

**भारतीय मानक ब्यूरो**

**BUREAU OF INDIAN STANDARDS**

*भारतीय मानक मसौदा*

**भूकृत्रिम – ड्राई सिविंग तकनीक द्वारा प्रतीत छिद्र आकार निर्धारण करने की  
पद्धति**

*( पहला पुनरीक्षण )*

*Draft Indian Standard*

**GEOSYNTHETICS — METHOD FOR DETERMINATION OF  
APPARENT OPENING SIZE BY DRY SIEVING TECHNIQUE**

*( First Revision )*

**ICS 59.080.70**

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Last date for receipt of comment is  
**30 May 2024**

**FOREWORD**

*(Formal clauses will be added later)*

This standard was first published in 1995. The present revision has been made in the light of experience gained since last revision and to incorporate the following major changes:

- 1) Title of the standard has been modified;
- 2) References to Indian Standard given in Annex A has been updated;
- 3) Amendment No. 1 has been incorporated in the standard;
- 4) Requirement for mechanical shaker has been modified;
- 5) Requirement for flexible rubber template used for tracing a line on the geotextile sample has been given;
- 6) Procedure for preparation of test specimen has been modified; and

- 7) Detailed method of AOS calculation by means of plotting 'percentage passing' versus 'bead/particle size' has been specified.

In the preparation of this standard assistance has been drawn from ASTM Designation : D4751-16 'Standard test method for determining apparent opening size of a geotextile', issued by the American Society for Testing and Materials, USA.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2: 2022 'Rules for rounding off numerical values (*first revision*)'.

## **1 SCOPE**

**1.1** This Indian Standard specifies method to determine apparent opening size (AOS) by dry sieving by dry- sieving glass beads or graded sand particles through a geotextile. This method is suitable for AOS 60 microns and above.

## **2 REFERENCES**

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

## **3 TERMINOLOGY**

For the purpose of this standard definitions as given in IS 13321 (Part 1) shall apply.

## **4 PRINCIPLE**

A specimen of geotextile is placed in a sieve frame and sized glass beads or graded sand particles are placed on the geotextile surface. The geotextile and frame are shaken so that the jarring motion will induce the glass beads or graded sand particles to pass through the test specimen. The procedure is repeated on the same specimen with various size glass beads or graded sand particles until its apparent opening size has been determined.

## **5 APPARATUS**

**5.1 Mechanical Sieve Shaker** — A mechanical sieve shaker, if used, shall impart a vertical, or lateral and vertical, motion to the sieve, causing the particles thereon to bounce and return so as to present different orientations to the sieving surface. The sieve shaker should be a constant frequency device utilizing a tapping arm to impart the proper motion to the glass beads.

Note — Care should be given to the cork or rubber contact point on shakers when the vertical motion comes from an arm striking the cork or rubber. Excessive wear on cork or rubber could affect the motion imparted to the glass beads or graded sand particles, and therefore the test results.

## 5.2 Pan, Cover and 200 mm Diameter Sieves

**5.3 Spherical Glass Beads or Graded Sand Particles**, in size fractions in accordance with Table 1. It is only necessary to have on hand the glass beads or graded sand particles size fractions necessary for the range of geotextiles for which testing is anticipated. The sizing of all glass beads or graded sand particles shall be verified prior to each use by sieving on the pairs of sieves shown in Table 1. Prepare at least 50 g of each size glass beads or graded sand particles to be used prior to beginning the test.

**5.4 Balance**, having a capacity adequate for the mass of samples anticipated and accurate to  $\pm 0.05$  g.

**5.5 Static Elimination**, to prevent the accumulation of static electricity when the beads are shaken on the surface of geotextile. Commercially available devices or 'anti-static' sprays are acceptable.

## 5.6 Drying Oven

## 5.7 Pan, for Collecting Sieved Beads or Graded Sand Particles

**5.8 Flexible Rubber Template**, either a square shaped flexible rubber template with a 203 mm diameter hole cut in it, or a 203 mm diameter template, constructed from a durable, yet flexible material such as rubber or neoprene. This template is used to trace the 203 mm diameter circles on the geotextile fabric for mounting into the sieves described in 5.2.

**Table 1 Glass Bead or Graded Sand Particles Sizes**  
( Clause 5.3 )

Sl No.	Bead or Sand Particle Size Range		Bead or Sand Particle Size Designation IS Sieve, mm
	Passing IS Sieve, mm	Retained IS Sieve, mm	
(1)	(2)	(3)	(4)
i)	2.0	1.70	1.7
ii)	1.4	1.18	1.18
iii)	1.00	0.850	0.850
iv)	0.710	0.600	0.600
v)	0.500	0.425	0.425
vi)	0.355	0.300	0.300
vii)	0.250	0.212	0.212

viii)	0.180	0.150	0.150
ix)	0.125	0.106	0.106
x)	0.090	0.075	0.075

## 6 PREPARATION OF TEST SPECIMEN

**6.1** Cut five specimens from each swatch in the laboratory sample with each specimen being cut to fit the appropriate specimen holder. Cut the specimens from a single swatch spaced along a diagonal line on the swatch.

**6.2** Weigh the specimens and then submerge them in distilled water for 1 hour at the standard atmosphere specified in IS 6359.

**6.3** Bring the specimen to moisture equilibrium condition at ambient temperature. The drying process may be accelerated with the use of fan. The specimen shall not be dried in oven or by exposing them to elevated temperature.

## 7 PROCEDURE

**7.1** Carryout the test at the standard atmosphere for testing textiles in such a manner that static electricity is prevented from affecting test results. If standard atmosphere cannot be maintained and static electricity is observed, any of the following methods may be used to prevent static electricity.

**7.1.1** Install static eliminating devices equally spaced along the circumference of sieve and one on centre of cover, or

**7.1.2** Apply commercially available 'anti-static' spray uniformly to the geotextile.

**7.2** Secure the geotextile between two sieves. It is important that the geotextile be supported so that it is light, without wrinkles or bulges. The geotextile shall not be stretched or deformed such that it changes or distorts the openings in the fabric. Two systems may be used to secure the geotextile sample

**7.2.1** Wedge between two sieve frames.

**7.2.2** Secure with the perimeter seal device inside sieve frame.

Note — For knitted sock geotextiles, some manipulation of the specimens may be necessary to ensure that the marked out circle is fitted to the sieve frame properly.

**7.3** Prior to each use, sieve the glass beads or graded sand particles in the laboratory to verify size of beads or sand particles.

**7.4** Start with the smallest diameter glass beads or graded sand particles that will be tested. Place 50 g of one size glass beads or graded sand particles on the centre of the geotextile.

**7.5** Place cover and pan on sieve frame and place in shaker. Shake the sieve horizontally as well as vertically for 10 min.

**7.6** Place the glass beads or graded sand particles still on the surface of the specimen in a pan and weigh. Include beads or sand particles that fall off as a result of turning the specimen over and lapping the rims of the sieves.

NOTE — The step provides information concerning the amount of glass beads or graded sand particles trapped within the geotextile and the amount of any glass beads or graded sand particles lost during testing

**7.7** Weigh the glass beads or graded sand particles that pass through the specimen, and record data on a worksheet (*see* Annex B for a sample worksheet which can be used to record the desired information).

**7.8** Repeat **7.3** through **7.7** using the next larger bead size or sand particle fraction. Repeat the trial using successively larger bead size fractions until the weight of beads passing through the specimen is 5 percent or less. Perform the trials such that the percent passing decreases from a value greater than 5 percent to a value less than or equal to 5 percent.

NOTE — All size are sieved through a single specimen of geotextile. Geotextile variability would make it difficult to obtain consistent results by sieving each size through a separate specimen

**7.9** Repeat **7.2** to **7.8** for all five specimens.

## **8 CALCULATIONS**

**8.1** For each size of glass beads or graded sand particle tested with each specimen, compute to the nearest percent the glass beads or graded sand particles passing through the specimen using the following equation:

$$B = 100 P/T$$

where

$B$  = beads passing through specimen, percent;

$P$  = mass of glass beads in the pan, g, and

$T$  = total mass of glass beads used, g.

**8.2** Record calculations and percent glass beads or graded sand particles passing (*see* Annex B).

**8.3** Assign the AOS for each specimen as the size designation in millimetres (*see 5.3*) of the glass beads or graded sand particles of which 5 percent or less pass. These AOS values are in millimetres, and are taken from the 'Bead or Sand Particle Size Designation' column of Table 1.

**8.5** Determine the AOS for the sample by averaging the AOS values of the five specimens.

## **9 PLOTTING**

**9.1** It is often desirable due to variability among the five test specimen results to determine the AOS value by plotting the percentage of beads passing the specimen versus the bead size used for each specimen. When plotting is desirable proceed as follows:

**9.1.1** For each specimen, plot the values of percent passing (ordinate) versus bead or particle size, mm (Abcissa) on semi-log graph. Draw a straight line connecting the two data points representing the bead sizes that are immediately on either side of the 5 percent passing ordinate. The particle size in millimetres (Abcissa) at the intersection of the straight line plotted and the 5 percent passing ordinate is the AOS of the specimen in millimetres, that is the theoretical bead or particle size that would result in exactly 5 percent passing of the specimen.

**9.1.2** Determine the sample AOS, in millimetres, by averaging the five AOS values obtained by the graphical interpolation in 9.1.1.

## **10 REPORT**

Report shall include the following information:

- a) IS number of the method followed for testing;
- b) Glass bead or graded sand particle size range (in millimetres ) used;
- c) Plots of glass bead/graded sand particle size versus percentage beads/particle passing for each specimen, if required (as described in **9**);
- d) The average apparent opening size (AOS =  $O_{95}$ ) in millimetres;
- e) When requested, AOS in terms of sieve number, that is, having nominal openings, in millimetres, next larger than or equal to the AOS, in millimetres; and
- f) Deviation, if any.

**ANNEX A**  
( *Clause 2* )  
**LIST OF REFERRED INDIAN STANDARDS**

<i>IS No.</i>	<i>Title</i>
460 (Part 1) : 2020	Test Sieves — Specification Part 1 Wire Cloth Test Sieves ( <i>Fourth Revision</i> )
(Part 2) : 2020	Test Sieves — Specification Part 2 Perforated Plate Test Sieves ( <i>Fourth Revision</i> )
(Part 3) : 2020	Test Sieves — Specification Part 3 Methods of Examination of Apertures of Test Sieves ( <i>Fourth Revision</i> )
6359 : 2023	Method for conditioning of textiles ( <i>first revision</i> )
13321 (Part 1) : 2022	Geosynthetics Part 1: Terms and definitions

**ANNEX B**  
( *Clauses 7.7 and 8.2* )

**SAMPLE WORKSHEET FOR DETERMINATION OF APPARENT OPENING SIZE OF GEOTEXTILE**

DATE

TEST BY

COMP BY

CHECK BY

Range (mm) IS Sieve	Minimum Dia (mm)	Wt. F+G* W/Glass Beads or Sand Particles	Wt. F+G	Wt. Glass Beads or Sand Particles	% Retained	Wt. Pan +Glass Beads or Sand Particles	Wt. Pan	Wt. Passing Glass Beads or Sand Particles	Percentage Passing	Wt. F+G Before Test	Wt. F+G After Test	Wt. Retained in Geotextile	Percentage Retained in Geotextile
2.0-1.70	1.70												
1.4-1.18	1.18												
1.0-0.850	0.850												
0.710-0.60	0.600												
0.50-0.425	0.425												
0.355-0.30	0.300												
0.25-0.212	0.212												
0.18-0.15	0.150												
0.125-0.106	0.106												
0.09-0.075	0.075												

\*F = Frame

G = Geotextile	
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