Dexwet Filter Technology

White Paper

Version 1.1

Introduction

Toner-based laser printing represents a very large global business. In Western Europe and the United States alone, more than US $51.9 billion in annual wholesale revenue is generated from the sale of laser printer hardware and supplies. Over 2,361 billion pages are printed each year, the majority on desktop laser printers.

Many of these desktop printers are placed in standard office environments, including large and medium-sized businesses, as well as small office/home office environments. In many cases, these printers are physically located in very close proximity to users.

Although printer manufacturers make significant efforts to meet health and safety regulations and produce systems and supplies that are safe for their customers, there have been articles written that suggest that there is a growing concern about potential particle emissions and the environmental impact on laser printer users, especially around ultra fine particles.

A series of recent studies indicate that during a standard business day, where laser printers are in use, the emissions of fine and ultra fine dust in a typical office environment during working hours are up to five times higher than those on a busy street; during non-working hours, up to twice as high.

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New Solutions for Laser Printers

There is new filter technology available that is designed to significantly reduce fine and ultra fine dust emissions by mounting the filter over the fan opening of the laser printer. Dexwet is bringing this unique technology to the marketplace for use with printers that utilize “out-blowing fans.” These Dexwet Filters are adaptable to suit different laser printer applications. With these filters fitted at the exhaust openings, air is able to exit the machines almost unobstructed, and without causing any significant increase to the machine’s internal temperature.

It is important to note that some printer models do not have an out-blowing fan. Instead, the fan blows inside the unit, which can, over time, lead to dust leaking out of various openings in the printer. In those instances, a fan filter will not significantly reduce emissions.

Definition of Fine and Ultra Fine Dust

Fine and Nano dust - also known as aerosols - are defined as airborne particles or droplets of solid or liquid materials. They range in size from less than 10 nanometers (billionths of a meter) to 10 micrometers (PM 10) in diameter.

Particle Sizes

1 m = 100 cm	1 cm = 10 mm	1 mm = 1000 µm	1 µm = 1000 nm	1 nm = 10 A	1 Angström = ca.750 MG/Dalton

Potential Impact of Fine and Ultra Fine Dust

Particular Matter (PM) affects more people than any other pollutant.

Source: http://www.who.int/mediacentre/factsheets/fs254/en/index.html

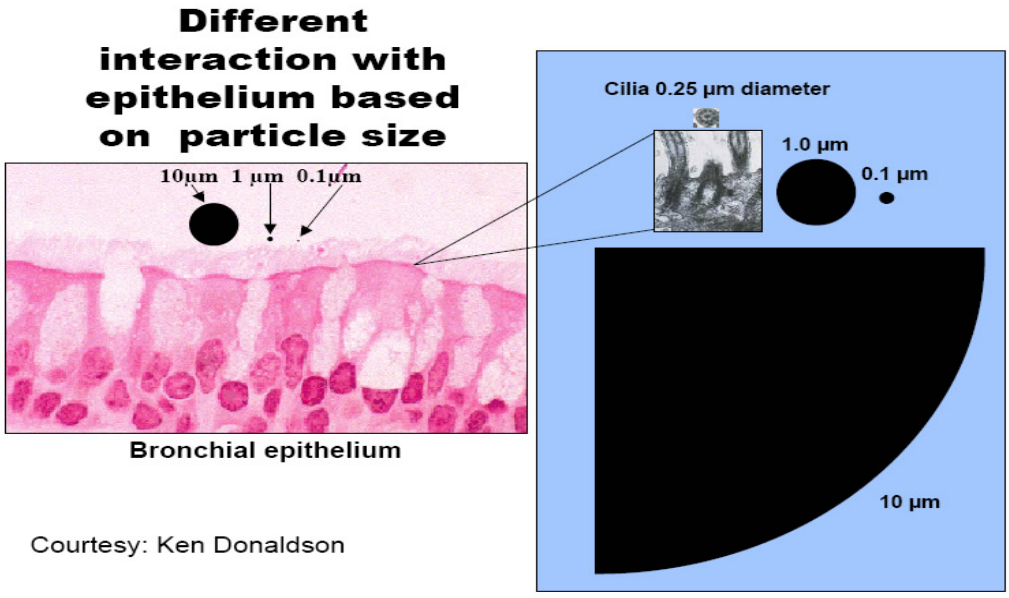
It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. The particles are identified according to their aerodynamic diameter, as either PM10 (particles with an aerodynamic diameter smaller than 10 µm) or PM2.5 (aerodynamic diameter smaller than 2.5 µm).

The latter are more of a concern since, when inhaled, they may reach the peripheral regions of the bronchioles, and interfere with gas exchange within the lungs.

Source: http://www.hvbg.de/d/bia/pub/rep/rep04/pdf_datei/biar0703/rep2003_07.pdf

Ultra fine particles (UFP, diameter <0 .1 µm) are thought to be the main cause of effects from environmental factors. These very small particles represent a fraction of the environmental aerosol with a low mass concentration, high number concentration, and very large specific surface area. Investigations of the size distribution of environmental particles in towns show that UFP comprise about 70% of the total number of particles but only 1% of the total mass. Because of their small size, they are deposited preferentially in the lung periphery where they can come into contact with alveolar macrophages (AM) and epithelial cells.

Source: http://www.who.int/mediacentre/factsheets/fs313/en/index.html
http://www.catf.us/publications/reports/CATF-Purdue_Multi_City_Bus_Study.pdf



In-blowing and Out-blowing Devices

There are two types of cooling systems current in laser printers today: fans that blow the exhaust out of the machines and fans that blow into the machines.

In machines with out-blowing fans (representing more than 60% of the market), the airflow carries approximately 80%-95% of all particle emissions, and therefore a filter system can be sued to trap the fine and ultra fine particles.

In machines using in-blowing fans, particles will initially collect inside the machine, and exit the device at various openings when internal absorption is eventually reached. Filter efficiency is therefore limited.

Highlights of Findings of a Recent Australian Study on Laser Printer Use

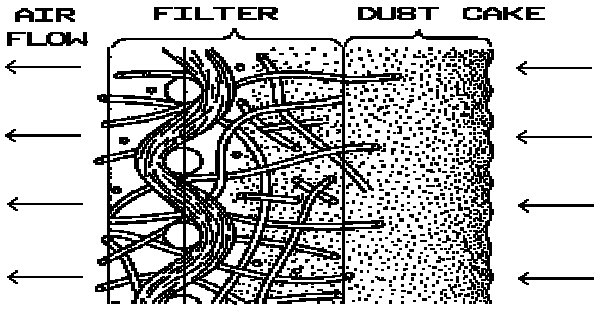
In the study “Particle Emission Characteristics of Office Printers,” conducted jointly by the International Laboratory for Air Quality and Health, Queensland University of Technology, Brisbane, Australia and the Queensland Department of Public Works, it was determined that the mean size of released particles from laser printers is small (in the range of **35 to 94 nm**).

Design and Related Issues of Traditional Dust Filters

Many HEPA (High Efficiency Particulate Air) and ULPA (Ultra Low Penetration Air) filters bind **ALL** emitted particles. After a short time period the combination of large, medium and small particles clogs the filter, stops the cleaning effect and causes the filter to stop working. Consequently, fine and ultra fine particles will no longer be filtered. Contamination, reduced or non-existent airflow and consequential high temperatures can damage the machine.

The very highly compressed synthetic fibers from HEPA and ULPA filters can restrict the necessary airflow of the exhaust fan. The inside temperature of some machines may increase immediately after fitting. In addition, the air pressure in the machines may increase immediately after installation and the ultra fine particles can escape from various leak points around the printer casing. In filters featuring less compression, the fine particles cannot be filtered by it and the overheating problem occurs later.

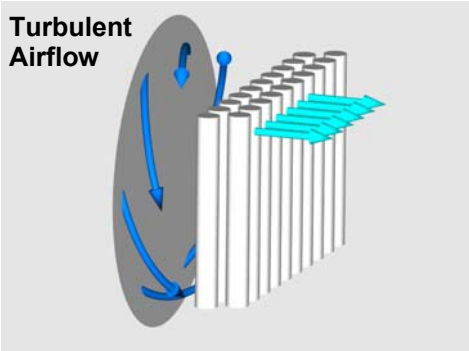
High temperatures - Risk of overheating - Short lifetime



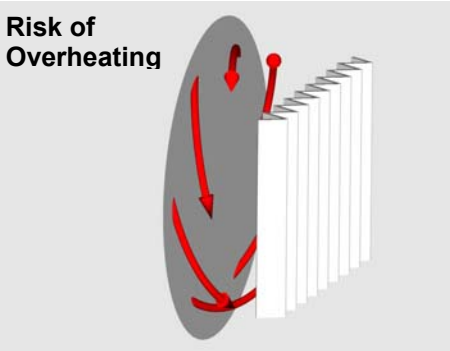
The Benefits of Using Dexwet Filter Technology

The Dexwet Filter for laser printers works with fine-fiber fabric rods and plastic sticks, impregnated with a fluid specifically adapted to a given application. Particles are bound efficiently and permanently in the oil of the filter sticks.
Fitted at the exhaust openings of the printer, the Dexwet filter is designed to enable air to exit the machine in an unobstructed way through these rods and sticks, without causing a significant temperature increase inside the printer.

The pictures below illustrate the airflow pattern with a Dexwet Filter compared to a traditional, very close fiber filter.

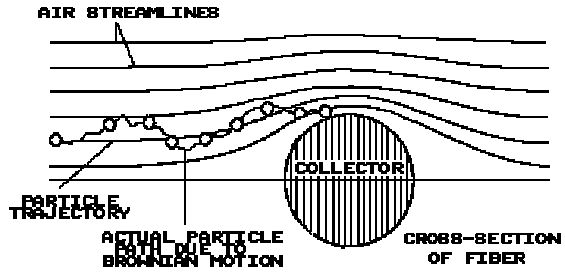


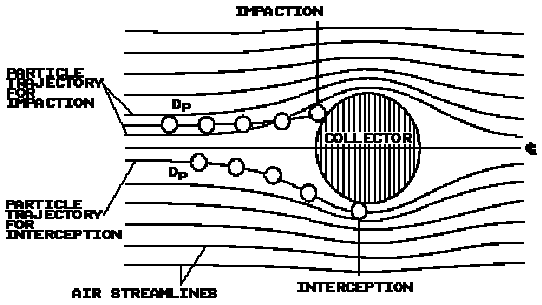
Consistent airflow – Dexwet Filter



Under performing air flow – HEPA/ULPA

The pictures below demonstrate that fine and ultra fine particles will not follow the normal airflow and therefore the majority of them come in touch with the collectors (Dexwet Filter sticks).





Even when subjected to elevated temperatures during printer operation, the Dexwet Filter has minimal loss of its fluidity. Dexwet Filter life is therefore very high – with life expectancy as high as 6 months or 70,000 mono prints.

Bacteria and germs that are bound in the fluid of the filter sticks will die due to lack of oxygen. Even when the filter is at the end of its life cycle, full or in some other way filtering inefficiently, it won't have a negative impact on the performance of the device.

Two well-known independent test institutes, **BAM** (Bundesamt für Materialforschung und Prüfung / Federal Agency for Material, Research and Tests, Berlin) and **LGA** (Landesgewerbeanstalt / a Public Law Corporation, Nürnberg), confirm in their reports the following performance of Dexwet Filter:
- **LGA:** Filters more than 90% of approx 10µm size particles
- **BAM:** Filters in average more than 50% of 0,3-10µm size particles

These results were achieved by correctly mounting the filter on the laser printer and insuring the printer was performing at OEM specification levels.

SUMMARY

Toner-based laser printers are a vital tool in today's business world, and represent $51.9 billion in annual wholesale revenue in the US and Western Europe. As concerns grow about the emission of fine and ultra fine dust from these devices, individuals and businesses worldwide are taking a close look at minimizing any negative impact these emissions may have on indoor air pollution.

Dexwet's unique filter technology can significantly impact the level of particle emissions from many of the most widely used laser printers, without the potential air-restriction and overheating issues that may arise with standard HEPA and ULPA filters.

For more information visit www.dexwet.com