

Viledon Filters for Surface Technology: The Key to a Mirror-smooth Finish



viledon®

Freudenberg
Filtration Technologies



What you need to make dust disappear into thin air

For reasons of operational reliability and health, paint spray booths have to be supplied with large quantities of fresh air. In order to prevent the paintwork being damaged by airborne dusts and fibers, effective filtration of the supply air is essential. Fundamental criteria for dimensioning the filter systems include dust parameters like particle size distribution and dust concentration.

The fine distinction

Fine dusts $< 5 \mu\text{m}$ come from industrial and combustion processes, vehicles etc. They typically have a high content of carbon and sulfur.

Dust particles $> 5 \mu\text{m}$ come primarily from natural sources (sand, earth), and are predominantly composed of elements like silicon, iron, aluminium, etc.

In surface technology, the particle size range $> 10 \mu\text{m}$ is especially important, since these particles cause damage to the painted surface visible to the naked eye.

Conversely, particles $< 10 \mu\text{m}$ will be completely enclosed by the paint, and will not cause any visually perceptible surface impairment.

The proportion of the different particle size ranges in the air and the dust concentration

vary from place to place and are in addition affected by meteorological and seasonal factors. The average dust concentration is approx. 0.05 mg/m^3 , and (depending on the location and weather conditions involved) the air will contain up to 82,000 fibrous particles per m^3 .

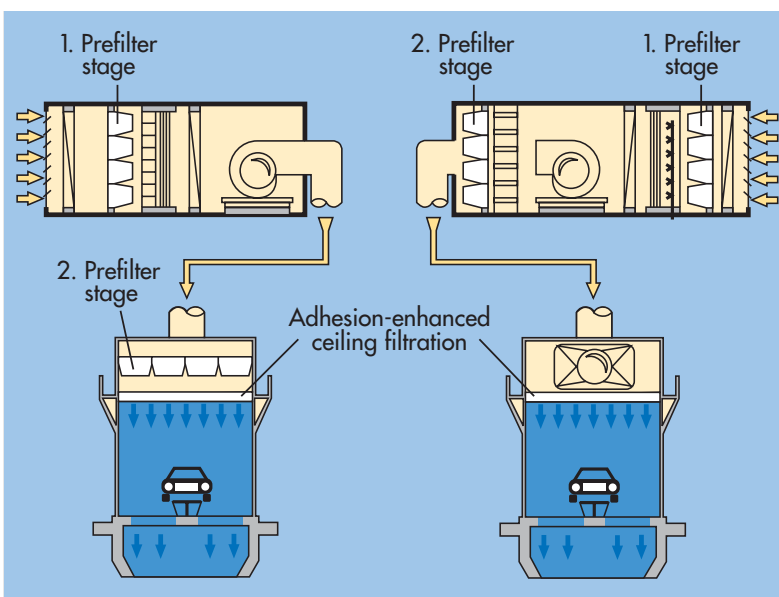
Making "doubly" sure

Potentially damaging dust and fiber particles can be prevented from penetrating into the paint spray zone only by a multi-stage supply air filtration concept. Given favourable conditions at the facility concerned, a 2-stage filtration system with a prefilter and a final/ceiling filter stage will suffice. Frequently, however, critical environmental or process conditions (like high dust loading or recirculated-air mode) will demand a second prefilter stage to make sure that the main dust content is effectively collected. This 3-stage filter concept offers maximized protection against damaged paintwork and economic advantages as well: air duct soiling is reduced (cutting your cleaning costs), and the useful life of the final fine filter installed in the ceiling is extended.

Last but not least

As the component closest to the actual paint process, the ceiling filter is the most important part of the system. Basically it has two tasks to perform:

- ▶ Final filtration of the precleaned supply air, this means reliable removal of any particles $> 10 \mu\text{m}$, which have either passed the prefilter system or have been generated downstream of it (lime particles from the humidifier, V-belt abrasion, rust, substances detached from the silencer and the duct system, etc.). These particles have to be permanently retained in spite of any system-inherent vibrations.
- ▶ Maximized consistency and minimized turbulence of air distribution and guidance inside the paint spray booth, to provide a smooth and even flow of clean air around the object being painted.



Viledon filters - A full range for brilliant paintwork

Dust situation: Concentration/ Fineness	1. Prefilter stage	2. Prefilter stage	Ceiling filter
low/coarse	G 35 SL G 3 F 40 G 4		
medium/ medium	F 50 F 5 T 60 F 6 MF 70 F 6		
high/fine	G 35 SL G 3 F 40 G 4	F 50 F 5 T 60 F 6 MF 70 F 6 MX 75 F 6 MX 85 F 7 MF 90 F 7/F 8	PA/500-10 F 5 PA/560 G-10 F 5
very high/ very fine	F 50 F 5 T 60 F 6 MF 70 F 6	MX 85 F 7 MF 90 F 7/F 8 MX 95 F 8 MF 95 F 8/F 9 MX 98 F 9	

Viledon filter combinations for supply air filtration in paint spray booths

The objective: mirror-smooth lustrous finishes - at an affordable cost

Choosing a cost-efficient filter combination always means selecting a customized package individually tailored to the locational factors involved, like the quality of the surrounding air, and the space available for installation, as well as any user-specific requirements.

For cost-efficient performance of a filter system it is vital that the filters are optimally matched in terms of their specific characteristics.

Basically, the first prefilter stage should incorporate filters of Classes G 3 to F 6 according to EN 779, which can be combined with appropriate filters of Classes F 5 to F 9 in the second prefilter stage. The final filter stage then comprises an adhesion-enhanced ceiling filter of Class F 5.

When planning new paint spray systems, increasingly stringent requirements for paintwork quality are often reflected in stipulations that as few particles as possible of >5 µm should

be present in the booth. A comparison of operating costs for various filter combinations has shown that fitting a G 4 model in the first prefilter stage and an F 6 in the second constitutes a particularly cost-efficient solution for this purpose if the dust situation is a normal one.

Compact filters taking over

Roll filters or filter mats sometimes still used as prefilters are being increasingly superseded by compact pocket or cassette filters. They offer high operational dependability, need almost no maintenance at all, and are very economical in use, thanks to low pressure drops and a resultant long lifetime.

In actual operation, Viledon Compact pocket filters and Viledon MaxiPleat cassette filters have proved particularly effective not only for filtering atmospheric aerosols, but also for arresting sticky paint particles (recirculated air, exhaust air, solvent adsorption).

Ceiling filters right on top

For the final filter stage, the use of the Viledon PA/500-10 or PA/560 G-10 ceiling filters is recommended. Both these filter mats are progressive in structure, permanently coated with an adhesive, and achieve the best possible rating in the highly critical Viledon migration test (see Page 6).

The ceiling filter's absolute dependability is crucial for reliable production quality in the paint spray process.

Everything it takes

The Viledon filter program for supply air filtration in paint booths is supplemented by special high-temperature filter packs for the paint drying zone as well as floor filter mats for paint mist arrestance.

It goes without saying that all Viledon filter media are self-extinguishing (DIN 53 438, Class F 1), and the floor filters are non-flammable in addition (DIN 4102).



Reg. No. 1420

Freudenberg
Filtration Technologies
Weinheim/Germany

Economical top performance in the first place: Compact pocket filters and MaxiPleat cassette filters



Compact pocket filters T 60



MaxiPleat cassette filter MX 95

State-of-the-art engineering saves you real money

The Viledon filter range has been designed for high filtration performance coupled with superlatively cost-efficient and dependable operation. Specifically, this means:

- ▶ Long lifetimes and high dust holding capacity due to special depth-loading filter media.
- ▶ Low pressure drops and resultant reduced energy costs, as the aerodynamically optimized design ensures even dust storage with full use of the filtering surface.
- ▶ Maximized operational reliability, thanks to synergized interaction of high-strength filter media, excellent dimensional stability and mechanical sturdiness, plus meticulous workmanship for completely leakproof filter elements.



- ▶ Viledon filters do not corrode, are 100% resistant to moisture, stand up well to most chemicals, and are fully incinerable.
- ▶ High-quality accessories, like a mounting frame made of stainless steel or galvanized sheeting, with a positive spring-lock system and a plug-in rubber seal.

Compact pocket filters:

Design credit points for mass storage

- ▶ The filter pockets are inherently rigid, weld-sealed, and foamed into the polyurethane front frame.
- ▶ Welded-in spacers ensure optimum aerodynamic shaping of the filter pockets.

MaxiPleat cassette filters:

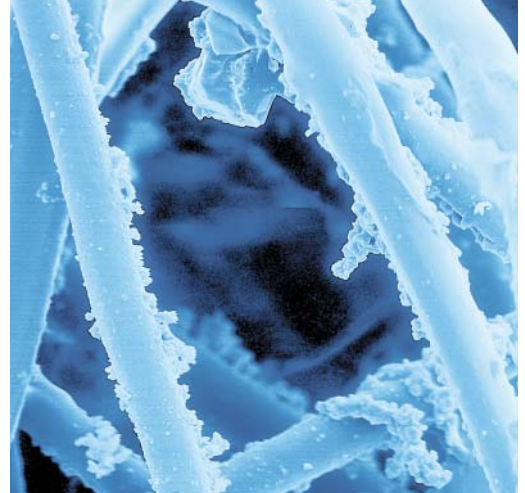
Technological quantum leap with patented production process

- ▶ The gentle thermal embossing process produces geometrically precise, extremely uniform pleats.
- ▶ The V-shape pleat geometry permits optimized, homogeneous air flow.
- ▶ The spacing is created by dimples in the filter medium – without any foreign materials.

Safety in the last instance: Ceiling filters PA/500-10 and PA/560 G-10



Ceiling filter PA/560 G-10



Dust deposits on adhesive-coated fibers

10 μm

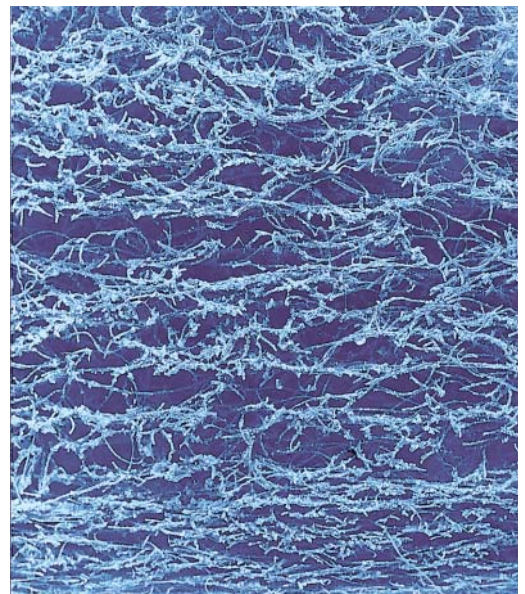
Always up-to-the-future

The sophisticated Viledon PA/560 G-10 and PA/500-10 ceiling filters, by virtue of their cost-efficient reliability, have long been standard equipment in the automotive industry. But good as they are acknowledged to be, there is always room for improvement: with an optimized fiber recipe and new manufacturing technology, we have satisfied the car-makers' increasingly stringent demands for eco-friendliness and environmentally harmless disposal.

So this is the new "eco-compatible" generation of these popular ceiling filters. The PA duo continue to guarantee practically 100% arrestance of particles $>10 \mu\text{m}$.

The "impenetrable two"

The PA/500-10 and PA/560 G-10 filter mats are made of synthetic-organic high-performance nonwovens, progressively structured in order to improve the dust holding capacity and the particle collection efficiency. Their excellent adhesive qualities are the result of effective fiber coating with optimally synergized adhesion enhancers. Even temperatures up to 100°C do not impair their efficiency. The clean-air sides of the PA duo are specially smoothed. The reliable fiber bonding prevents any shedding of fibers.



Progressive media structure

500 μm

The PA/560 G-10 version is additionally reinforced with a synthetic scrim on the downstream side, thus increasing the stability of the filter mat and preventing potential damage to the clean-air side during installation. This makes handling significantly easier, and reduces installation times.

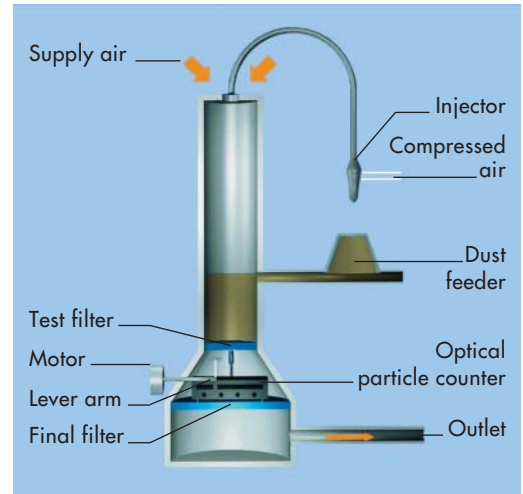
Will a filter “keep” all its promises? The Viledon migration test will tell.

The crucial grains of truth

The paramount criterion for ceiling filters in surface treatment applications is how good they are at preventing dust penetration. This means that even under unfavourable operating conditions like system-inherent vibrations, the dust particles must not detach themselves from the filter fibers once they have been collected.

The usual methods of testing are attuned to the requirements for air filters in general ventilation and air-conditioning applications. But these methods are not suitable for measuring and evaluating the criteria relevant to surface treatment jobs. This is why Freudenberg has developed a realistic method for determining the adhesion efficacy of filter media: the Viledon migration test.

In the Viledon migration test, the ASHRAE test dust, which is relatively adhesive due to its soot content, is replaced by a defined test dust consisting of free-flowing aluminium oxide particles ranging from 2 to 13 µm in size. In addition, the test rig enables booth ceiling vibrations to be simulated.



Migration test rig with optical particle counter

For detection reasons, approx. 300,000 particles >10 µm are dispersed per m³ upstream of the test filter. For comparison: in a real installation the particle concentration challenging the ceiling filter is approx. 10,000 times lower. For assessing the filter, the concentration of particles >10 µm on the clean-gas side is determined using a laser particle counter. The filter concerned is then assigned to one of the migration test classes, S0 to S3, depending on the test result obtained.

Viledon ceiling filters are a (migration test) class of their own: “S0”

The PA/500-10 and PA/560 G-10 ceiling filters with the “10 µm dimension” and a migration test classification of “S0” represent a new technical standard. Field studies have shown that only ceiling filters of the S0 migration test class offer the requisite protection over their entire operating lifetime. Filters in the S1 to S3 classes exhibit a significantly lower adhesion capability for dust particles, and thus constitute a risk.

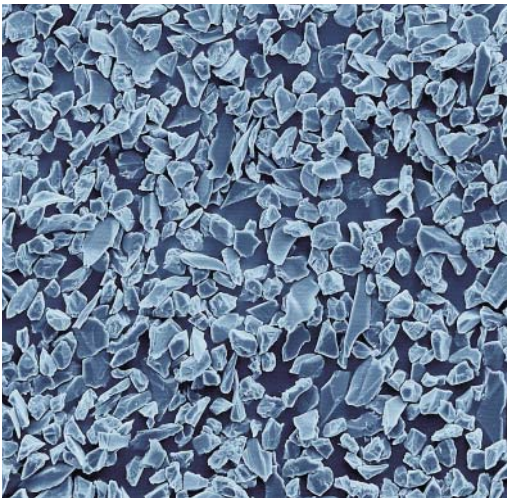
Type	Arrestance to EN 779	Viledon migration test	Particles >10 µm per m ³
Viledon PA/500-10 PA/560 G-10	98% 99%	S0	<10
Diffusion filter impregnated	97%	S1	<100
Diffusion filter sprayed	97%	S2	<1000
Viledon A3/300S	97%	S3	>1000
Glassfiber fine filter	97%	S3	>1000

Comparison of fine filter mats, using different test methods



Free-flowing test dust (fine)

50 μm 



Free-flowing test dust (coarse)

50 μm 

Adhesion enhancement in the endurance test

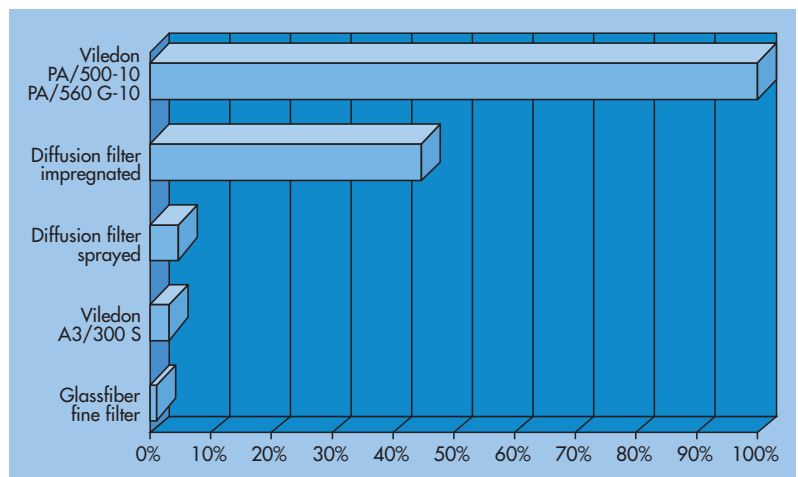
To simulate long-time behavior, the ceiling filter is loaded with free-flowing, adhesion-resistant coarse dust until the dust bonding capacity is no longer sufficient to maintain the original migration test class, or the collection efficiency drops below its initial value. The test result is a direct measure for the long-term stability of a filter's adhesion-enhanced finish (see diagram).

A complex system has its own idiosyncrasies

When properly installed and operated, Viledon ceiling filters offer maximized protection against damaging particles from the supply air flow.

Thanks to decades of empirical feedback from all over the world, however, we know that even with the best ceiling filtration possible there are still some more essentials which have to be satisfied if inclusions in the paintwork are to be dependably avoided, e.g.

- ▶ The object to be painted must be clean, with no dirt particles adhering.
- ▶ Staff's clothing must be produced and stored in such a way that no fluff can be set free into the surrounding air.
- ▶ The compressed air must be free of contaminants like dirt, water and oil.
- ▶ The paint must be free of contaminants or pigment agglomerates.

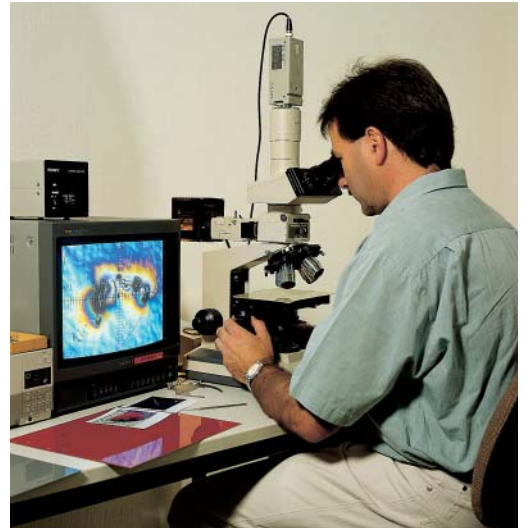


Relative dust bonding capacity (referenced to Viledon ceiling filters)

You don't have to bring your paint booth to us: Viledon on-the-spot filter tests



Particle counter for measuring the dust concentration on-site



Paintwork sample analysis in Freudenberg's laboratory

In paint booths it is not uncommon for paintwork to be damaged occasionally by dust or lint. The usual assumption is that the ceiling filter is not working properly or even releasing fibers.

Our service team will carry out measurements on-site in order to evaluate the actual filter performance. The use of an appropriate optical particle counter allows to collect information regarding number and size of the particles being in the booth in a comparatively short period of time. The membrane filter method in conjunction with a microscopic analysis will then enable these dust particles to be identified.

For this purpose, one air flow sample is taken directly below the ceiling filter and another one at working level. While sampling at working level, painting of the vehicle is simulated. This means the supply air delivered through the ceiling filter can be assessed separately from the air possibly contaminated subsequently by pollutants inside the booth.

Here is a short checklist which you may find useful in ascertaining the causes of any paintwork damage you encounter:

- ▶ Have the ceiling filters been properly installed without any leaks?
- ▶ Is the ceiling filter damaged?
- ▶ Have prefilter or ceiling filter reached their final pressure drop?
- ▶ Is there sufficient air flow?
- ▶ Does the booth have sufficient positive pressure?
- ▶ Is the air flow being uniformly distributed throughout the paint booth? Are there any uncontrolled air flows?
- ▶ Is it possible that dirt is coming off from staff clothing?
- ▶ Do external personnel have access to the paint booth?
- ▶ Are compressed-air filters and paint filters functioning perfectly?

If there's anything else you'd like to know, your Viledon advisor will be pleased to assist you!

Freudenberg Filtration Technologies KG

69465 Weinheim/Germany

Tel. +49 (0) 6201/80-6264 | Fax +49 (0) 6201/88-6299

viledon@freudenberg-filter.com | www.viledon-filter.com

