

Water Flow through a Geotextile

Measuring Perpendicular Water Flow and Permittivity



Introduction

This Technical Note discusses the ways of measuring the water flow through a geotextile in a laboratory. This is an important property as it can be the critical factor in specifying a suitable geotextile for filtration such as the flow of water into a drainage layer. The main test methods are 'perpendicular water flow' and 'permittivity' which are similar but not identical methods. Wider information on the behaviour of filtration geotextiles is included in the Technical Note titled 'Geotextile Filtration' (ABG, 2020).

Perpendicular Water Flow, v

The perpendicular water flow through a geotextile (aka water flow normal to plane) is defined by EN ISO 11058 as the flow rate (in litres per second) divided by the area of the geotextile tested. The test is carried out at a hydraulic head of 50mm as shown in Figure 1. The perpendicular water flow is presented as a velocity as shown in the following expression:

$$v = \frac{\text{Flow rate}}{\text{Area}_{\text{geotextile}}} = \frac{\left[\frac{l}{s}\right]}{\left[m^2\right]} = \frac{l}{m^2 \cdot s}$$

Permittivity, ψ

Permittivity is the standard method of measuring the flow rate of water through a geotextile. The method is most commonly used in the United States, in accordance with ASTM D4491 as shown in Figure 1. Permittivity is defined as the flow rate (in cubic metres per second), divided by the area of the geotextile tested, divided by the hydraulic head. ASTM D4491 specifies a hydraulic head of 50mm for testing.

$$\psi = \frac{\text{Flow rate}}{\text{Area}_{\text{geotextile}} \cdot \text{Hydraulic head}} = \frac{\left[\frac{m^3}{s}\right]}{\left[m^2\right] \cdot [m]} = \frac{1}{s} = s^{-1}$$

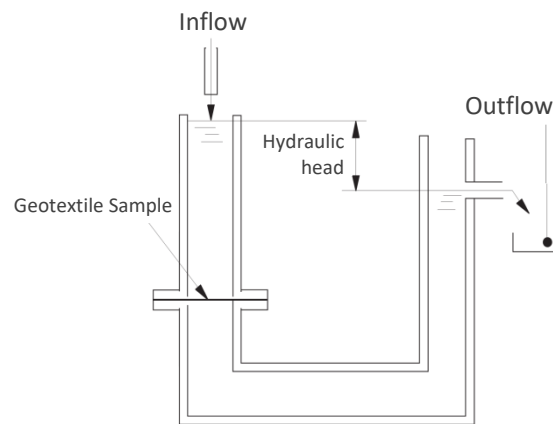


Figure 1: General arrangement for measuring water flow through a geotextile

Comparison

Both test methods are basically the same. The differences between these two reporting methods are; measuring water flow in l/s compared with m³/s and dividing the result by the hydraulic head (ASTM 4491) or not (EN ISO 11058). Since both test methods give results measured at 50mm hydraulic head, the values obtained can be easily converted by using a factor of fifty as follows:

Perpendicular Water Flow, v
(measured in accordance with EN ISO 11058)

$$v = 50 \cdot \psi$$

Permittivity, ψ
(measured in accordance with ASTM D4491)

References

ABG Geosynthetics (2020) *Geosynthetic Properties | Geotextile Filtration | ABG Technical Note*. [online] Available at: <http://www.abg-geosynthetics.com/technical/geosynthetic-properties-geotextile-filtration> [December 2020].

ASTM D4491 / D4491M-20, *Standard Test Methods for Water Permeability of Geotextiles by Permittivity*, ASTM International, West Conshohocken, PA, 2020, www.astm.org

British Standards Institution, BS EN ISO 11058:2019 – *Geotextiles and geotextile-related products – Determination of water permeability characteristics normal to the plane, without load (ISO 11058:2019)*