camfil FARR

indoor air quality – IAQ

Camfil Farr	Segment brochure
EN 13779:2007 – European standard	
Camfil Farr – clean air solutions	

environment, air quality and health

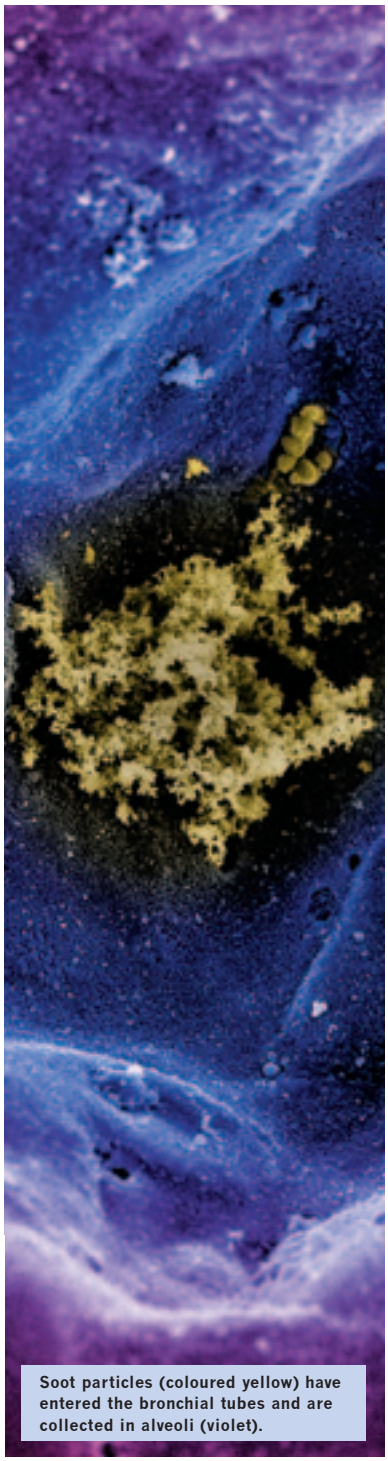


PHOTO: LENNART NILSSON

Soot particles (coloured yellow) have entered the bronchial tubes and are collected in alveoli (violet).

The industrialised world is a very different place compared to that 50 years ago. One real difference is that the air we breathe is now more heavily and more diversely polluted. Although natural sources of pollution exit, the greater concerns arise as a result of mans own activities. There are tens of thousands of synthetic chemicals (not found in nature) made today with an estimated annual production rate in excess of a billion tonnes. These chemicals are released to the atmosphere during manufacture and use and can subsequently travel vast distances. They are an inevitable part of our lives.

Our lifestyles (work and leisure activities) mean that we spend increasing amounts of time inside buildings. The necessary ventilation of buildings means we are increasingly exposed to the particulate and gas pollution in the external air.

Air pollution can be conveniently categorised as being either particulate (dust) or molecular (gas). Particles can be induced into the body and respiratory systems through breathing. Gas or molecular pollution also enters the body in breathing air, but it is able to penetrate beyond the lungs, into the bloodstream and around the entire body. Although these entities are invisible, bulk pollution is clearly visible in many forms, including; vehicle emissions, factory chimneys, dust raised by speeding cars and cigarette smoke.

Exposure to pollution has been known to impact humans for some time. The common health symptoms of headaches, itchy eyes, reduced work efficiency etc have been traditionally termed Sick Building Syndrome (SBS) or similar names.

Few if any studies so far have been able to precisely state the toxicological hazards associated with different size particulate and molecular pollution. However it is beyond dispute that pollution in breathing air is linked directly to increases in respiratory symptoms, increased use of rescue medication, asthma, chronic obstructive pulmonary disease resulting in emergency room treatment, and even reduced lung growth in children (1, 2).

To answer these concerns, there is a growing focus on the health impacts of pollution. The CAFÉ (Clean Air for Europe) group acting within the European Commission have already concluded that for both coarse and fine particles (PM_{10}, PM 2.5) a safe concentration (no effect or threshold) is unlikely to exist (1).

In the absence of clear data, the regulating authorities and policy makers such as the European Commission act to protect us from harm using the most practical methodologies. An example is the new European standard for the ventilation of Non-Residential Buildings: EN 13779. This standard sets out various categories of outdoor air quality, several categories of desirable indoor air quality and the air filtration steps that should be applied to transform from one category to another.

1,T. Sandstrom, D. Nowak and L. Van Bree. Health effects of coarse particles in ambient air: messages for research and decision-making. Eur Respir J 2005;26:187-188

2,Gaudeman WJ, Avol E, Gilliand F, et al. The effect of air pollution on lung development from 10 to 18 years of age. N Engl J Med 2004; 351:1057-1067

the new European standard for ventilation

The new European standard EN 13779 focuses on achieving a comfortable and healthy indoor environment in all seasons with acceptable installation and running costs. It is now a national standard in all countries. It specifies the required filter performance in a system to achieve a good Indoor Air Quality (IAQ) taking into consideration the outdoor air.

The outdoor air is categorised in 3 levels, from ODA 1 where the air is pure except for temporary pollution such as pollen, up to ODA 3 with high concentrations of both gases and particles.

The particulate matter refers to the total amount of solid or liquid particles in the air. Most outdoor air guidelines still refer to PM_{10} (particle diameter up to 10 µm). But for the purpose of health protection, there is a growing acceptance that emphasis should be placed on particles much smaller than 10 µm.

The gaseous pollutants refer to the concentrations of CO_2, CO, NO_2, SO_2 and VOC's. The table below indicates typical concentration levels in outdoor air, together with a suggestion for how to categorize the quality.

Concentration levels of outdoor air

Description of air quality	Concentration levels*					Category of outdoor air
	CO_2 (ppm)	CO (mg/m^3)	NO_2 ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	
Rural areas with no significant sources	350	< 1	5 – 35	< 5	< 20	ODA 1
Smaller towns	400	1 – 3	15 – 40	5 – 15	10 – 30	ODA 2
City centres	450	2 – 6	30 – 80	10 – 50	20 – 50	ODA 3

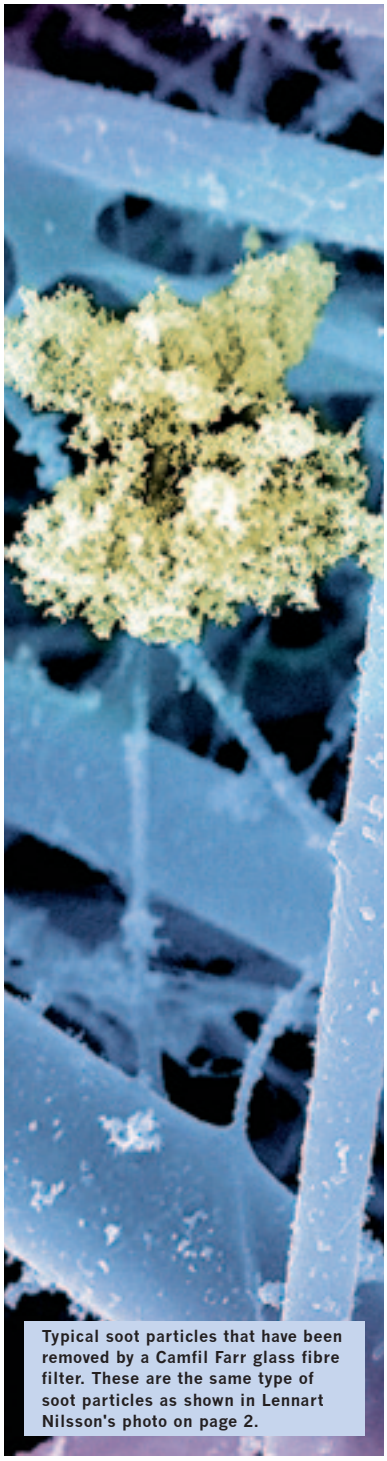
***For most European cities you can check the current, daily concentration levels online over the Internet!**

Notice, that in most cities what is termed a "normal concentration level" for particulates Actually falls in the upper range (poor quality) for outdoor i.e. ODA 3. For particulate matter the World Health Organization has established targets to reach an annual mean of PM10 below 40 µg/m^3. That target is not yet reached. In other words, most people in Europe spend most of their time in areas where the outdoor air must be categorized as ODA 3. It can be readily concluded that the application of appropriate filtration is critical for health concerns.

The new standard classifies the indoor air quality from IDA 4 (low IAQ) up to IDA 1 (high IAQ). One traditional but limited method to determine the IAQ is to study the CO_2 levels. CO_2 is the product of human respiration. It is a good indicator of effective ventilation but not absolute air quality. Another established method for spaces with human occupancy is to specify the rate of external air added for each person.These type of values are often used to size the ventilation system. The table below lists typical ranges for CO_2 levels and recommended rates for added external air to achieve different categories of indoor air quality. Note, neither method takes account of the particulate and gaseous pollutants brought into the building with the external air.

Classification of indoor air quality

Category	Description	CO_2 –level above level of outdoor air (ppm) Typical range	Rate of outdoor air (m^3/h/person) Typical range, non-smoking area
IDA 1	High IAQ	≤ 400	>54
IDA 2	Medium IAQ	400 – 600	36 – 54
IDA 3	Moderate IAQ	600 –1000	22 – 36
IDA 4	Low IAQ	> 1000	< 22



Typical soot particles that have been removed by a Camfil Farr glass fibre filter. These are the same type of soot particles as shown in Lennart Nilsson's photo on page 2.

PHOTO: CAMFIL FARR

filter recommendations according to EN 13779

After the Outdoor Air Quality has been categorised, EN 13779 clearly specifies the filter class that is required to achieve preferred Indoor Air Quality. The filter classes are specified inaccordance with EN 779:2002.

The EN 13779 standard is clear, when you require a decent IAQ (IDA 1 or IDA 2) and you are situated in a city environment, not only is F9 required as the final filter, but also a gas filter (GF) is required to protect against gaseous (molecular) pollutants!

Filter Recommendations according to EN 13779

Outdoor Air Quality		IAQ Indoor Air Quality			
		IDA 1 (High)	IDA 2 (Medium)	IDA 3 (Moderate)	IDA 4 (Low)
Pollution level ↓	ODA 1	F9	F8	F7	F5
	ODA 2	F7 + F9	F6 + F8	F5 + F7	F5 + F6
	ODA 3	F7 + GF + F9	F7 + GF + F9	F5 + F7	F5 + F6

Table refering to appendix "A3. Use of Air Filters" in The European Standard EN 13779:2007.

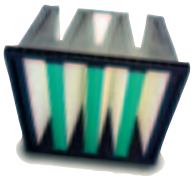
- In a city environment, it is recommended to use a molecular filter (gas filter). It is also a good solution in an area of categories ODA 3. The gas filter should be combined with a downstream F8 or F9 particulate filter.
- For hygienic reasons, it is recommended to use two-stage particle filtration:
  - Minimum F5, but preferably F7 in the first step.
  - Minimum F7, but preferably F9 in the second step.
  - If there is only one filtration step, the minimum requirement is F7.
- For recirculation air, at least F5 quality must be used in order to protect the system. Preferably the same filter class as the main external air stream should be used.
- For protecting the extract and exhaust systems, use at least class F5.
- Regardless of filter class used, the efficiency must not deteriorate below defined values. Always look for the untreated (discharged) efficiency. The untreated (discharged) efficiency is reported when a filter is tested according to the current valid European standard EN 779:2002, which replaced the former EN 779.
- The interval of filter replacement must not be selected only on the basis of economical optimisation. Hygiene issues must also be taken into account. Three limits must be considered, and the one that is reached first will determine the time for replacement: final pressure drop, time installed and time in operation.
  - For first step filters: 2000 hours operation or maximum 1 year installed or when the final pressure drop is reached.
  - For second or third step filters: 4000 hours operation or maximum 2 years installed or when the final pressure drop is reached.
  - For exhaust- and recirculated air filters: 4000 hours operation or maximum 2 years installed or when the final pressure drop is reached.
- To avoid microbial growth, the plant should be designed so that the relative humidity (R.H) always stays below 90% and so that the average R.H for three days is less than 80% in all parts of the system, including the filters.
- Gas filters do not change pressure loss during normal operation. In the absence of a definitive statement within EN 13779, Camfil Farr recommends to change IAQ gas (molecular) filters after 1 year installed or 5000 hours operation.

camfil farr products for IAQ

Solid pollutants (particle filtration)

To effectively control hazardous fine particles, the EN 13779 standard recommends the use of F7 and F9 efficiency filters. Camfil Farr, who have more than 50 years of experience in comfort air filtration, strongly recommend the following particulate air filters for your ventilation systems.

Hi-Flo F7 to F9
The best first stage for an optimised low pressure drop and long life product. Highest possible standard of AHU cleanliness and hygiene. Maximum protection of second stage filtration – to achieve maximum life time.



Opakfil Green F9
The best second stage to eliminate more than 95% of all particles > 0.4 µm in size the distribution duct system will remain clean and greatly reduce maintenance costs. Highest levels of duct hygiene are assured.

Ecopleat
This new generation of fine compact filters is the ideal filtration solution for applications with restricted space. Upgrade any G3 or G4 compact filter with Ecopleat F6 to F7.

Molecular pollutants (gas filtration)

The following gaseous (molecular) pollutants have a particular importance:
sulphur dioxide (SO_2), oxides of nitrogen (NO_X), polycyclic aromatic hydrocarbons (PAH) and the volatile organic compounds (VOC's).
The EN 13779 standard states: “In a city environment, it is recommended to use a molecular filter (gas filter). The gas filter should preferably be combined with a F8 or F9 particulate filter downstream”. In accordance with the standard, Camfil Farr recommend:

Citycarb
In a rigid compact format, Citycarb provides effective molecular filtration. Citycarb and Citysorb are appropriate for all new installations and to upgrade those already equipped with standard dimension filters. The Citycarb product provides combined particulate and molecular filtration in a single stage.

City-Flo
This product provides combined particulate and molecular filtration in a Hi-Flo bag filter format. This product is ideal for use in all urban applications where standard size holding frames are available.

Citysorb
The Citysorb filter provides effective molecular filtration and is suitable for urban environments with high gas levels in installations where particulate filtration (minimum F7 Hi-Flo or Opakfil) is provided separately.

Gigacheck – a method of measuring molecular pollution

Gigacheck – a convenient and economic technique to assess levels of gaseous (molecular) pollution in outdoor or indoor air. In a dedicated IAQ device, levels of volatile organic compounds (VOCs), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and ozone (O_3) are determined simultaneously.

camfil FARR

On world standards...

...Camfil Farr is the global leader in clean air technology and energy efficient air filter solutions with product development, R&D and local representation in the Americas, Europe and Asia-Pacific region.

We supply high quality products and services with the aim of making our customers operations more sustainable, energy efficient and productive.

Our own vision of sustainability is a global approach combining consideration for people, environmental protection and business performance.

Camfil Farr is a member of the United Nations Global Compact programme and follows the GRI sustainability reporting framework.

www.camfilfarr.com

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YOU WILL FIND THEM ON OUR WEBSITE.

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