GEOTEXTILE OPENING SIZE

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March 2019

This technical note focuses on the various past and present test methods, which have been used to characterize the soil particle retention ability of various geotextiles. TenCate Geosynthetics manufactures and markets both polypropylene woven monofilament and needle punched nonwoven geotextiles. These are the products of choice for filtration and drainage applications. **Slit film geotextiles should never be used for filtration and drainage applications.**

Woven monofilament geotextiles are 2-dimensional products with a distinct orientation of fibers, uniform opening size and a high percent open area. These products typically have an Apparent Opening Size (AOS) larger than or equal to 0.212 mm (US Sieve 70) and a percent open area (POA) from 4% - 10%. In any application, a geotextile with a higher POA will generally be less susceptible to long-term clogging or blinding.

Nonwoven needle punched geotextiles are 3-dimensional products with random orientation of fibers and range of opening sizes. These products typically have an AOS less than or equal to 0.212 mm (US Sieve 70).

The opening size of geotextiles was measured by the Equivalent Opening Size (EOS) method (Test Method CW02215-77) until 1988 in Canada and 1993 in the U.S.A. The EOS of a geotextile is determined by dry sieving uniform particles (glass beads or sand) of a known standard sieve size through the geotextile. Successively finer sizes are tested to find the smallest size of particles that have 5% or less by mass passing through the geotextile. The value obtained is expressed either as a US Sieve # and/or mm. Assuming that geotextiles and screen mesh (sieves) have comparable retention ability, the EOS was a rational means of correlating fabric pore structure to an equivalent mesh size. The EOS method is no longer used by the geosynthetics industry and has been replaced with the AOS method.

The U.S.A adopted the AOS method ASTM D4751 in 1993. This test method (current standard ASTM D4751-16), although similar to the EOS method, is used to indicate the AOS in a geotextile that reflects the approximate largest opening dimension available for soil to pass through. The AOS is also determined by dry sieving uniform sized glass beads of a known standard sieve size through the geotextile until the weight of beads passing through the geotextile is 5% or less. Its value is expressed as a US Sieve # and/or in millimeters.

The Ministry of Transportation of Ontario, together with several eastern provinces, adopted the Filtration Opening Size (FOS) method (CAN CGSB148.1 No.10) in 1990. The FOS of a geotextile is determined by wet sieving a well-graded mixture of glass beads through a geotextile. The glass beads are forced through the geotextile under hydrodynamic forces rather than by a shaking action. The geotextile specimens are alternately plunged in and out of a water tank for

exactly 1000 cycles. At the end of the test, the water in which the specimens have been immersed is decanted and the glass beads retained on the geotextile sample are collected. The glass beads collected are then graded to obtain a particle size distribution. The D95 of the soil is determined and is expressed in microns.

For comparison purposes EOS and AOS values can be interchanged. However, this cannot be said for the relationship between EOS/AOS and FOS. The values obtained from FOS testing are different from those obtained from the EOS/AOS test method. For example, Mirafi® 1100N has an AOS of 0.150 mm (150 microns) but has an FOS of .070 mm (70 microns). In general, the thicker the geotextile, the lower the FOS, i.e. Mirafi® 1100N will always have a FOS value lower than Mirafi® 160N.

Please note that AOS, FOS, and EOS do have some significant shortcomings. While these tests are not completely destructive, setting the fabric in the sieve can lead to inaccurate results due to distortion of the sample from over handling. These tests do not have the ability to distinguish between material defects such as a singular larger hole that does not reflect the typical properties or product characteristics of the material. Other problems with these tests include: electrostatic effects; testing beads sticking together; damaged/fractured beads; and beads becoming trapped in the material through friction.

The most obvious issue encountered in the AOS, FOS, and EOS tests is that these test methods provide only a single opening size value. Most geotextiles typically have a range of different opening sizes, but the distribution of these various opening sizes across the surface of the geotextile cannot be characterized from these test methods. An alternative test method, ASTM D6767 - Pore Size Characteristics of Geotextiles by Capillary Flow Test, has been developed to address the above concerns regarding overhandling, glass bead problems, and it provides pore size distribution of various opening-sizes (range of geotextile opening sizes) that a specific geotextile offers. Please refer to the TenCate Tech Note "Understanding Porometer versus AOS Testing of a Geotextile". for more information.

Contact your local TenCate Geosynthetics representative for technical support and product recommendations.