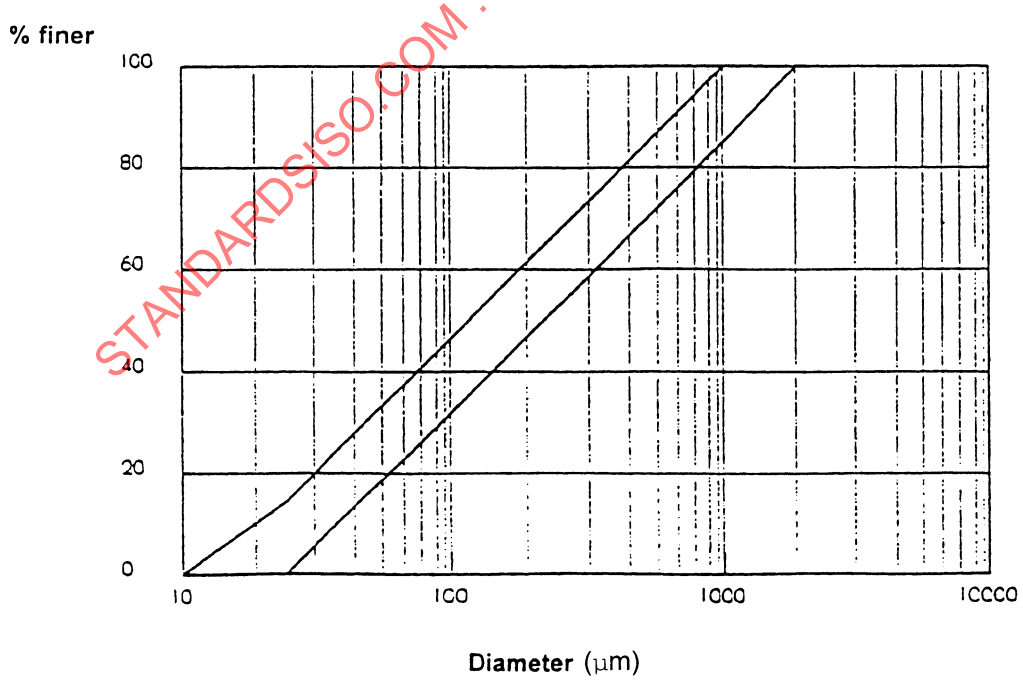


Figure 2 - The required zone of the cumulative percentage of size distribution of the granular material used

Table 1 - Typical data sheet for three specimens

Product designation :_____ Date:_____

Sample designation : _____

Specimen	Granular material (g)			Lost granular material 100[(1)-(2)-(3)]/(1) (%)	Passed granular material 100[(2)/(1)] (%)	$\lvert \bar{p} - p_i \rvert$ (%)	$\left\lvert \frac{\bar{p} - p_i}{\bar{p}} \right\rvert$ x 100 (%)
	initial (1)	passed (2)	retained (3)				
1					p_1 =		
2					p_2 =		
3					p_3 =		
Total				**Mean**	p =		

If maximum $\left\lvert \frac{\bar{p} - p_i}{\bar{p}} \right\rvert$ x 100 < 25%, then the data from the three specimens are acceptable.

If maximum $\left\lvert \frac{\bar{p} - p_i}{\bar{p}} \right\rvert$ x 100 $\geq$ 25 %, then two more specimens shall be tested (see table 2).

Table 2 - Typical data sheet for five specimens

Product designation :_____ Date : _____

Sample designation : _____

Specimen	Initial granular material (g) (1)	Passed granular material (g) (2)	Retained granular material (g) (3)	Lost granular material (%) 100[(1) - [(2)+(3)]] /(1)	Passed granular material (%) 100[(2)/(1)]
1					
2					
3					
4					
5					
Total				**Mean**	

ANNEX A (normative)

Table A.1: Mesh sizes of sets of test sieves in accordance with ISO 565/R 20

µm	µm	µm	mm	mm	mm	mm
20	80	280	1,00	3,55	12,5	45,0
25	90	315	1,12	4,00	14,0	50,0
28	100	355	1,25	4,50	16,0	56,0
32	112	400	1,40	5,00	18,0	63,0
36	125	450	1,60	5,60	20,0	71,0
40	140	500	1,80	6,30	22,4	80,0
45	160	560	2,00	7,10	25,0	90,0
50	180	630	2,24	8,00	28,0	100
56	200	710	2,50	9,00	31,5	112
63	224	800	2,80	10,0	35,5	125
71	250	900	3,15	11,2	40,0	

ANNEX B (informative)

Example of the determination of the characteristic opening size

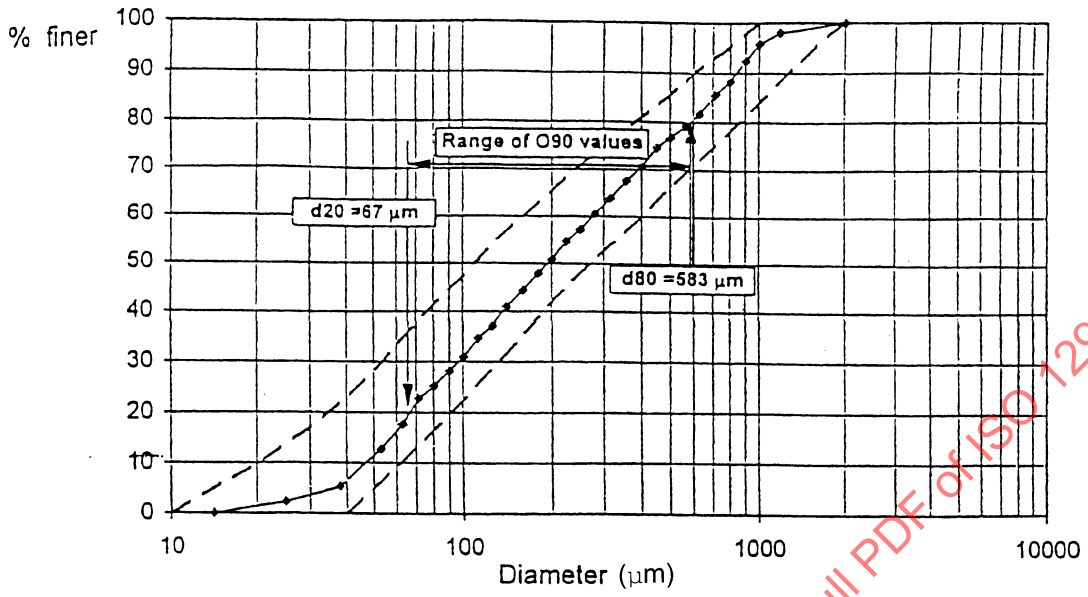


Figure B.1 - Particle size distribution curve

Table B.1 - Particle size analysis of the granular material used

Sieving analysis					
Sieve size (µm)	Σ (%)	Sieve size (µm)	Σ (%)	Sieve size (µm)	Σ (%)
63	42,5	160	72,1	400	90,5
71	46,2	180	74,5	450	92,1
80	50,2	200	77,2	500	94,2
90	53,3	224	79,8	560	96,4
100	57,6	250	81,1	630	98,6
112	61,3	280	83,2	710	99,3
125	64,6	315	86,2	800	99,8
140	66,8	355	88,3		

The amounts of granular material passed through three specimens are given in table B.2. From the relation between the mean percentage of passed granular material and O_{90} (see figure B.2), O_{90} is found to be about 200 µm. The sieves are then selected from both sides of the expected O_{90} value. These sieve sizes are 250 µm, 224 µm, 200 µm, 180 µm, 160 µm, and 140 µm (see annex A).

The size of the top sieve opening is 250 µm and according to ISO 2591-1, the minimum amount of granular material required for round sieves with a diameter of 200 mm is 100 g. The amount of passed granular material used for the sieve analysis is 113,008 g. The mass retained by each selected sieve is given in table B.3.