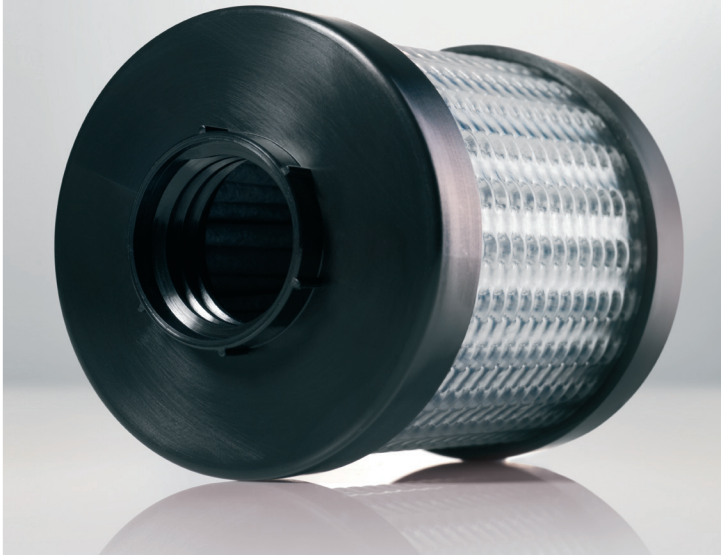


Nonwoven Flow Rate – Membrane Efficiency

Ahlstrom Disruptor® Nonwoven filter media



The patented Ahlstrom Disruptor® technology is based on grafting 2 nm x 250 nm alumina fibers of the mineral pseudoboehmite to a microglass carrier fiber. This technology creates a filter media that has a very high electropositive charge potential that removes submicron contaminants through electroadsorption, not mechanical filtration. This charge field covers essentially the entire void volume of the filter media to disrupt the natural path of the contaminant as it traverses through the pore structure of the filter media until becoming adsorbed by the alumina fibers. The pore size of the nonwoven media has been designed such that the capture cross section of the 0.7 micron pore by the charge field is total. The contaminants must pass through approximately 400 pores in the Z direction of the depth filter media that are totally covered by the charge field generated by the alumina fibers. This is the reason that a 0.8 mm thick media with a 0.7 micron mean pore size can efficiently remove virus, bacteria, colloids, organic acids, cell debris and other submicron particles at very high flow rates and very low pressure drop.

This design gives the media >3LRV of MS2 virus (0.027 um), >4 LRV of B. Diminutia bacteria (0.3 um) and > 4 LRV of cryptosporidium (3.0 um). Testing has also found the media to be able to remove certain species of dissolved metals, PCB's and trace pharmaceuticals. This feature can provide significant benefits for both potable and waste water processing. The Ahlstrom Disruptor® nonwoven filter media can be easily converted using standard converting equipment to fit nearly any flat sheet, pleated or lenticular filter design.

Continuing work with laboratories, universities and commercial partners shows that Ahlstrom Disruptor® is effective in removing polysaccharides or Transparent Exopolymer Particles (TEP) from fresh, brackish and salt water. TEP is gaining attention in the RO industry as possibly being the major cause of membrane biofouling. Removal of TEP with Ahlstrom Disruptor® filter media can be a cost effective component as part of the RO pretreatment train to improve flux rates and lower energy costs in all RO membrane market segments.

Ahlstrom Disruptor® PAC

In addition to containing alumina fibers, Ahlstrom Disruptor® PAC also contains 32% by weight of powdered activated carbon (PAC) with an average particle size of only 8 microns. PAC at this particle size produces remarkably high dynamic adsorption as compared to nonwovens containing granular carbon. Since no adhesives or binders are used in manufacturing Ahlstrom Disruptor® PAC all the pores of the PAC available for adsorption of chlorine, iodine, volatile organic compounds (VOCs), disinfection by products (DPBs) and organic acids from water.

Even with 32% PAC added, all the alumina fibers remain available to remove particulate and colloidal contaminants as effectively as Ahlstrom Disruptor® without PAC. Testing has determined that unlike microfiltration (MF) or ultrafiltration (UF) polymeric membranes, Ahlstrom Disruptor® PAC is very effective in removing humic compounds. Removal of humic compounds prior to disinfection

can reduce or eliminate the disinfection by products (DBPs) that are often created due to their interaction with chlorine or bromine.

Health Safety and the Environment

Being a naturally occurring element, boehmite has none of the known HSE issues surrounding other nanofibers such as single and multiwalled carbon nanotubes. Boehmite has long been used as an additive to food products, digestive analgesics, industrial applications and as an adjuvant for human vaccines. Submicron boehmite has been commercially manufactured for many years for use in refractory materials and fillers. The manufacturers of the media classify it as a nontoxic nuisance dust. This media has passed testing to NSF/ANSI standard 61 for potable water contact, USP Class VI testing and endotoxin testing.

Typical Properties of Ahlstrom Disruptor® Grades

| Grade | | 5281 | 5282 | 5283 | 5284 | 5288 | 5289 |
|----------------------|-----------------------|--------------------------------|---------------------------------------|--------------------------------|---------------------------------------|---|--|
| Revision | | Rev 1 | Rev 0 | Rev 0 | Rev 0 | Rev 0 | Rev 0 |
| Revision Date | | 22/05/2008 | 17/07/2008 | 18/07/2008 | 18/07/2008 | 30/12/2010 | 30/12/2010 |
| Description | | Cellulose Disruptor® Laminated | Carbon Cellulose Disruptor® Laminated | Heat Seal Disruptor® Laminated | Carbon Heat Seal Disruptor® Laminated | Heat Seal Disruptor® with Antimicrobial Laminated | Carbon Heat Seal Disruptor® with Antimicrobial Laminated |
| Weight | lbs/1389 ft² | 90.70 | 90.70 | 90.70 | 90.70 | 90.60 | 90.60 |
| Weight | oz/yd² | 9.40 | 9.41 | 9.41 | 9.41 | 9.40 | 9.40 |
| Weight | g/m² | 319.00 | 319.00 | 319.00 | 319.00 | 318.00 | 318.00 |
| Thickness | mils | 36.00 | 34.50 | 40.50 | 34.50 | 39.00 | 38.50 |
| Thickness | mm | 0.91 | 0.88 | 1.03 | 0.88 | 0.99 | 0.98 |
| Rapidity | mls/min | 5.00 | 5.00 | 8.00 | 9.00 | – | – |
| Frazier Permeability | cfm/ft² | 0.40 | 0.40 | 0.55 | 0.60 | 5.50 | 5.00 |
| Tensile Strength | lbs/in MD | 13.00 | 17.00 | 18.00 | 13.00 | – | – |
| Retention | Mean Flow Pore | 0.70 | 0.70 | 1.20 | 0.80 | – | – |
| Wet Burst | inch H ₂ O | >250 | >250 | >250 | >250 | >250 | >250 |

Antimicrobial Statement Regarding Ahlstrom Disruptor® Products

Ahlstrom Disruptor® products can be treated with antimicrobial product protection. Materials utilizing naturally occurring silver are frequently used to protect products from bacterial and fungal growth. Such treatments are recognized in a broad range of regulatory requirements including EPA, FDA, NSF, USDA, European BPD and FSA. Such a use of silver is an environmentally intelligent treatment, allowing used filters to be disposed of in standard waste facilities. While antimicrobial product protection can prevent the growth of odor-causing microbes, protection is limited to the treated article. It does not further enhance the Ahlstrom Disruptor® filter's ability to protect against disease.

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