Recent Advances in Geotextile Filtration Design: Pore Opening Size Measurement using a Porometer or an Optical Test IGS Technical Committee on Hydraulics April 26, 2022



### Application of optical measurements for Manufacturing Quality Control of heat-bonded geotextiles

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### Overview

- Product concerned : Nonwoven heat-bonded Geotextile PP
  - Unit weight (EN ISO 9864): from 68gsm to 320gsm
  - Thickness (EN 9863-1) : from 0.3mm to 0.8mm
  - O90 range (EN ISO 12956): from 70 microns to 230 microns
  - Color:grey
- Our products are CE Marking certified and the opening size 0<sub>90</sub> according to ISO EN 12956 has to be controlled and specified.
- The method to determine the O<sub>90</sub> according to ISO 12956 is time consuming and it cannot be implemented in routine test.
- In our production Lab, since more than 20 years, an **optical tool** developed by an external company has been qualified to determine **quickly** (less than 20min) the **optical O<sub>90</sub>** and the **open area** (sum of pores areas divided by total analyzed area) and we use a **correlation** to get the O<sub>90</sub> values according to the ISO EN 12956.
- The release of the product is based on the optical O<sub>90</sub> and open area results.

#### **Principle of the optical method**





- The specimen moves in front of the camera and the pore size is measured by image analysis (1 image per s)
- Every pore is counted, measured and modelized by an ellipse with its two axes.
- Using the optical method we can acquire results for the entire length of the product (more than 1000 image analyses per specimen and 10.000 pores analyzed ).

### **Pores detection : threshold parameter**

The threshold command is used to gather information about the highlights and shadows in the image, and to locate where the pores are. It has to be defined based on a certain light intensity.



 $\rightarrow$  The threshold is the same for every product : [190-255] and with a fixed light intensity.

 $\rightarrow$  Only the pores (in white color) have to be take into account and not the filaments (a little more darker).

 $\rightarrow$  The size of the pore is defined by the small axis of the ellipse

# **Other device settings**

- Camera resolution : 1064x768 (about 250 pixels)
- Light intensity: 230 (or 3.63 Lux)
- **Exposure time :** 54ms
- Minimum criteria : pores <15μm are not taken into account
- Magnification factors : G2.5
- Calibration procedure :
  - 1/shift (8h) : verification of the light intensity (230 +/-3 or 3.63 Lux +/-0.06)
  - Every month (ISO check) : determination of the o<sub>90</sub> and Open Area on a reference specimen



090=200 μm +/-15

OA=15% +/-1

#### **Principle of the correlation**



- 4 times a year and for the whole product range (from 68gsm to 320gsm), the 090 according to EN ISO 12956 and according to the optical image analysis are measured on the same production roll.
- The correlation is checked once a year.

# **Reports and data available**

#### • o<sub>90</sub> by channels (1 channel corresponds to 30cm):





#### Pore size distribution curve:



#### Statistics :

Poresize statistics		
Average O90	104	μm
Scanned area	10874	mm²
Opened area	1.7	%

 $O_{90} = 104 \mu m \rightarrow 90\%$  of the pores are lower than 104µm (small axis of the ellipse) Scanned area = 10874mm<sup>2</sup> → more than 900 images analyzed Opened area = 1.7 % → the pore area represents 1.7% of the total analyzed area

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# **Conclusions and limitations**

- This specific optical test method has been developed on basis of our product technology and is only applicable to our product.
- The effectiveness of this method has been proven with over 20 years of experience. We have not lost any certification due to the opening size property.
- In general, the optical method can be used only on thin products (difficult with thick needle-punched geotextiles).
- The threshold factor and the light intensity are the most important parameters and have to be adapted in function of the color and the manufacturing of the product (do not count as pores the filament,...)



#### **THANKS FOR YOUR ATTENTION**

**QUESTIONS ?**