

Australian Standard[®]

AS 3706.10.1—2012

Geotextiles—Methods of test

Method 10.1: Determination of transmissivity— Radial method

1 SCOPE

This Standard sets out the method for determining the transmissivity of geotextiles by measuring the rate of flow of water in the plane of the fabric under a constant head using a radial flow apparatus.*

NOTES:

- 1 Transmissivity is the preferred measure of the in-plane water flow capacity of a geotextile.
- 2 This method may have limitations for materials where the transmissivity varies with direction of flow.
- 3 The transmissivity of the fabric varies with other contact surfaces, compressive stress and hydraulic gradient.

2 APPLICATION

This Method is applicable to non-woven or composite geotextiles. It is not applicable to high-flow capacity geocomposite sheet drains.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

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| 3704 | Geotextiles—Glossary of terms |
| 3706 | Geotextiles—Methods of test |
| 3706.1 | Method 1: General requirements, sampling, conditioning, basic physical properties and statistical analysis |

RILEM

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| SM-10 | Synthetic membranes—Geotextiles. Transmittivity |
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4 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 3704 apply.

5 PRINCIPLE

The flow of water through a single layer of geotextile under hydraulic load is measured.

NOTE: The determination of the transmissivity (θ) is based on Darcy's law. This means that θ is only a constant for a particular material of given thickness and confining pressure if laminar flow conditions exist, which is likely for most geotechnical applications taking advantage of the in-plane drainage capacity of geotextiles.

* This method is based on RILEM SM-10, *Synthetic membranes—Geotextiles. Transmittivity*.

6 APPARATUS

The following apparatus is required:

- (a) Two metal plates covered on the surface exposed to the geotextile by a watertight elastomer. The dimensions of the metal plates shall be as follows:
 - (i) Outer radius of plates (r_1)..... 150 mm.
 - (ii) Radius of central water supply inlet (r_0)..... 25 mm.

NOTE: RILEM SM-10 recommends an elastomer of Shore hardness 60 ± 3 and a thickness of 2 mm.

- (b) Means of applying a measured load to the upper plate.
- (c) Supply of de-aired water. If the dissolved oxygen content in the de-aired water is more than 6mg/L, water that is used for this test shall be de-aired under a vacuum. Where de-aired water is not available, the dissolved oxygen content of the water that is used shall be measured and recorded.

If air bubbles or sediments are trapped in the fabric, its transmissivity could be reduced significantly. The formation and trapping of these bubbles and sediments on the fabric shall be observed visually and reported.

If de-aired water is not available, improved results may be obtained if the water is filtered upstream of the test specimen by a fabric similar to or finer than that being tested.

- (d) Water flow measurement device.
- (e) Piezometric tube on the water supply inlet.
- (f) Thermometer.
- (g) Dial gauge for measurement of specimen thickness under test, if coefficient of permeability is to be reported.

NOTE: A typical test arrangement is shown in Figure 1.

7 PREPARATION OF TEST SPECIMENS

7.1 Sampling

A minimum of five test specimens shall be sampled in accordance with AS 3706.1. The specimens shall be cut neatly to size to fit the metal plates, with the 25 mm radius supply inlet area cut out.

7.2 Conditioning

The specimens shall be wet-conditioned in accordance with AS 3706.1.

8 PROCEDURE

For each specimen, the procedure shall be as follows:

- (a) Measure and record the temperature of the test water.
- (b) Remove one specimen from wet conditioning and immediately place it in the apparatus. Visually inspect the specimen to ensure that it is thoroughly saturated and no air bubbles are trapped.
- (c) Apply a pressure of 100 kPa on the specimen area ($17\,180\text{ mm}^2$) for a period of 1 h, maintaining saturation of the specimen.
- (d) If the coefficient of permeability is to be reported, determine the thickness of the specimen under load, to 0.01 mm, in accordance with AS 3706.1.

- (e) After 1 h apply a hydraulic head of 500 mm.
NOTE: With some materials, a hydraulic head of 500 mm may be impracticable. In such cases, a different head may be used and reported.
- (f) Measure the flow rate of water through the fabric.
- (g) Repeat Steps (a) to (f) until a minimum of five specimens have been tested.
- (h) Reject any abnormal results in accordance with AS 3706.1 and test other specimens from the same roll.

9 CALCULATIONS

9.1 For each specimen

9.1.1 Transmissivity

The transmissivity (θ) shall be calculated as follows:

$$\theta = \frac{q_v}{2 \times \pi \times \Delta h} \ln \left(\frac{r_1}{r_0} \right) \quad \dots 9.1.1$$

where

- q_v = flow rate, in cubic metres per second
- Δh = head loss, in metres
- r_1 = outer radius of the plates, in millimetres
- r_0 = radius of the water supply inlet, in millimetres

9.1.2 Darcy coefficient of permeability

The in-plane Darcy coefficient of permeability (k_p) shall be calculated as follows:

$$k_p = \frac{\theta}{t} \quad \dots 9.1.2$$

where

- θ = transmissivity, in square metres per second
- t = thickness of specimen under test, in metres

9.2 Representative values

Representative values shall be calculated for transmissivity (θ) and Darcy coefficient of permeability (k_p) in accordance with AS 3706.1 as follows:

- (a) Mean.
- (b) Standard deviation.
- (c) Coefficient of variation.

Test results that were rejected in accordance with the provisions of Clause 8(h) shall not be included in the calculations; however, the rejected results shall be recorded and reported separately.

9.3 Requirements for further testing

9.3.1 Repeatability of results

Where the coefficient of variation calculated in Clause 9.2(c) exceeds 20%, additional tests shall be conducted to produce results within the limits of error specified in AS 3706.1. The number of test specimens required to be tested shall be calculated as shown in AS 3706.1.