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**Series 148**

**Série des 148**

# WITHDRAWAL

**June 2016**

## Standards in series Geosynthetics

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# RETRAIT

**Juin 2016**

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**CAN/CGSB-148.1**

Methods of testing geosynthetics

**No. 1-94/ISO 9862:1990**

Geotextiles ─ Sampling and preparation of test specimens (ICS 59.080.70)

**No. 2-M85**

Mass per unit area (ICS 59.080.70)

**No. 3-M85**

Thickness of geotextiles (ICS 59.080.70)

**No. 4-94**

Geotextiles ─ Normal water permeability under no compressive load (ICS 59.080.70)

**No. 6.1-93**

Bursting strength of geotextiles under no compressive load (ICS 59.080.70)

**No. 7.3-92**

Grab tensile test for geotextiles (ICS 59.080.70)

**No. 10-94**

Geotextiles ─ Filtration opening size (ICS 59.080.70)

**CAN/CGSB-148.1**

Méthodes d'essai des géosynthétiques

**Nº 1-94/ISO 9862 :1990**

Géotextiles ─ Échantillonnage et préparation des spécimens d'essai (ICS 59.080.70)

**Nº 2-M85**

Masse surfacique (ICS 59.080.70)

**Nº 3-M85**

Épaisseur des géotextiles (ICS 59.080.70)

**Nº 4-94**

Géotextiles ─ Perméabilité à l'eau dans un sens normal sans charge de compression (ICS 59.080.70)

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Résistance à l'éclatement des géotextiles non sollicités en compression (ICS 59.080.70)

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CAN/CGSB-148.1
No. 10-94

# Methods of Testing Geosynthetics

## Geotextiles — Filtration Opening Size

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National Standard of Canada

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NATIONAL STANDARD OF CANADA

CAN/CGSB-148.1
No. 10-94

# METHODS OF TESTING GEOSYNTHETICS

## GEOTEXTILES — FILTRATION OPENING SIZE

Withdrawn/Retiree

**Prepared by the**
Canadian General Standards Board CGSB

**Approved by the**
Standards Council of Canada

Published September 1994 by the
**Canadian General Standards Board**
Ottawa, Canada K1A 1G6

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| CGSB Ottawa Canada K1A 1G6 | METHODS OF TESTING GEOSYNTHETICS | CAN/CGSB-148.1 |
|---|---|---|
| | Geotextiles — Filtration Opening Size | No. 10-94 |

## 1. PURPOSE AND SCOPE

1.1 This method is used to determine the Filtration Opening Size (FOS) of woven, knitted and non-woven geotextiles but it is particularly recommended for non-woven geotextiles.

1.2 This method can be used to measure the FOS of all types and thicknesses of geotextiles with pore dimensions ranging from 40 to 800 µm.

1.3 The testing and evaluation of a product against this method may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this method has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any existing applicable regulatory requirements prior to its use.

## 2. PRINCIPLE

2.1 The Filtration Opening Size (FOS) of a geotextile is determined from the gradation of glass beads which have passed through the geotextile under the action of waterflow resulting from the immersion and withdrawal of the geotextile in a water tank. The geotextile specimen is secured at the bottom of a cylindrical basket. Testing glass beads are placed on the geotextile surface and the system is mechanically or electrically driven in and out of water contained in a tank. The value of the Filtration Opening Size is the 95% (by mass) bead diameter of glass beads which has passed through the geotextile under the hydrodynamic action.

## 3. APPLICABLE PUBLICATIONS

3.1 The following publications are applicable to this method:

3.1.1 Canadian General Standards Board (CGSB)

CAN/CGSB-4.2 — Textile Test Methods:

No. 2 — Conditioning Textile Materials for Testing

CAN/CGSB-148.1 — Methods of Testing Geosynthetics:

No. 1/ISO 9862 — Geotextiles — Sampling and Preparation of Test Specimens

No. 2 — Geotextiles — Mass per Unit Area

No. 3 — Geotextiles — Thickness.

3.2 Reference to the above publications is to the latest issues, unless otherwise specified by the authority applying this method. The sources of these publications are shown in the Notes section.

## 4. DEFINITIONS

4.1 For the purpose of this method, the following definitions shall apply:

4.1.1 ***Geotextile:*** A permeable textile product which, when used in association with soil, has the ability to separate, filter, reinforce or drain.

4.1.2 ***Filtration Opening Size (FOS):*** The 95% (by mass) bead diameter of testing glass beads which has passed through the geotextile under the action of water following a specified hydrodynamic sieving procedure.

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4.1.3 ***Thickness, Nominal $t_o$:*** The distance between the upper and lower surfaces of a geotextile under a pressure of 2 kPa.

4.1.4 Descriptions of terms specific to this method:

4.1.4.1 *$d_{95}$:* The bead diameter corresponding to 95% finer on the cumulative bead-size distribution curve.

4.1.4.2 *Coefficient of Uniformity, $C_u$:* The ratio $d_{60}/d_{10}$, where $d_{60}$ and $d_{10}$ are the bead diameters corresponding to 60% and 10% finer on the cumulative bead-size distribution curve, respectively.

## 5. APPARATUS

5.1 The apparatus used is shown in Figure 1 and schematically represented in Figure 2.

5.2 The testing device is comprised of four plastic cylinders with open ends (1) of 300 mm inside diameter and of 150 mm height, fixed vertically on a frame (2). This frame is connected to a mechanical or electrical device (3) that permits the cylinders to be immersed into and then withdrawn from water contained in tanks located under each of the baskets.

5.3 Each geotextile specimen (4) is placed between two 10 mm mesh grids (5) which prevent deformation of the specimen under the immersion and withdrawal actions.

5.4 The geotextile specimen and its grids are locked at the bottom of each cylinder by flanges (6) to prevent any testing beads from passing between the specimen and the wall of the cylinder.

5.5 The cylinder is plunged into the water tank (7) for a period of time that is needed to produce water penetration to a depth of 100 mm of water over the geotextile specimen during the immersion period.

5.6 The withdrawal period must be long enough to ensure that the cylinder empties, i.e. there is no water above the geotextile specimens.

5.7 The apparatus must be designed to ensure that during the withdrawal period, all of the water draining from any one cylinder falls into its associated tank to avoid the loss of beads.

5.8 The minimum number of immersion-withdrawal cycles for each test must be 1000.

## 6. SELECTION OF GLASS BEADS

6.1 Each of the four baskets is partially filled with a well graded glass beads mixure with a maximum bead size greater than twice the expected Filtration Opening Size of the geotextile and with a coefficient of uniformity, $C_u$ greater than 4.

6.2 A mass of 5.65 ± 0.05 kg of dry glass beads per square metre of the specimen area being tested is placed on the specimen.

6.3 Follow the procedures of par. 8.1 to 8.10, except that only the mass of the collected and dried beads is measured. If the mass of collected beads is less than 50 g, a second (finer) gradation of glass beads has to be selected according to a new estimation of Filtration Opening Size. The selection should be done according to recommendations presented in par. 6.1. Repeat the procedure until at least 50 g of beads are collected in the water tank.

## 7. TEST SPECIMENS

7.1 The selection of the four specimens shall be performed in accordance with CAN/CGSB-148.1 No. 1/ISO 9862.

7.2 The specimens can be conditioned in accordance with CAN/CGSB-4.2 No. 2. This procedure is intended to permit the relaxation of the geotextile but is not mandatory since the geotextiles will be immersed in water during the test.

7.3 The size of the circular specimens should be equal to or slightly smaller than the external diameter of the flanges installed at the bottom of each basket. Also, small holes must be made near the edge of the circular specimen to permit the insertion of bolts to tighten both flanges. These holes must have a diameter slightly greater than the bolt diameter so that the geotextile specimen is not distorted during installation.

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## 8. PROCEDURE

8.1 Determine the thickness and the mass per unit area of each specimen in accordance with CAN/CGSB-148.1 Nos. 2 and 3.

8.2 Install the geotextile specimens (4) between the two grids (5) at the base of each basket and clamp the two flanges (6) to ensure watertightness. Caution must be taken to ensure that the structure of the geotextile specimens is not altered during the installation procedure.

8.3 Weigh the necessary quantity, 5.65 kg/m$^2$, of air-dry glass beads for each cylinder and place the beads on the geotextile specimen.

8.4 Position the apparatus frame (2) at its upper location and attach the cylinders (1) to the frame.

8.5 Fill the tanks (7) with tap water at a temperature of 20°C to the height necessary to have the desired 100 mm depth of water penetration in the cylinders (1).

8.6 Position each water tank (7) under its corresponding cylinder (1).

8.7 Set the total number of cycles, the immersion time, the withdrawal time on the timer (8), and start the test by actuating the mechanical or electrical device (3).

8.8 After two cycles, verify the immersion and withdrawal time. The immersion period shall be long enough to ensure that the cylinder fills to 100 mm of cylinder height. The withdrawal period should be such that, at the end of each draining period, there is no water above the geotextile specimens.

8.9 Repeat par. 8.8 after 10 and 20 cycles and adjust times as necessary.

8.10 At the end of the test (par. 5.8), allow for the settlement of beads in the water tank (7). Collect and dry the beads which have passed through specimens. The beads which have passed through each specimen are collected separately and gradation tests undertaken to obtain the particle size distribution for each specimen tested.

## 9. CALCULATIONS

9.1 Plot the complete gradation curve obtained from the fraction of glass beads recovered from each tank.

9.2 Determine graphically the $d_{95}$ of the gradation curve expressed in micrometers as shown in Figure 3 (in this example, a well-graded curve).

9.3 The geotextile Filtration Opening Size (FOS) is the $d_{95}$ as graphically determined in par. 9.2.

## 10. ACCURACY AND PRECISION

10.1 The accuracy of this testing procedure can range between 10 and 30% resulting from the fluctuation of geotextile characteristics from one specimen to another.

10.2 Data obtained during an interlaboratory test program indicated that an inherent variability of 70% could be expected between different apparatus.

## 11. REPORT

11.1 Tabulate the following data for each geotextile specimen tested:

Identification

Nominal thickness

Mass per unit area

Surface area tested.

11.2 Report the gradation curve of testing glass beads.

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11.3 Report the number of cycles used in the test, the immersion time and the withdrawal time.

11.4 Report for each specimen: the mass of the testing beads placed on the specimen and the mass of the beads passing through the specimen.

11.5 Report and plot for each specimen the granulometric curve obtained, indicating graphically the $d_{95}$ on the figure.

11.6 Report the Filtration Opening Size (FOS) in micrometers for each specimen and the average FOS for the four specimens tested.

## 12. NOTES

### 12.1 Significance and Use

12.1.1 The characteristic opening size of non-woven geotextiles must be determined using an indirect method such as this one. The FOS can be related to filtration criteria.

12.1.2 The significance of the method is that measurements have been performed successfully on materials with pore sizes between 40 to 800 µm.

12.2 **Source of Referenced Publications** — The publications referred to in par. 3.1.1 may be obtained from the Canadian General Standards Board, Sales Centre, Ottawa, Canada K1A 1G6. Telephone (613) 941-8703 or 1-800-665-CGSB (Canada only). Fax (613) 941-8705.

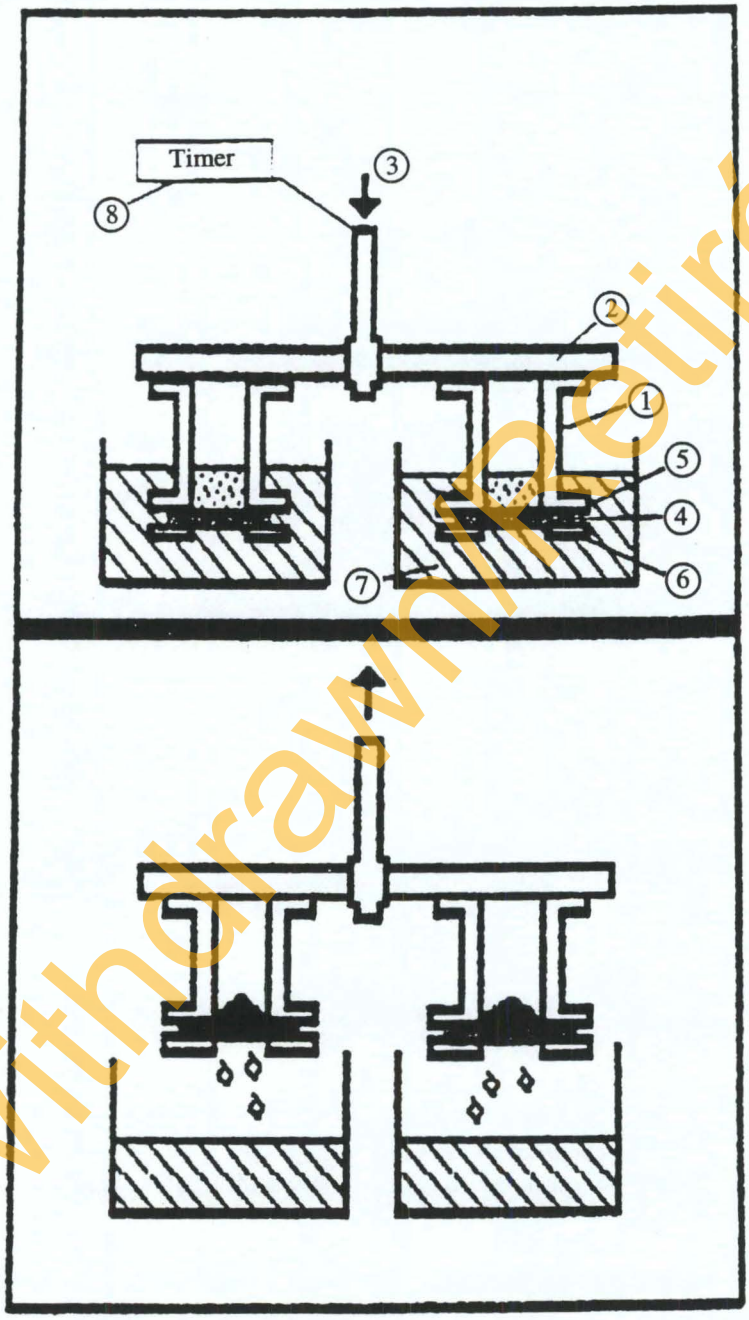
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**FIGURE 1**

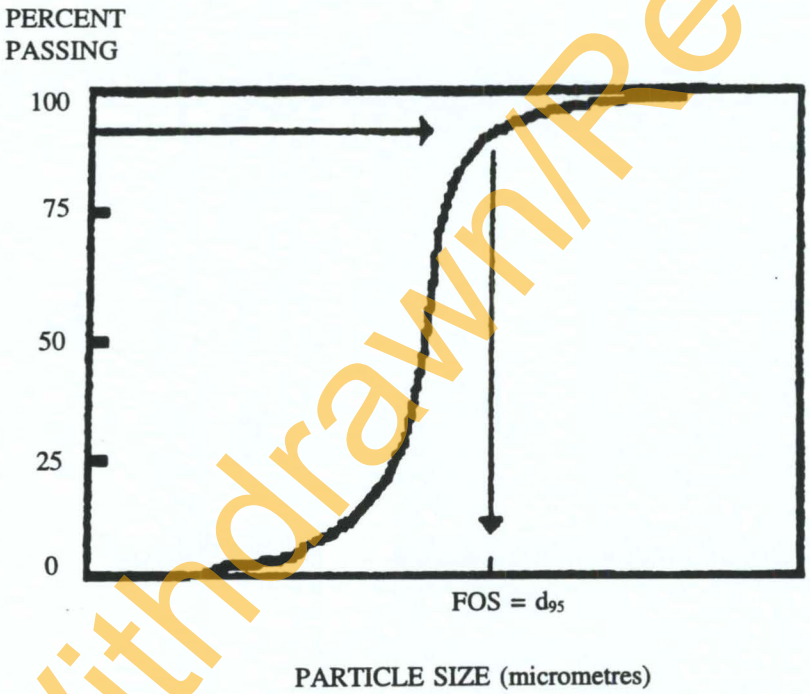
**Photograph of FOS Apparatus**




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**FIGURE 2**

**Schematic of FOS Apparatus**




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**FIGURE 3**

**FOS Determination from Granulometric Curve of Recovered Glass Beads**

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