



AIR FILTRATION

UPGRADES WITHOUT COMPROMISE

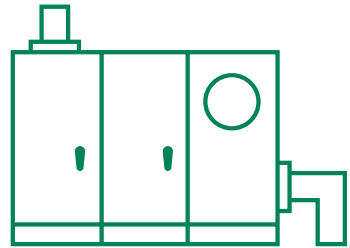


Clean air requirements for your facility

Clean air is important to all facilities, it helps protect your people, products and processes from airborne contaminants. When enhanced clean air requirements are placed on a building there is often a concern that this will result in a dramatic increase in your buildings energy consumption. This booklet has been designed to allow you to understand how your air filtration levels can be enhanced without compromising on energy consumption.

Air in your facility

In any commercial or industrial environment your building should be supplied with clean air by your HVAC systems. In your HVAC system, air filters are used to help ensure the air introduced into your facility matches the requirements. The air quality requirements such as air change rates and filtration levels are often set during building design and construction but often these requirements can change.



Why clean air requirements can change



PM₁
People
Matter 1st

Protecting the people in your building is the first function of clean air. By ensuring adequate air filtration you can protect employee health by:

- Reducing the risk of airborne virus transmission
- Reduce the health impacts of particulate matter
- Reduce the health impacts of VOCs and molecular contamination



When a building is designed the airflow requirements are often designed around planned work practices. Due to a number of different factors these work practices can change which can lead to an increase in air quality requirements. Upgrading air filtration can help meet these new demands.

Clean air standards

For the use of air filters in commercial or Industrial buildings there are standards based on efficiency, selection and energy consumption that need to be considered. Understanding these standards is a first step to ensuring increased protection without compromising on energy costs.

Efficiency standard: ISO 16890

ISO 16890 is the international standard for filtration efficiency. This standard classifies your filter selection based on its performance against different particulate ranges. ISO 16890 classifies the performance of your air filter into three main classifications ePM1, ePM2.5 and ePM10 filters. The ISO 16890 standard replaced EN779:2012 for European filter classification, while for North America, ASHRAE 52.2 is still the predominant standard.

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%

PM1 = Particulate Matter 1 (1 micron and below)

Selection standard: Eurovent 4/23

Eurovent 4/23 was first developed in 2017 with further iterations released in 2018 and 2020. The standard gives clear guidance on the filtration efficiency that should be chosen depending on the commercial and industrial use of the building.

Supply air category	Description	Outdoor air (ODA 1)	Outdoor air (ODA 2)	Outdoor air (ODA 3)	Recommended air changes
SUP1	Areas with high hygienic demands – Food and beverage production, hospitals, pharmaceutical, optics and microelectronics	ePM1 70%+	ePM1 80%+	ePM1 90%+	9-12
SUP2	Medium hygienic demands or rooms of permanent occupancy – Offices, hotels, schools and commercial buildings	ePM1 50%+	ePM1 70%+	ePM1 80%+	5-8
SUP3	Basic hygienic demands, short term occupation, shopping centres, server rooms and copier rooms	ePM2.5 50%+	ePM2.5 70%+	ePM2.5 80%+	3-5

Outdoor Air (ODA) – The outdoor air quality is determined by WHO guidelines

Supply Air (SUP) – Supply air category is determined by the workplace practices in the building

Energy consumption and your filter

Energy is not consumed by the air filter, the energy is consumed by the fan within the HVAC system. The filter is a cause of pressure drop in the HVAC system. The higher the pressure drop, the harder the fan needs to work in order to maintain air volume. Whilst the filter can account for up to 30% of the total energy consumption in the HVAC system, it is an easily exchangeable maintenance part of a HVAC system so a low energy consuming, long life filter has a great influence on the total cost of ownership.

Energy consumption standard: Eurovent 4/21

Since the air filter can account for such a large proportion of the total energy costs of the HVAC system, a new energy rating was developed in 2014 with the newest update encompassing the ISO 16890 classifications. In this the air filters are grouped together according to their efficiencies with a Energy rating from A+ to E being determined by the direct effect the filter has on energy.

M_{10} = 200 g (AC Fine)	AEC in kWh/y for ePM_{10} (ePM_{10} and $ePM_{10min} \geq 50\%$)					
	A+	A	B	C	D	E
50 & 55%	800	900	1050	1400	2000	>2000
60 & 65%	850	950	1100	1450	2050	>2050
70 & 75%	950	1100	1250	1550	2150	>2150
80 % 85%	1050	1250	1450	1800	2400	>2400
> 90%	1200	1400	1550	1900	2500	>2500

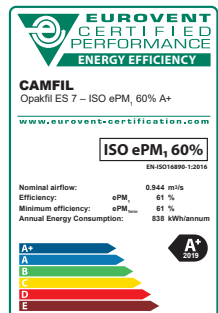
$M_{2.5}$ = 250 g (AC Fine)	AEC in kWh/y for $ePM_{2.5}$ ($ePM_{2.5}$ and $ePM_{2.5min} \geq 50\%$)					
	A+	A	B	C	D	E
50 & 55%	700	800	950	1300	1900	>1900
60 & 65%	750	850	1000	1350	1950	>1950
70 & 75%	800	900	1050	1400	2000	>2000
80 % 85%	900	1000	1200	1500	2100	>2100
> 90%	1000	1100	1300	1600	2200	>2200

Where to find your energy rating

Every filter that has been tested and certified against the Eurovent 4/21 standard must display the energy rating on the box. The label shows the standard design of all Eurovent tested air filters. On the label you can note:

1. The Filtration efficiency
2. the Annual Energy consumption
3. The rating of the filter

This ensures easy and quick comparison between different filters.



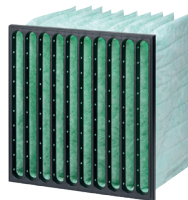
Supply air upgrades – Meeting standards

A building owner wants to upgrade its filtration efficiency to help reduce the risk of airborne virus transmission. The customer has one AHU that houses 10 filters in the system. To evaluate the system we base the study over a 3 year lifecycle.

The filters for comparison



ePM1 50% - D



ePM1 60% - A+

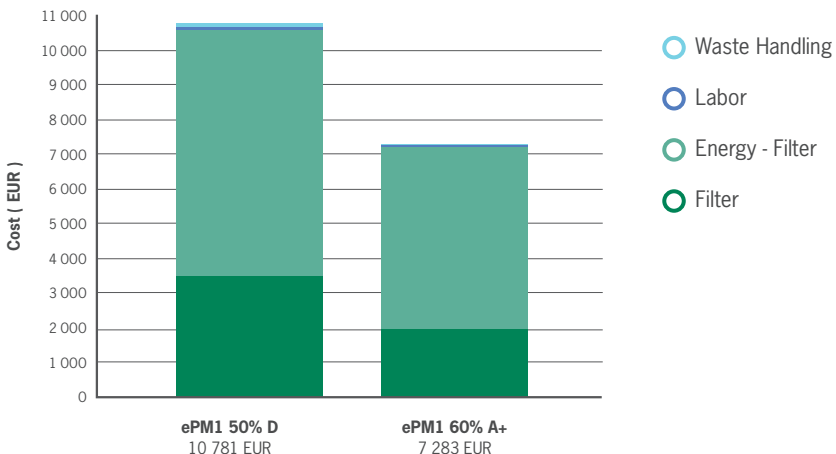
20%
increased efficiency



The results

To help protect your building from the spread of airborne viruses, REVHA recommends supply air to be filtered using a ePM1 60% filter at a minimum. By Upgrading efficiency but choosing an A+ energy rated air filter, the system is able to operate with €2000 less in energy consumption over the three year period. This upgrade not only adds protection for employees but it also reduces costs. Other benefits that can be experienced include: reduced filter changeouts meaning reduced labour costs, reduced wastage costs and a reduction in overall filter cost over the project lifetime.

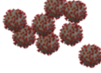






Total cost of ownership



Recirculation air upgrades – Upgrading efficiencies

The problem:

Recirculating air in buildings was brought in as an energy saving initiative. By reusing the rooms air there was less need for cooling and heating which saved companies energy. The problem with this method is that Indoor environments are up to 50x more polluted that outdoor air this means an increase in filtration levels is required. During airborne virus outbreaks, such as Coronavirus, the recirculation system can spread the infected air around your building. This means higher levels of filtration will again be required.

Particle size test range	Fractional efficiency values according to ISO16890-1:2016					
 <p>Virus particle size range in micrometers (µm)</p>	 <p>ePM1 60% Opakfil</p>	 <p>ePM1 60% Hi-Flo Bag</p>	 <p>ePM1 70% Opakfil</p>	 <p>ePM1 70% Hi-Flo Bag</p>	 <p>ePM1 80% Opakfil</p>	 <p>ePM1 85% Hi-Flo Bag</p>
0.3 - 0.4	54%	48%	62%	57%	79%	80%
0.4 - 0.55	62%	57%	70%	67%	85%	87%
0.55 - 0.7	67%	67%	78%	77%	90%	93%
0.7 - 1.0	73%	75%	86%	86%	95%	96%

Recommendations and guidelines:

As the volume of air outside is so vast the risk of airborne viruses entering your supply air system is low. Recirculation air utilises Indoor air which can have much larger concentrations of viruses. With this in mind recirculation air is recommended to be turned off in commercial and industrial buildings when there is a risk of virus transmission. If recirculation air is required for energy savings initiatives it is recommended that an ePM1 80-85% filter is used in this environment. The chart above highlights the number of particulates expected to be removed when utilising the different filter grades.

By using ePM1 80%+ filters in your recirculation air system, previous energy saving initiatives can be maintained. By using Camfils LCC software, the most energy efficient filter upgrades can be proposed. This will improve the total cost of ownership of your filtration systems.



HEPA air purifiers – Utilisation with energy savings

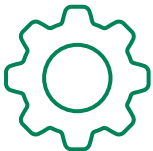
HEPA air purifiers are used to help supplement your buildings ventilation system to both increase air changes within the environment and reduce and remove airborne contaminants from source. There are three key circumstances where HEPA air purifiers can be used:



Where the room does not achieve the required air changes, HEPA air purifiers can supplement the ventilation system. By using in room air purification systems, energy consumption in your HVAC system will not be affected as increased airflow is not needed.



The risk of airborne contamination is higher in buildings with high occupation rates. The more people within the building the greater the risk of airborne contamination. HEPA air purifiers can be used to remove contaminants at source, thus reducing the risk of virus transmission.



If your building utilises equipment or processes that generate low to medium level particulates or molecular contaminants, HEPA air cleaners can assist. Ensuring low levels of particulate concentrations indoors, you can protect your people from airborne contaminants such as viruses.

Energy efficient air purification systems

Using plug and play HEPA air purifiers throughout your building can add to energy consumption. To reduce energy consumption these systems should only be used when needed. By using Air Quality sensors linked with your HEPA air purifiers, you can ensure that the systems are utilised depending on activities in your building. Linking operational activity to particulate levels can ensure the use of your air cleaners is optimised.



Camfil – a global leader in air filters and clean air solutions

For more than half a century, Camfil has been helping people breathe cleaner air. As a leading manufacturer of premium clean air solutions, we provide commercial and industrial systems for air filtration and air pollution control that improve worker and equipment productivity, minimize energy use and benefit human health and the environment.

We firmly believe that the best solutions for our customers are the best solutions for our planet, too. That's why every step of the way – from design to delivery and across the product life cycle – we consider the impact of what we do on people and on the world around us. Through a fresh approach to problem-solving, innovative design, precise process control and a strong customer focus we aim to conserve more, use less and find better ways – so we can all breathe easier.

The Camfil Group is headquartered in Stockholm, Sweden and has 33 manufacturing sites, six R&D centres, local sales offices in 30 countries and 4,800 employees and growing. We proudly serve and support customers in a wide variety of industries and in communities across the world. To discover how Camfil can help you to protect people, processes and the environment.

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