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Série des 148

WITHDRAWAL

June 2016

Standards in series Geosynthetics

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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)

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CAN/CGSB-148.1

Méthodes d'essai des géosynthétiques

N° 1-94/ISO 9862 :1990

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

N° 2-M85

Masse surfacique (ICS 59.080.70)

N° 3-M85

Épaisseur des géotextiles (ICS 59.080.70)

N° 4-94

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

N° 6.1-93

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

N° 7.3-92

Essai de résistance à la rupture des géotextiles — Essai d'arrachement (ICS 59.080.70)

N° 10-94

Géotextiles — Détermination du diamètre d'ouverture de filtration (ICS 59.080.70)

No. 14-93

Stiffness of geotextiles (ICS 59.080.70)

No. 100-95

Conditioning geosynthetics for testing
(ICS 59.080.70)

CAN/CGSB-148.2-M89

Geotextiles and geomembranes —
Definitions (ICS 59.080.70)

N° 14-93

Rigidité des géotextiles (ICS 59.080.70)

N° 100-95

Conditionnement des géosynthétiques
pour fins d'essais (ICS 59.080.70)

CAN/CGSB-148.2-M89

Géotextiles et géomembranes — Définitions
(ICS 59.080.70)



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CAN/CGSB-148.1
No. 4-94

Methods of Testing Geosynthetics

Geotextiles — Normal Water Permeability
Under No Compressive Load

Withdrawn/Retirée



National Standard of Canada

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METHODS OF TESTING GEOSYNTHETICS

GEOTEXTILES — NORMAL WATER PERMEABILITY UNDER NO COMPRESSIVE LOAD

Prepared by the
Canadian General Standards Board 

Approved by the
Standards Council of Canada 

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CGSB Ottawa Canada K1A 1G6	METHODS OF TESTING GEOSYNTHETICS	CAN/CGSB-148.1
	Geotextiles — Normal Water Permeability Under No Compressive Load	No. 4-94

1. PURPOSE AND SCOPE

- 1.1 This method is for the determination of the water permeability of woven, knitted and non-woven geotextiles in a direction normal to the plane of the geotextile.
- 1.2 This procedure is not applicable to the measurement of the normal permeability of geotextiles under load.
- 1.3 As there are many applications and environmental conditions under which a geotextile may be used, care should be taken when attempting to apply the results of these test methods to the field performance of a geotextile.
- 1.4 This method enables the measurement of the normal water permeability of geotextiles under no load and is considered satisfactory for acceptance testing of commercial geotextiles. The normal water permeability is used to compare the geotextile permeability to the permeabilities of other porous media.
- 1.5 As there are fabrics of various thicknesses in use, it is often more indicative to evaluate the quantity of water which would pass through a geotextile under a given water head over a particular cross-section area. Permittivity is an expression of this and is used to compare geotextiles.
- 1.6 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 normal water permeability of a fabric, k_n , is determined by measuring the water flow, in the normal direction, through a known cross section of a geotextile at predetermined constant hydraulic gradients.
- 2.2 The permittivity of a geotextile, ψ , can be determined by measuring the rate of flow of water, in the normal direction, through a known cross section of a geotextile at predetermined constant water heads.

3. APPLICABLE PUBLICATIONS

- 3.1 The following publications are applicable to this method:

- 3.1.1 Canadian General Standards Board (CGSB)

CAN/CGSB-148.1 — Methods of Testing Geosynthetics:

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

No. 3 — Geotextiles — Thickness

CAN/CGSB-148.2 — Geotextiles and Geomembranes — Definitions.

- 3.2 Reference to the above publications is to the latest issues, unless otherwise specified by the authority applying this method. The source of these publications is 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 **Coefficient of permeability, k :** The rate of discharge of a fluid through a unit cross-section area of geotextile under a unit hydraulic gradient at a standard water temperature. The coefficient normal to the geotextile plane (k_n) should be distinguished from that within the geotextile plane (k_p).
- 4.1.3 **Hydraulic gradient, i :** The ratio of the water head (h) to the length of the flow path (L), which in this case is the geotextile thickness (t_o).
- 4.1.4 **Permittivity, ψ :** The volumetric flow rate of fluid per unit cross-section area, per unit head, in the normal direction through a geotextile. It is expressed as the ratio of the coefficient of permeability in the normal direction (k_n) to the thickness of the geotextile (t_o).
- 4.1.5 **Thickness, Nominal, t_o :** The distance between the upper and lower surfaces of a geotextile under a uniform loading of 2 kPa (measured as per CAN/CGSB-148.1 No. 3).

4.2 For definitions of other geotextile terms, refer to CAN/CGSB-148.2.

5. APPARATUS

- 5.1 The apparatus used for the normal permeability tests must be capable of maintaining a constant head of water on the geotextile being tested.
- 5.2 A schematic diagram of the apparatus is presented in Figure 1. The apparatus consists of a cylinder (1) and a stand (2) which fasten together. The geotextile specimen is positioned in the opening of the stand and is locked by a retaining ring (3) which fits in the same opening. All parts should be watertight.
- 5.3 Once the fabric is secured, different parts must be assembled on the stand (2) according to the variable to be measured:
- knife rings (4) and (5) control the area of the specimen available for flow through the fabric. Knife ring (5) should be watertight when attached to retaining ring (3)
 - the outlet (6) allows the determination of the constant water level (Note 1)
 - the lower reservoir (7) ensures that there is water on both sides of the textile specimen
 - the water inlet valve (12) allows a constant flow of water to be maintained
 - the graduate (9) allows collection of the discharge water that flows through the specimen (preferably a graduated cylinder).
- 5.4 The overflow (10) of the lower reservoir (7) must be located above the geotextile specimen installed in the stand and its diameter must be large enough not to offer resistance to flow.
- 5.5 Some required dimensions of the apparatus are shown in Figure 1.
- 5.6 Calibration of the apparatus must be performed before initial use, and when a modification has been made, to ensure that the apparatus is not the controlling agent for the water flow during the test. It will be necessary to establish a calibration curve of flow rate versus head for the apparatus alone in order to establish compliance with this requirement.

6. WATER PREPARATION

- 6.1 The test water shall be deaerated to provide reproducible test results.
- 6.2 Water should be deaerated for sufficient time to bring the dissolved oxygen content down to a maximum of 6 parts per million.

Note 1: The lowest outlet (6) should be located 20 mm above the geotextile specimen.

- 6.3 A dissolved oxygen meter or commercially available chemical kits may be used to determine the dissolved oxygen content.

7. TEST SPECIMENS

- 7.1 Prepare four specimens of the geotextile in accordance with CAN/CGSB-148.1 No. 1/ISO 9862 avoiding sampling along the edges of the geotextile roll to insure homogeneity of the specimens.
- 7.2 The diameter of each specimen should be equal to the larger diameter of the opening in the stand (2). (The required diameter [d] is greater than 40 mm but should not exceed 150 mm.)

8. PROCEDURE

- 8.1 Soak the specimens in a vessel containing deaerated water, at room conditions, for a period of 2 h to ensure saturation of the geotextile.
- 8.2 Fasten knife ring (4) to the stand (2), and then attach the stand to the lower reservoir (7).
- 8.3 Connect drain valve (11) to upper reservoir (8). Close valve at discharge (10). Open drain valve (11) and allow water level to rise from the bottom to the level of the overflow (10), at the top of the reservoir (7). Close valve at the drain (11).
- 8.4 Place the water saturated specimen in the opening in the stand (2) and secure it with the retaining ring (3). To avoid any evacuation of water from the saturated specimen, the specimen has to be installed under the water level.
- 8.5 Install knife ring (5) on the stand (2).
- 8.6 Install the cylinder (1).
- 8.7 Open valve (11) until water fills the cylinder (1) to the outlet (6). This step is needed to flush out any air bubbles located in the apparatus. Close valve (11).
- 8.8 Open water inlet valve (12) and adjust water flow from reservoir (8) to maintain a constant water head. Then fully open the valve at discharge (10) of the reservoir (7). If the constant head cannot be maintained when the outlet (6) is located at 350 mm, open the valve at the next lower outlet located on the cylinder (1) and adjust the inlet water flow to maintain a constant water head.
- 8.9 Take three successive flow measurements (Q) using the graduated cylinder (9) to verify that the discharge flow is constant. Measure the water temperature.
- 8.10 Open the valve at the next lower outlet located on the cylinder (1) and adjust the inlet water flow to maintain a constant head of water.
- 8.11 Repeat par. 8.8 and 8.9 thus giving flow rates for at least three different heads of water.
- 8.12 Close the water inlet valve and drain the water out of the apparatus using the drain valve (11).
- 8.13 Disassemble the apparatus and remove the tested specimen.
- 8.14 Perform calculations described in par. 9.1.
- 8.15 Start the procedure from par. 8.1 with the second specimen. Use the head determined in par. 9.1. Do not perform par. 8.9 or 8.10.
- 8.16 Repeat with the third and fourth specimens.
- 8.17 If not already known, determine the thickness of the geotextile in accordance with CAN/CGSB-148.1 No. 3.

9. CALCULATIONS

- 9.1 For the first specimen, plot the curve of the flow rate per unit area (Q/A) versus hydraulic gradient $\frac{(i = h)}{t_o}$. The initial straight line portion of the curve defines the region of applicability of the Darcy's law. Record the higher measured hydraulic gradient on the linear portion of the curve and use the corresponding outlet (6) for testing the remaining geotextile specimens (see par. 8.15).

- 9.2 Calculate the normal water permeability coefficient, k_n , for each specimen from the following equation:

$$k_n = \frac{Q R_t t_o}{A \cdot \Delta h} \text{ for water at } 20^\circ\text{C}$$

where:

- k_n = normal permeability in m/s
 Q = water flow through the specimen in m^3/s
 A = surface area of the geotextile specimen in m^2
 t_o = geotextile nominal thickness in m
 Δh = water head in m
 R_t = temperature correction factor as per Figure 2

- 9.3 Compute the permittivity of the geotextile using the following equation:

$$\psi = \frac{QR_t}{\Delta h \cdot A}$$

where ψ = permittivity in s^{-1} (m/s-m)

10. ACCURACY AND PRECISION

- 10.1 The accuracy of this testing procedure can range between 10 and 50% resulting from the fluctuation of geotextile characteristics.
- 10.2 Data obtained during an interlaboratory test program indicated that results between different apparatus can vary by a factor of two which is within accepted practice.

11. REPORT

- 11.1 Report the geotextile identification, the nominal thickness (t_o), and the surface area (A). Present in tabular form for each specimen: the water temperature, the constant water head (Δh), the measured flow rate (Q), and the calculated normal permeability (k_n) and permittivity (ψ) at 20°C .
- 11.2 Include in the report the plot of the flow rate per unit area versus hydraulic gradient (par. 9.1).
- 11.3 Report the number of this method: CAN/CGSB-148.1 No. 4-94.

12. NOTES

- 12.1 **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.

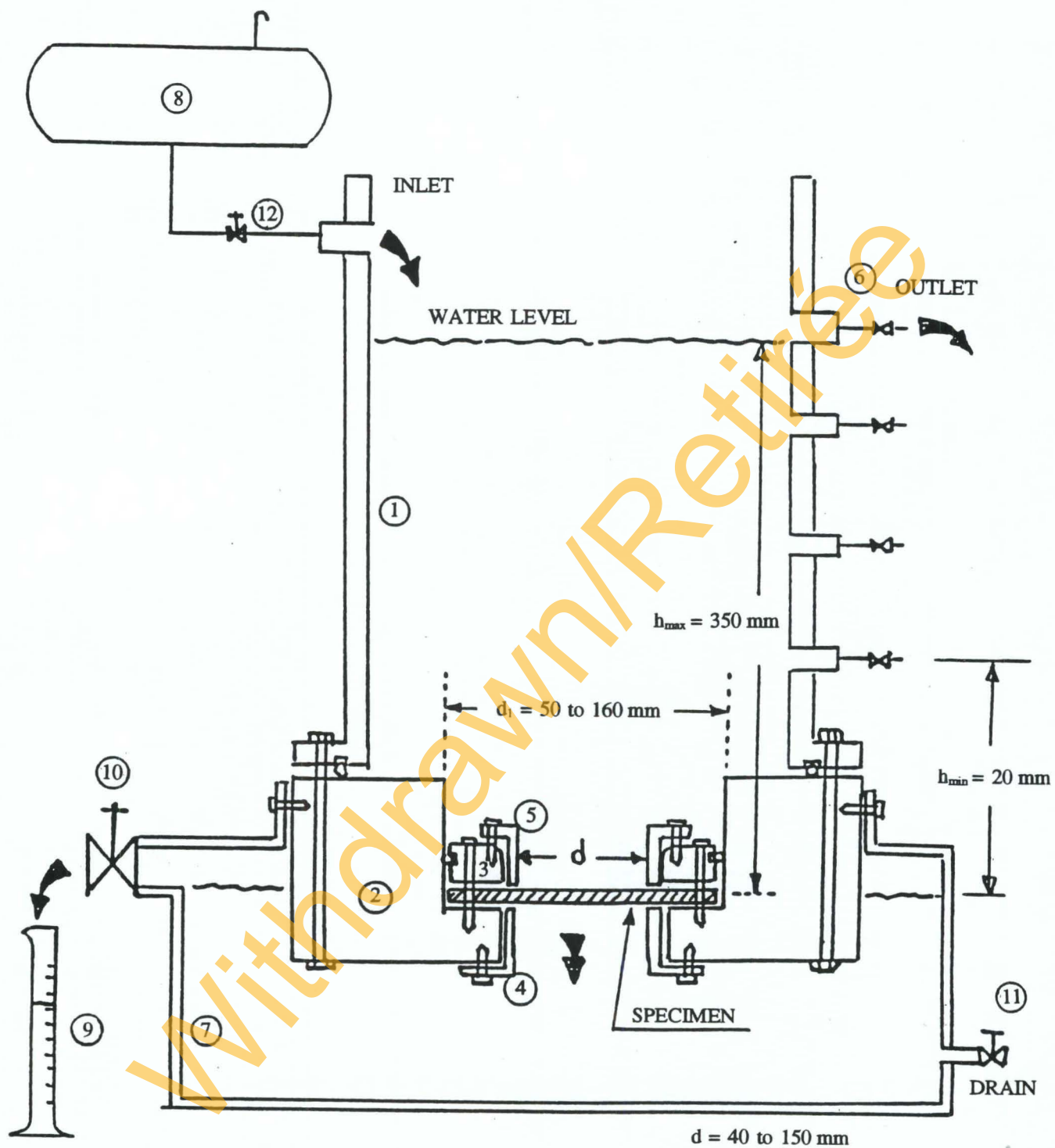


FIGURE 1
Test Apparatus

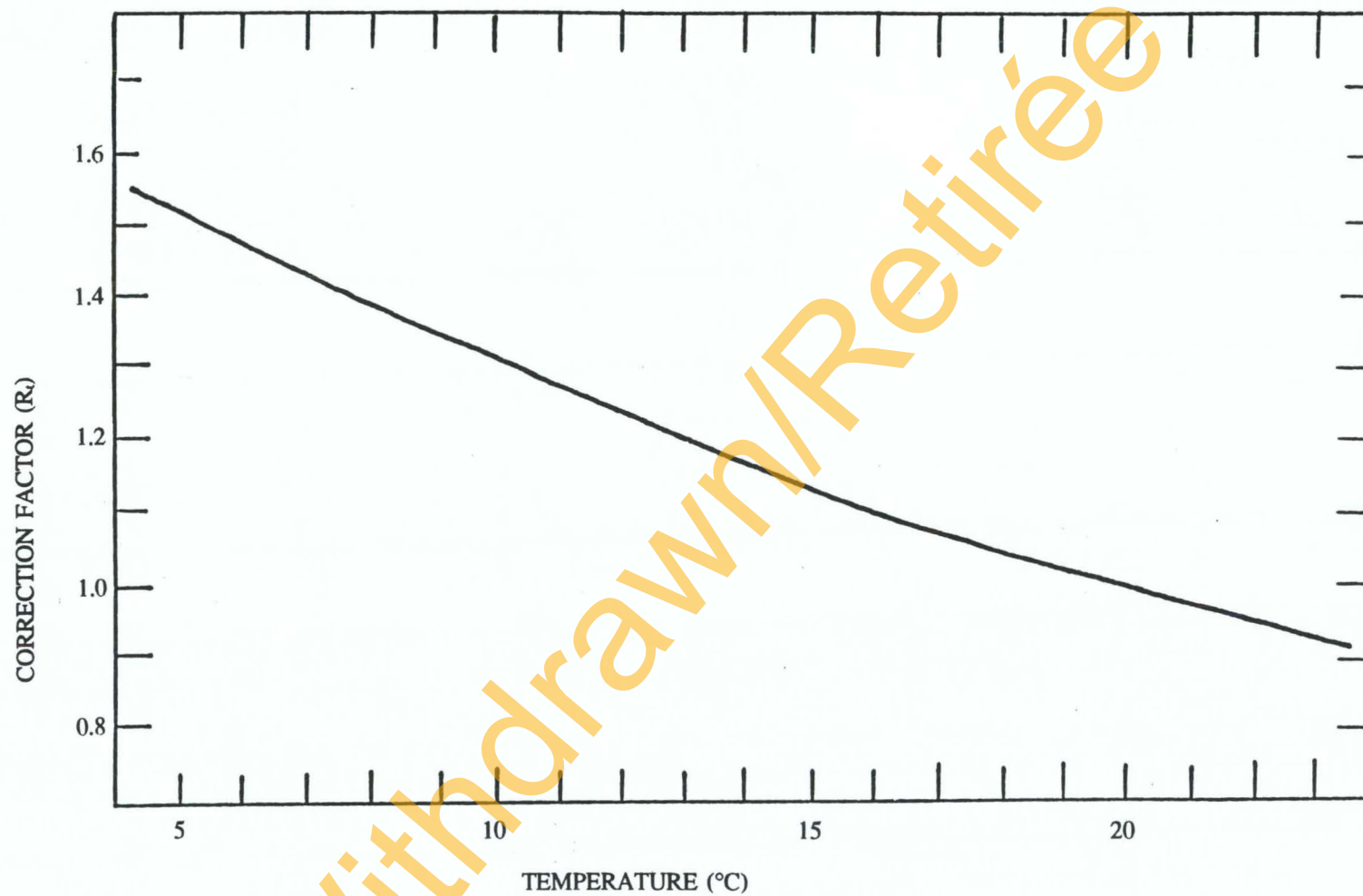


FIGURE 2
Correction Factor R_t as a Function of Temperature



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