camfil

PM1 – FINE DUST HAZARD TO HEALTH

Clean air solutions

FOCUS ON PM1
FOR PROTECTION OF HUMAN HEALTH

We all know that air pollution is bad for human health. A much less known fact is that new research indicates that the smallest particles in the air are the most dangerous.

To provide a healthy and productive indoor air environment, this means that the focus should be put on filtering particles that are 1 µm (micrometre) or smaller in diameter – particles also known as PM1 (Particulate Matter 1).

PM1 is so bad for our health because the human body has no protection against these very small particles. They enter our bodies through the respiratory system – we inhale them – and a significant part go deep into our lungs and continue out into the blood stream.

At worst, **PM1** particles contribute to deadly diseases such as heart attacks and lung cancer. It is recently stated that the small particles have an influense of demens desease.

- Air pollution is responsible for 5.5 million premature deaths around the world each year.*
- Air pollution is the fourth highest risk factor for death globally and by far the leading environmental risk factor for disease.**
- WHO (the World Health Organisation) has also concluded that the content of outdoor air pollution – for example particles from diesel fuel combustion – is carcinogenic.
- **PM1** air pollutants are considered to be the most harmful. Fine particles in the air, measuring between 0.25 to 0.5 microns in diameter, have a closer relationship to human health, especially an increased risk of cardiovascular disease. ***

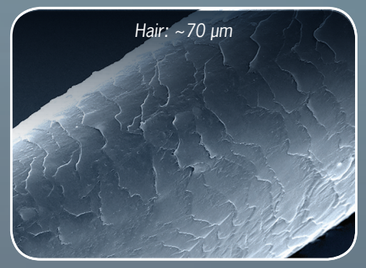
Air filters that effectively separate **PM1** particles will not only protect people from serious health problems. They will also help sustain the general well-being and productivity of people by preventing bacteria and viruses (which are often **PM1** in size) from spreading through the ventilation system.

Another fact supporting the need to filter **PM1** particles is that research**** has shown that the smallest particles often account for about 90% of all particulate matter in outdoor air. And we also know that the smaller a particle is, the longer it can stay in the air, which means it can travel further – potentially up to hundreds of kilometres.

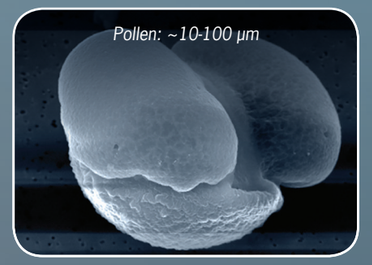
So how do you protect people from these harmful micro-particles?
You do it by choosing high-quality air filters – F7 filters and better – which have a filtration efficiency of at least 50% on **PM1** particles (see table page 7).

An additional advantage is that these air filters will also take care of the larger particles in sizes up to PM2.5 and PM10, as well as coarse dust.

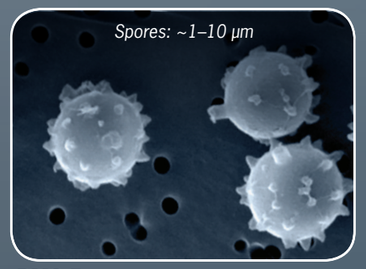
EXAMPLE OF PARTICLES SIZES



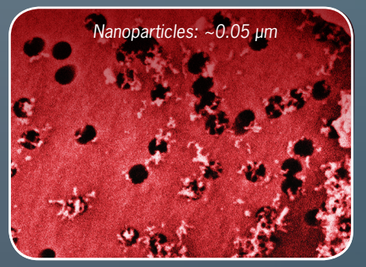
COARSE PARTICLES
Visible coarse dust and sand, leaves, hairs and other large organic particles.



PM10
Smoke, dust, dirt and pollen. Coarser fine dust and bigger organic particles.

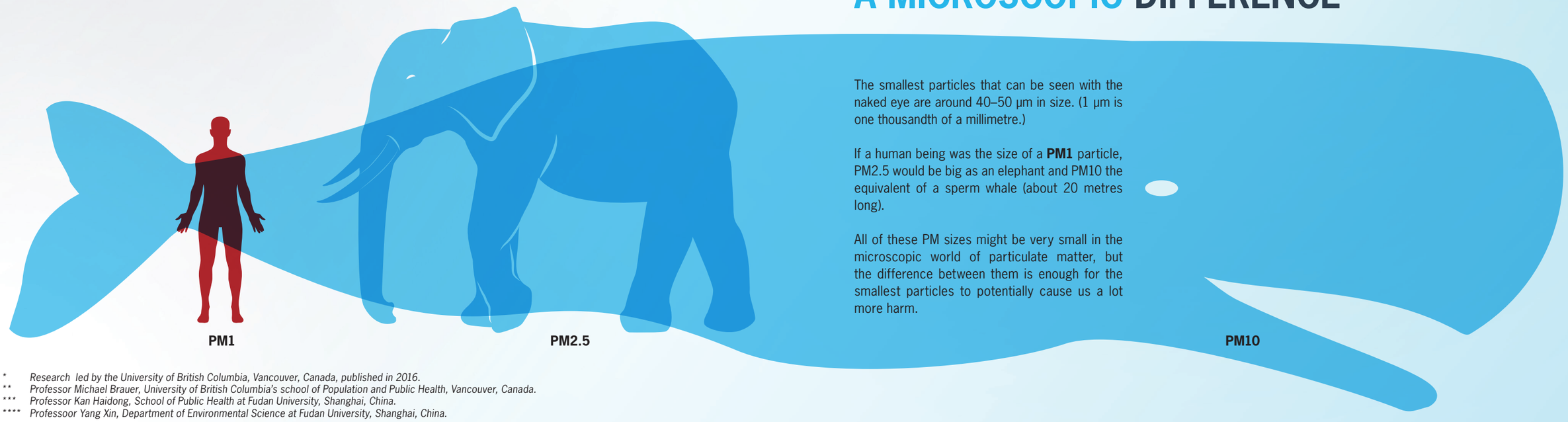


PM2.5
Bigger spores and other organic particles.



PM1 – HEALTH AND HYGIENE
Very fine dust, combustion particles, nano particles, bacteria, viruses and smaller spores.

HEALTHY OR NOT – A MICROSCOPIC DIFFERENCE



The smallest particles that can be seen with the naked eye are around 40–50 µm in size. (1 µm is one thousandth of a millimetre.)

If a human being was the size of a **PM1** particle, PM2.5 would be big as an elephant and PM10 the equivalent of a sperm whale (about 20 metres long).

All of these PM sizes might be very small in the microscopic world of particulate matter, but the difference between them is enough for the smallest particles to potentially cause us a lot more harm.

* *Research led by the University of British Columbia, Vancouver, Canada, published in 2016.*
** *Professor Michael Brauer, University of British Columbia's school of Population and Public Health, Vancouver, Canada.*
*** *Professor Kan Haidong, School of Public Health at Fudan University, Shanghai, China.*
**** *Professoor Yang Xin, Department of Environmental Science at Fudan University, Shanghai, China.*

PM1
WHAT IS HAPPENING INSIDE THE BODY?

The particles with the greatest capacity for reaching the outermost areas of our respiratory system are very small, approximately 0.01–1 µm in size – **PM1**. The ability of different particles to form deposits (the degree to which they can become trapped in the body) depends on their size and whether they can pass through the walls of our airways, for example.

YOUR LUNGS AND CLEAN AIR

The function of the lungs depends on clean air even in the outermost of the seven million air sacs (alveoli) where the gas exchange with the capillaries takes place. The blood flows through the capillaries and gives off the carbon dioxide (CO_2) that has formed during the metabolic process. At the same time, it takes in oxygen (O_2) via the alveoli. The oxygen is transported from the alveoli to the muscles and other organs. The carbon dioxide and other impurities leave our bodies when we breathe out.

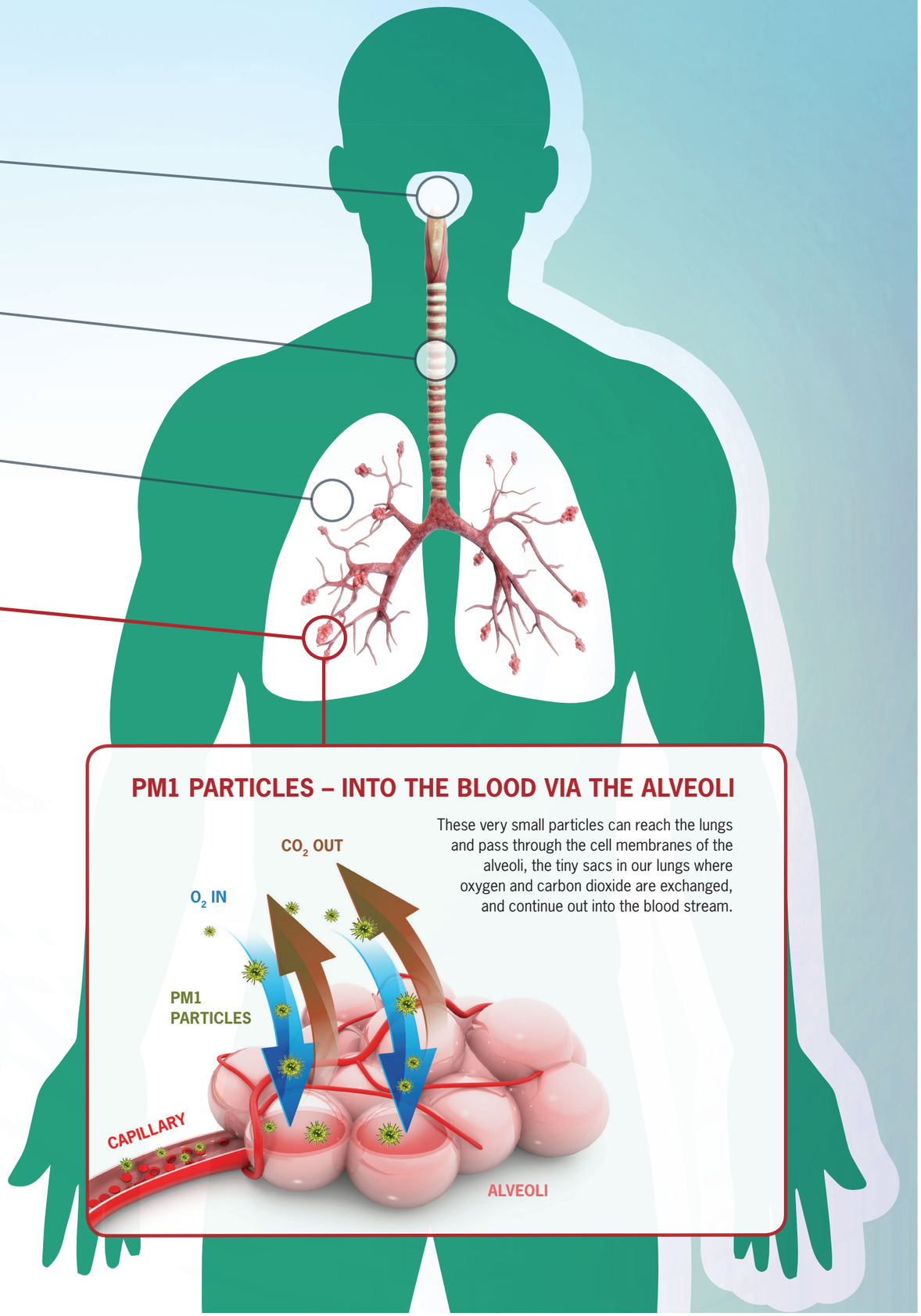
Nanoparticles, which are no larger than a virus, can become deposited (trapped) in the cell membranes (walls) of the alveoli. These have a total surface area of around 70 m² and are highly sensitive to particles and harmful substances. If these substances remain in the respiratory system, they can contribute to the development of emphysema, oedema and other serious illnesses, as well as premature deaths.

COARSE DUST
Particles 10 µm in diameter and larger. The human body is able to "filter" these particles in the nose via the nose hairs and mucous membranes. Limited health impact.

PM10
Particles 10 µm in diameter or smaller that can reach the respiratory ducts and potentially cause decreased lung function.

PM2.5
Particles 2.5 µm in diameter or smaller that can penetrate the lungs and cause decreased lung function, skin and eye problems, etc.

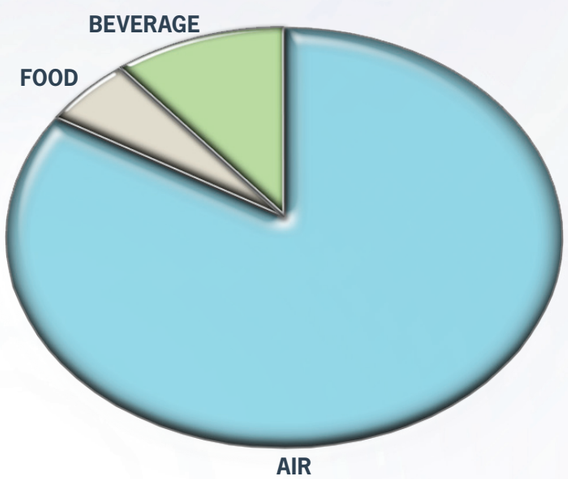
PM1
Particles 1 µm in diameter or smaller. A significant part of these particles are tiny enough to enter the blood stream and lead to tumours, cardiovascular diseases, dementia, etc.



PM1 PARTICLES – INTO THE BLOOD VIA THE ALVEOLI

These very small particles can reach the lungs and pass through the cell membranes of the alveoli, the tiny sacs in our lungs where oxygen and carbon dioxide are exchanged, and continue out into the blood stream.

EVERY DAY WE EAT 1 KG FOOD, DRINK 2 KG BEVERAGE AND BREATHE 15 KG AIR!



SYMPTOMS OF POOR AIR

Poor air quality has an impact on the body. Certain symptoms indicate that the air has a high particulate content and contains substances which do not belong there. Examples of warning signs which must be taken seriously include sore or itchy eyes, problems with wearing contact lenses, a runny nose, an irritated throat, headaches, tiredness and asthma-like symptoms.

It is also worth mentioning that different people have different levels of sensitivity to poor air. We do not always react in the same way to the quality of indoor air. It is possible to be affected by air pollution even if you do not experience any obvious problems.

THE BEST PROTECTION AGAINST PM1 – CHOOSE THE RIGHT AIR FILTERS!

INDOOR AIR

The basic idea behind ventilation is to mix indoor air with outdoor air. But because the outdoor air is now so polluted, as a result of different types of combustion processes and diesel exhaust gases among other things, several stages of purification are needed.

If the air is not cleaned, there is a risk that indoor air will contain a very large quantity of harmful particulates which will find their way into people's respiratory tracts and circulation systems. Effective filters in the ventilation system can prevent the majority of particles (and gases) in the outdoor air from making their way indoors.

The diagram (right) shows the size of particles and gas molecules in µm from 0.0001-1000 µm. **PM1** particles are marked with red.

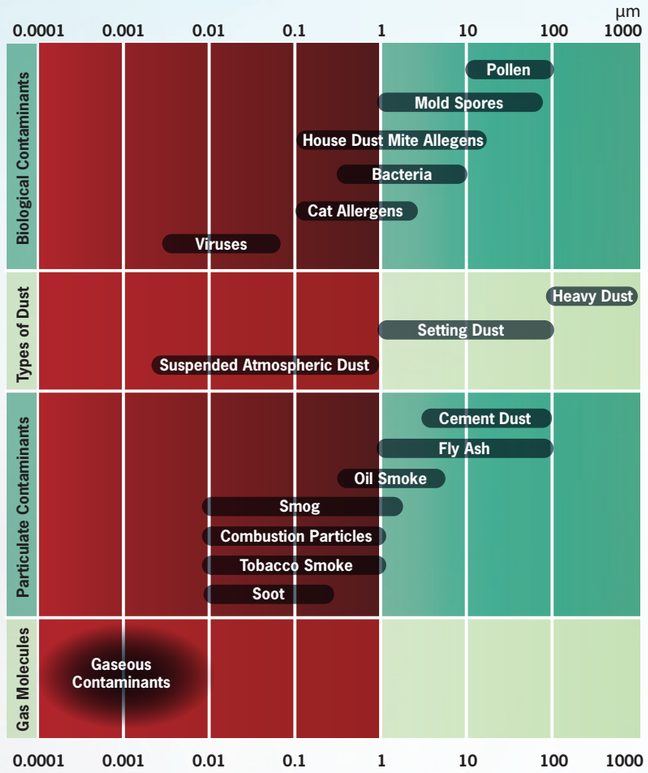
USING THE RIGHT FILTER

Using the right air filter will not only help you to maintain healthy indoor air quality. It will also help you to save energy and money.

With Eurovent's new and objective system for classifying energy efficiency, it will now be easier for you to find the right air filter for the lowest energy usage and highest indoor air quality.

Today, all air filters can be graded from A+ to E. Grade A+ stands for the lowest energy consumption and E for the highest. The classification, based on EN779:2012, will give you a better understanding of a filter's annual energy consumption, initial efficiency and minimum efficiency.

TYPICAL PARTICLE SIZES OF MOST COMMON CONTAMINANTS



TYPICAL EFFICIENCIES OF AIR FILTERS AGAINST PM1 AND OTHER FINE DUST MASS CONCENTRATIONS

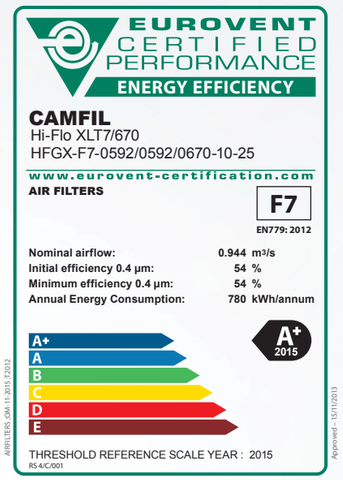
Filter class	PM1	PM2.5	PM10
M5	<20%	<40%	**≥50%**
M6	<40%	**≥50%**	**≥60%**
F7	**≥50%**	≥70%	≥80%
F8	**≥70%**	≥80%	≥90%
F9	**≥80%**	≥90%	≥95%

AIR FILTERS

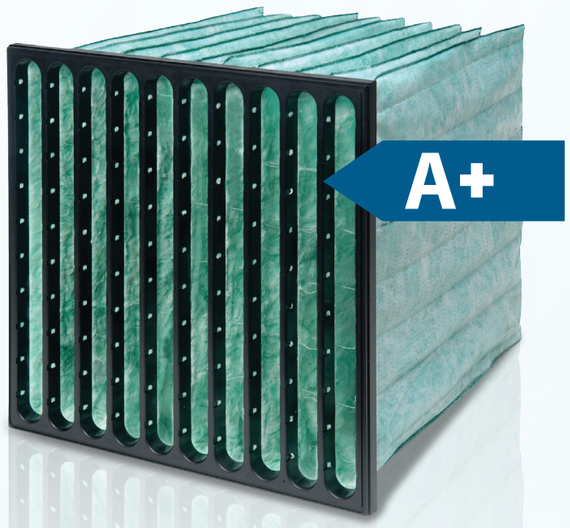
Air filters protect people's health by maintaining a good hygiene level in your ventilation system. For maximum protection from **PM1** and larger PM sizes, choose high-quality air filters with a filtration efficiency of 50% or higher – see **F7, F8** and **F9** filters in the table above.

EN779 STANDARD

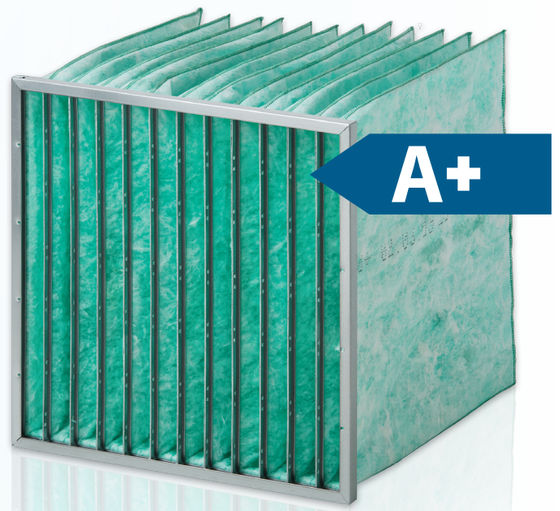
The European standard for air filters (EN779:2012) classifies air filters based on their filtration efficiency against small particles of 0,4µm (part of PM1).



Opakfil ES (F7, F8, F9)



Hi-Flo XLT7/670 50+ (F7)



Hi-Flo M7 50+ (F7)

CAMFIL is the world's largest and leading manufacturer of filters and clean air solutions.

Camfil is the global industry leader in clean air solutions with more than 50 years of experience. Our solutions protect people, processes and the environment to benefit human health, increase performance, and reduce and manage energy consumption. Twenty-five manufacturing plants, six R&D sites and 65 local sales offices worldwide provide service and support to our customers. The Camfil Group is headquartered in Sweden but more than 95% of sales are international. The Group has approximately 3,800 employees and sales more than SEK 6.0 billion.

www.camfil.com