# Permittivity and Transmissivity



## Permittivity (ASTM 4491 US terminology) vs perpendicular water flow to EN ISO 11058

Permittivity is quoted in units of s<sup>-1</sup> (reciprocal seconds), and is calculated as flow rate/(head x area) in consistent units. The default head value for flow measurement is 50 mm, but in certain circumstances it might be less; this probably would not affect non-wovens.

Perpendicular water flow is measured at 50 mm head (flow rate/area) and is usually expressed in litres per square metre per second  $(I/m^2.s)$ .

Numerically, the permittivity is equal to the  $l/m^2$  s value divided by 50.

The perpendicular flow rate  $(I/m^2.s)$  is equal to the permittivity x 50.

### **Example**

The perpendicular water flow of NW8/8 is 115 l/m<sup>2</sup>.s to EN ISO 11058. What is its permittivity?

Answer: Its permittivity is  $115/50 = 2.3 \text{ s}^{-1}$ .

Conversely a specification calls for a permittivity of  $2.0 \text{ s}^{-1}$ . What perpendicular water flow will meet this requirement?

Answer: 2 x 50 = 100 l/m2.s therefore NW8/8 would meet specification.

### Transmissivity vs in-plane water flow to EN ISO 12958

Transmissivity is quoted in units of  $m^2/s$  at a 'unit hydraulic gradient', which means that the actual flow rate measured at a hydraulic gradient of 0.1 is divided by 0.1, i.e. multiplied by 10!

Transmissivity (m<sup>2</sup>/s) = Flow (m<sup>3</sup>/m.s)/hydraulic gradient

= Flow (l/m.s) x  $10^{-3}$ /hydraulic gradient

#### Example

The flow capacity of Deck 600S is given as 1.4 l/m.s at HG 1 and 0.42 l/m.s at HG 0.1, measured in accordance with EN ISO 12958 using **soft platens** and at 100 kPa confining pressure.

Transmissivity of Deck 600S = Flow  $(I/m/s) \times 10^{-3}/Gradient$ 

= 
$$1.4 \times 10^{-3}/1$$
  
=  $1.4 \times 10^{-3} \text{ m}^2/\text{s}$  at HG 1 and 100 kPa

Transmissivity is not a uniform value for all hydraulic gradients; the transmissivity gets larger as the hydraulic gradient reduces. So doing the calculation again at HG 0.1:

Transmissivity of Deck 600S =  $0.42 \times 10^{-3}/0.1$ 

=  $4.2 \times 10^{-3} \text{ m}^2/\text{s}$  at HG 0.1 and 100 kPa

Conversely, a specification calls for a transmissivity of  $1.3 \times 10^{-2} \text{ m}^2/\text{s}$  at HG 0.1 and 100 kPa. To obtain required flow rate in l/m.s, multiply by the HG and by 1000.

Answer:  $1.3 \times 10^{-2} \times 0.1 \times 1000 = 1.3$  l/m.s **at HG 0.1 and 100 kPa** therefore Deckdrain 600S would meet specification.

ABG Permittivity and Transmissivity TECH NOTE