



# Vacuum Filtration Technology for Industrial Applications

## The Science of Filtration

### Why Filtration is Important

Efficient filtration is critical to the cleaning success of your industrial vacuum cleaner. After all, you want the dust and debris you collect to remain safely confined within your vacuum, not be exhausted back into the air.

Nilfisk CFM offers you a complete line of filters designed for the safe, efficient collection of nuisance and hazardous materials. They're ideal for the control of food ingredients, pharmaceutical powders, lead, asbestos, powder paint, metalworking fluids, silica, pesticides, and more. For cleanroom environments, we offer HEPA-filtered and ULPA-filtered vacuum cleaners that meet standards up to ISO 4 (Class 10).

### Vacuum Filtration Methods

Nilfisk and Nilfisk CFM vacuums use three proven filtration methods: chemical, mechanical, and multi-stage.

#### Chemical Filtration

Several Nilfisk vacuums use chemical filtration, which either transforms the physical characteristics of the gas/vapor, or captures and retains the gas/vapor safely in the vacuum. For example, Nilfisk Mercury Vacuums adsorb toxic mercury vapors and exhaust only clean air, while Nilfisk Vapor Vacuums use specialized filters to absorb and retain toxic vapors such as arsine, phosphine, and chlorinated solvents.

#### Mechanical Filtration

In mechanical filtration, particles are captured and retained by means of a physical barrier. Nilfisk vacuums accomplish this by a series of cloth, polyethylene, and/or paper filters that cleanse the vacuum's working air of particulate and exhaust clean air back into the surrounding environment. Following are descriptions of the four key factors that affect mechanical filtration:

**Particle Size:** The smaller the particle, the more difficult it is to filter because small particles can easily penetrate filter media that is too porous. Nilfisk filtration systems are designed to capture microscopic particles, including invisible particles that can adversely affect your product or enter your lungs and cause medical problems.

**Air Speed:** Also called velocity, air speed is the pace at which particles move through the hose and into the vacuum. The faster the particles travel, the deeper they penetrate the filter media. At high speeds, particles may build enough force to push through the pores of the filter material. Nilfisk vacuums combine cyclonic filtration with an oversized main filter to slow air down as it enters the machine, ensuring particles are captured on or between the fibers of the filter media.

**Filter Media:** Filtration efficiency is directly affected by the air-to-cloth (ATC) ratio, or relationship between the surface area of the filter media and the volume of air trying to pass through it. The lower the ATC, the more efficient the filtration system.

Filters with larger surface areas are more efficient because they have a larger area in which to trap particles. On the other hand, small filters clog quickly and a large airflow through such a filter will cause the debris to penetrate the filters. Therefore, the optimum condition is slow airflow through a large filter.

Designed with this in mind, Nilfisk vacuums are equipped with oversized main filters to lower the ATC ratio.

**Running Time:** Over time, debris will build up on the surface of a filter and embed itself into the filter material. The filter is most efficient just before it clogs because its pores become smaller, turning it into a finer filter. However, vacuum performance does not increase because there is little or no airflow to lift and move debris.

#### Multi-Stage Filtration

A multi-stage, graduated filtration system is built into all of Nilfisk vacuums. This system uses a series of progressively finer filters to capture increasingly smaller particles as they travel through the vacuum. The filters include a paper bag, a main filter, a microfilter, and a HEPA or ULPA filter.

## Filters For Every Application

**Paper Bag:** Paper bags are the first stage of filtration in many of our vacuums, and are available in two forms. Standard bags are two-ply; an inner lining captures particles, while air passes through the outer cellulose layer. With a filtration efficiency of 99.7% at 3 microns, the paper bag captures the bulk of large particles for easy collection and disposal. Particles smaller than 3 microns move through the paper bag to the next filter. For dust-free disposal, the container can be lined with a disposable polyliner.



The electrostatic paper bag offers finer filtration capabilities, retaining 97.8% of particles down to 1.5 microns. Its electrostatically charged inner lining is comprised of meltblown polypropylene to attract ultra-fine particles, enabling the bag to capture materials such as toner. *(Continued on next page)*

## Filters For Every Application

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**Main Filter:** Nilfisk and Nilfisk CFM main filters are oversized to provide maximum filter surface area. The extra large surface helps maintain a steady, even airflow, pro-longing filter life and ensuring optimum vacuum performance.

**Nilfisk Vacuum Main Filter:** The standard main filter is an oversized, napped cotton filter, which retains 99.8% of particles down to 3 microns. Napped cotton provides additional filtering area by furnishing depth to the filter.

Specialty main filters for the Nilfisk line include Gore-Tex and AES Polycomposite. Ideal for fine powder filtration, Gore-Tex membrane filters are non-stick and retain 99.995% of particles down to 0.33 microns using a smooth PTFE membrane. They can be used with Gore-Tex microfilters. AES Polycomposite filters achieve high separation efficiency when removing particles from the airflow, while maintaining a high airflow rate and low pressure. As a result, they enable longer running times by preventing filter loading. AES Polycomposite

filters retain 99.9986% of particles down to 0.5 microns and are ideal for abrasive particles such as cement, steel and ceramic dust. They can be used with AES Polycomposite microfilters.

### Nilfisk CFM Vacuum Main Filter:

The standard Nilfisk CFM main filter is polyester and retains 99.1% efficiency at 1.5 microns. The star-shaped pleats add surface area, lowering the ATC ratio and increasing filtration efficiency.



The Nilfisk CFM line features several specialty main filters. A PVC Membrane filter is ideal for fine powders, is capable of quick release during purging, and retains 99.9% of particles down to 1.5 microns. A Nomex filter withstands temperatures up to 220°C, and retains 98.4% of particles down to 1.5 microns. An anti-static main filter prevents static build-up and retains 99.7% of particles down to 1.5 microns.

**Microfilter:** Part of the multi-stage Nilfisk filtration system, the standard polyester microfilter protects the motor. It retains 99.5% of particles down to and including 2 microns.



**HEPA/ULPA Filters:** Nilfisk HEPA filters, the final stage of filtration, retain particles down to and including 0.3 microns. In Nilfisk CFM vacuums, the HEPA filtration is 99.999% efficient; in Nilfisk vacuums, it's 99.97% efficient. All HEPA filters are DOP-tested. For ultra-fine filtration, Nilfisk vacuums are available with an optional ULPA filter, which retains 99.999% of all particles down to 0.12 microns.



### Special Application Filters

**Cartridge Filter:** Designed for Nilfisk CFM vacuums, the cartridge filter retains 99.7% of particles down to 0.3 microns. Ideal for ultra-fine dusts, this non-stick filter captures dust on the surface, eliminating clogging. Dust is easily cleaned from the filter media (available for dry collection only). The filter is conductive and features Teflon coating for sticky dusts.



### Explosion-Proof Filter:

Designed for use in the Nilfisk three-phase explosion-proof vacuum, this specialty cartridge filter is ideal for the safe collection of materials in explosion hazard environments. It is anti-static, PTFE-laminated, and retains 99.95% of particles down to 0.5 microns. Due to its large size, the explosion-proof filter has a low ATC ratio.

### Porous Polyethylene Filter:

This filter is used in several wet/dry Nilfisk vacuums, and is ideal for collecting liquids. Its microporous plastic material is water, mildew, rot, and corrosion-resistant. The filter features 105 filter "fingers" with pores arranged in a labyrinthine design that trap particles on the surface and in their deep channels. It is completely washable and captures particles down to 1 micron.



### Why Controlling Airborne Particles is Critical To You

Small particles in the air, on the floor, and on your machinery can be dangerous for a number of reasons. Most importantly, they can contaminate your product and endanger your workers' health.

Nilfisk and Nilfisk CFM vacuums can filter down to 0.12 microns in size. One micron is equal to one millionth of a meter, or 1/26,000 of an inch. Particles 10 microns or less are considered respirable and can settle deep into the lungs – often causing adverse health effects. Respirable particles make up more than 99% of the 7 million particles in every breath you take.

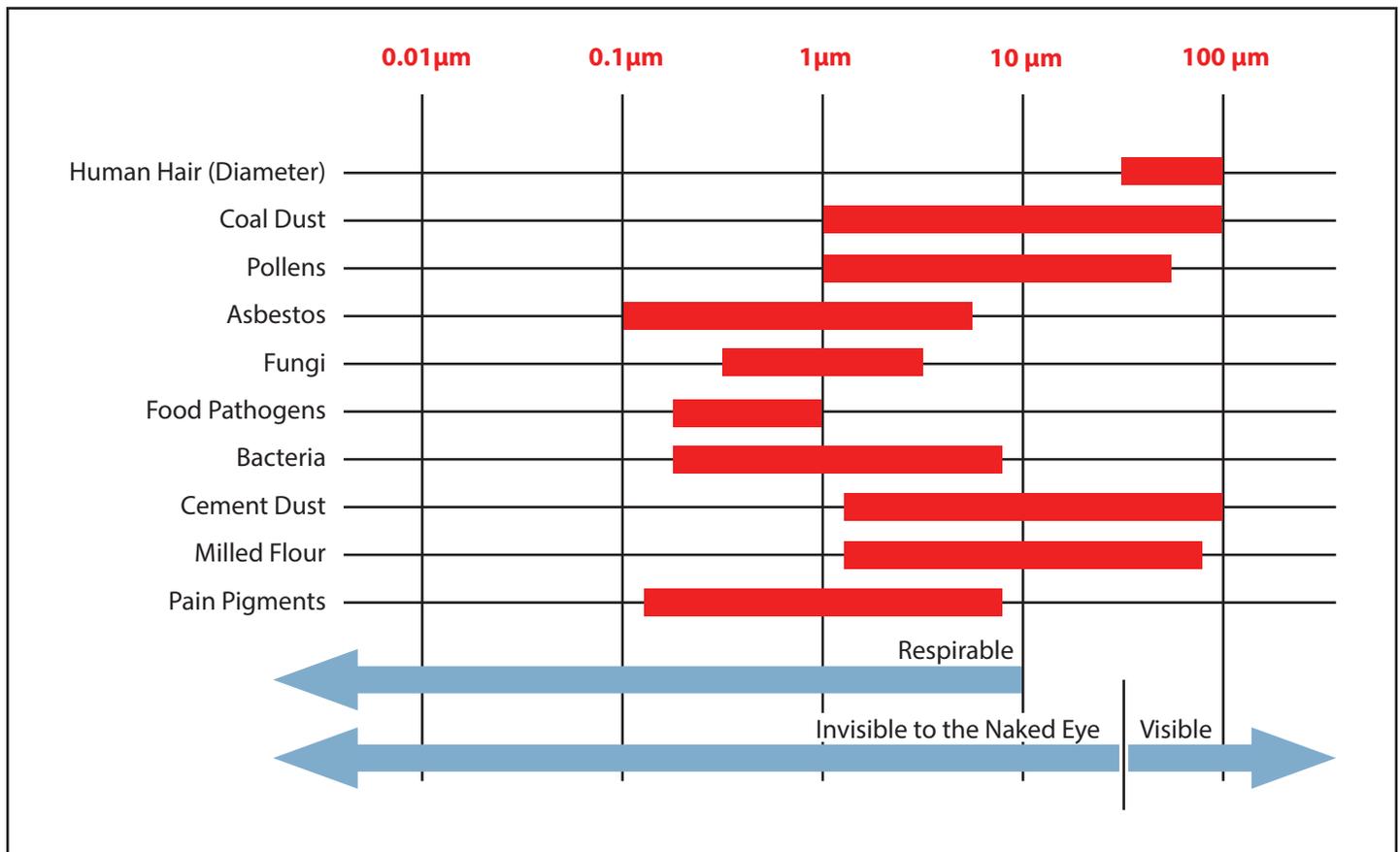
## High Performance Filters For Every Application

To ensure that your vacuum cleaner meets the dust-control requirements for your specific cleaning application, Nilfisk CFM offers a complete line of filters. Each filter is designed to optimize the performance of your Nilfisk CFM vacuum cleaner.

Nilfisk CFM's filters meet or exceed all standards for filtration efficiency. These filtration systems, including our HEPA (High Efficiency Particulate Air) and ULPA (Ultra Low Penetration Air) filters, can increase retention efficiencies to ensure that up to 99.999% of particles, down to and including 0.12 microns in size, are retained in the vacuum.

### Particle Sizes

The size of dust particles is measured in millionths of meters, called micrometers or microns (notated  $\mu\text{m}$ ). This chart shows the relative sizes of common particles in order to help you determine the Nilfisk filter most appropriate for your specific application.



### A Spotless Reputation...With a Guarantee to Prove It!

Nilfisk has earned their solid reputation by consistently producing top-quality vacuums and offering the industry's most complete selection of vacuum filtration options, attachments, and accessories. They back all of their products with an industry-leading 2-year warranty. Nilfisk CFM empowers you with complete buying confidence.

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