

What is a HEPA Filter?

HEPA is an acronym which stands for High Efficiency Particulate Air. HEPA filters provide a very high level of filtration efficiency for the smallest as well as the largest particulate contaminants. As defined by the Institute of Environmental Sciences and Technology, IEST-RP-CC001.3 and MIL-STD-282 Method 102.9.1, a HEPA filter must capture a minimum of 99.97% of contaminants at 0.3 microns in size.

The 0.3 micron benchmark is used in efficiency ratings, because it approximates the most difficult particle size for a filter to capture. HEPA filters are even more efficient in removing particles that are smaller than 0.3 microns and larger than 0.3 microns. The fact that a HEPA filter's removal efficiency increases as particle size decreases below 0.3 microns is counter intuitive. However, this is a proven and accepted fact in the filtration sciences. The filtration mechanisms below explain how a HEPA filter does this.

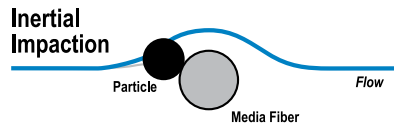
Filtration Mechanisms

There are four basic ways media captures particles:

Inertial Impaction

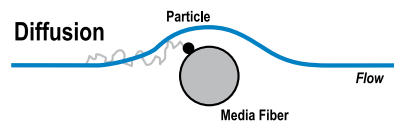
Inertia works on large, heavy particles suspended in the flow stream.

These particles are heavier than the fluid surrounding them. As the fluid changes direction to enter the fiber space, the particle continues in a straight line and collides with the media fibers where it is trapped and held.



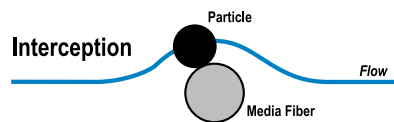
Diffusion

Diffusion works on the smallest particles. Small particles are not held in place by the viscous fluid and diffuse within the flow stream. As the particles traverse the flow stream, they collide with the fiber and are collected.



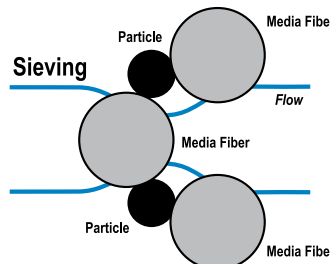
Interception

Direct interception works on particles in the mid-range size that are not quite large enough to have inertia and not small enough to diffuse within the flow stream. These mid-sized particles follow the flow stream as it bends through the fiber spaces. Particles are intercepted or captured when they touch a fiber.



Sieving

Sieving, the most common mechanism in filtration, occurs when the particle is too large to fit between the fiber spaces.



What Are The Principles Behind Filtration?

The filter efficiency chart below (Figure 1) represents a filter that is approximately 90% efficient against a range of particle sizes. A HEPA filter would follow the same filtration principles but would have a total filtration efficiency greater than 99.97% (Figure 2, next page). In other words, the worst that a HEPA filter would perform would be to capture 99.97% of particles.

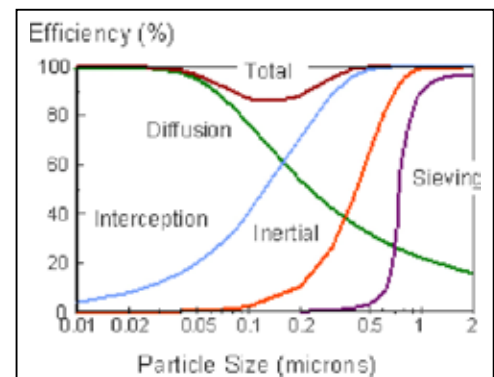


Figure 1 - Filter Efficiency vs. Particle Size

There's No Such Thing as "True HEPA"

The terminology of "True HEPA" is a loosely used marketing term. Various industries and institutions have different specifications as to how they define HEPA. For example the European Standard EN1822-1 defines a HEPA filter as ranging from 85% to 99.995% efficient against a 0.3 micron challenge. The standard adopted by commercial aircraft manufactures and many other industries is MIL-STD-282 Method 102.9.1 which requires the filter to capture 99.97% of 0.3 micron particles.

Figure 2 illustrates how a HEPA filter, as defined by MIL-STD-282 Method 102.9.1, performs compared to lower efficiency filters.

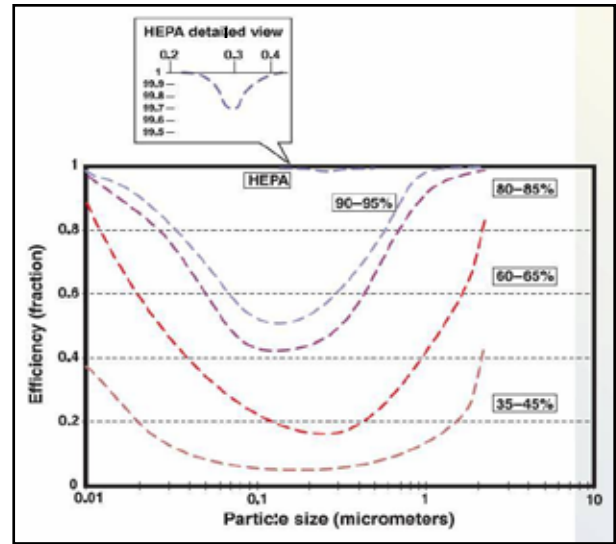


Figure 2 - Detail of HEPA Filter Efficiency vs. Particle Size

What does "Microbially Tested" mean?

Microbially tested simply means that a filter was tested against a particular bacterial, fungal, or viral particle challenge. Many industry and university studies have shown that a HEPA filter provides the same removal efficiency against a viable or a non-viable particulate challenge of the same size. The physical laws at work governing the removal efficiency of a filter media do not discern between a viable and a non-viable particle. The same capture mechanisms apply. Thus, the removal efficiencies for a viable and a non-viable particle are equivalent. The removal efficiency of the HEPA media against a 0.027 micron viral particle is dominated by the diffusion filtration mechanism. This mechanism provides a very effective means of removing very small particles, such as viruses. In fact, the smaller the particle, the higher the removal efficiency due to the diffusion filtration mechanism.

Independent Test Results for Donaldson Filter Media

An independent research study conducted by Nelson Laboratories reported that our HEPA filter media achieved a viral removal efficiency greater than 99.99909% and a bacterial removal efficiency greater than 99.99996%.

Beyond the protection offered by our standard HEPA filter, we also offer an enhanced microbial barrier in our BIOAdvantage™ Antimicrobial HEPA Filtration Technology. The BIOAdvantage Antimicrobial HEPA filter media was also tested by the experts at Nelson Laboratories and achieved a viral removal efficiency greater than 99.9996% and a bacterial removal efficiency greater than 99.99996%.

The BIOAdvantage product line is designed specifically for the airline industry and is PMA approved from most Boeing and Airbus aircraft. BIOAdvantage filters are completely interchangeable with current commercial aircraft air recirculation filters.



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Brochure No. F112202 (1/11)

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