

## 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, $v$

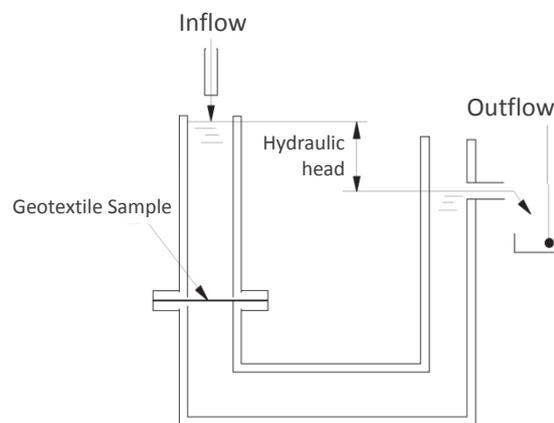
The test method for measuring perpendicular water flow (aka water flow normal to the plane) is defined by EN ISO 11058 and the test method is effectively the same as ASTM D4491. The difference is the perpendicular water flow is defined as the flow rate (in litres per second), divided by the area of the geotextile tested, but not divided by the hydraulic head. EN ISO 11058 also uses a hydraulic head of 50mm for testing and the result is presented as a velocity.

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

### Permittivity, $\psi$

Permittivity is measured in accordance with ASTM D4491 and is a method most commonly used in the United States. 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

The differences between these two reporting methods are; measuring flow in  $m^3/s$  compared with  $l/s$ , and dividing the result by the hydraulic head or not. Because both test methods report results measured at 50mm hydraulic head, this means that the results of these two methods are directly comparable and the results can be easily converted using a factor of fifty.

Perpendicular Water Flow, $v$ (measured in accordance with EN ISO 11058)	$v = 50 \cdot \psi$	Permittivity, $\psi$ (measured in accordance with ASTM D4491)
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### References

- ABG Geosynthetics (2020) *Geosynthetic Properties | Geotextile Filtration | ABG Technical Note*. [online] Available at: <http://www.abg-geosynthetics.com/technical/geosynthetic-properties-geotextile-filtration> [Accessed 14 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](http://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)*