Latest **EUROVENT 4/23** (2018) recommendations included

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CLOSER TO REALITY

THE NEW ISO 16890 ENABLES THE BEST FILTER SOLUTION

FREUDENBERG
FILTRATION TECHNOLOGIES

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INNOVATING TOGETHER

CLOSER TO YOUR GOALS

AIR FILTRATION ACCORDING TO YOUR NEEDS – ISO 16890 MAKES IT POSSIBLE

The ISO 16890 test standard has been valid for the classification of air filters since January 2017 and, since August, also as DIN EN ISO 16890:2017. Since July 2018, it has completely replaced the previous industry standard EN 779. The advantage of ISO 16890 is that filter efficiency is determined realistically using the four dust categories PM_1, $PM_{2,5}$, PM_{10} and coarse dust. This makes the selection of the best possible filters for your individual requirements much easier.

EN 779 does not reflect reality

According to the EN 779 standard, the filtration efficiency of air filters is evaluated using a synthetic laboratory dust (ASHRAE dust) only for the particle size of 0.4 microns (µm). However, the particle spectrum in the outdoor air is much wider. This means that a large proportion of the hazardous particulate matter is not taken into account during the measurement process. Another point of criticism is that, under laboratory test conditions, the filters achieve higher efficiency with increasing dust load. In practice, however, the degree of separation efficiency of a filter with respect to the atmospheric dust remains constant or even slightly decreases. In conclusion, performance measured according to EN 779 does not correspond to the real filter behavior. In addition, the test standard says nothing about which particle spectrum is separated and to what degree.

ISO 16890: More transparency and practical relevance

In contrast to EN 779, the test procedure according to ISO 16890 is much more differentiated and is based on the local air quality of the respective process site. Unlike the old standard, the filters are rated in the test according to a broad particle range of 0.3–10 microns. This is derived from the typical dispersion densities of urban and rural regions. Your advantage is that the filter test takes into account the actual particle sizes prevailing in the air. The filters are classified according to the particulate matter classes PM_1, $PM_{2,5}$, PM_{10} and coarse dust (ISO coarse). The ISO 16890 standard thus uses the same evaluation parameters as the World Health Organization (WHO) and other environmental authorities use for measurement, such as the Federal Environment Agency in Germany.

ISO designations simply explained

To be assigned to a specific particulate matter group – PM_1, $PM_{2,5}$ or PM_{10} – filter needs to retain at least 50 percent of the corresponding particle size range. Filters that capture less than 50 percent of PM_{10} particles are designated as coarse dust filters. The efficiency of the filter is given in down-rounded 5-percent increments. A filter that captures 87 percent of PM_1 particles is thus classified as ISO ePM1 85 %, where the “e” stands for “efficiency”.

GROUP CLASSIFICATION TO SEPARATION EFFICIENCY	
ISO coarse	< 50 percent of the PM_{10} particle fraction
ISO ePM10	≥ 50 percent of the PM_{10} particle fraction
ISO ePM2,5	≥ 50 percent of the $PM_{2,5}$ particle fraction
ISO ePM1	≥ 50 percent of the PM_1 particle fraction

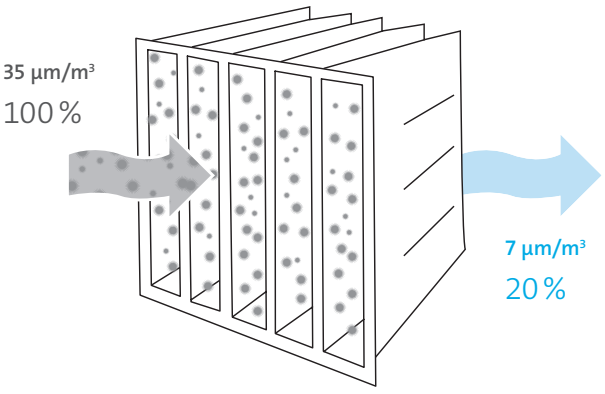
Particulate matter is not just one size

Particulate matter is a pollutant mixture that comes from various sources. Among the natural sources of particulate matter are mainly pollen, fungal spores and dust from erosion processes. Due to their relatively large particle diameter of about 10 microns, these are usually visible to the naked eye. The main causes of the much more dangerous, tiny particles of 0.3 microns are motor vehicle traffic, industrial emissions, building heating and agriculture.

On the website of the German Federal Environmental Agency as well as those of the European (EEA) and American Environmental Protection Agencies (EPA) you can view local levels of particulate matter pollution. This is usually a very good basis for characterizing actual dust pollution on site. The location of your plant and the climatic conditions have a major effect on the ambient air. This in turn means that the most efficient filtration solution for your plants and processes can differ significantly.

The path to optimal filter selection

1. To determine the local air quality, we determine the current data of the nearest measuring station via the website of the Federal Environmental Agency.
2. Let us suppose that the annual mean value for PM_{10} particulate matter is 35 µg/m³.
3. If an ISO ePM10 80 % filter is now used, this means that it will allow a maximum of 20 % of the PM_{10} fine particulates to pass through. The calculation shows that the mean value is reduced to 7 µg/m³ after filtration.



Filter ISO ePM10 80 %

CLOSER TO YOUR SURROUNDINGS

HOW LOCAL PARTICLE SIZES AFFECT THE DEMANDS PLACED ON YOUR FILTERS

The annual mean values for particulate matter differ between locations due to natural conditions and the influence of human activity. Here we outline four characteristic environments and the specific demands they place on the filtration of the supply air.

PM_{10}

Rural areas
Particulate pollution in the countryside is mainly due to particles of natural origin, such as pollens, spores or erosion dusts. In these locations, ISO ePM10 filters already filter a majority of the particles from the supply air.

PM_{1} $PM_{2,5}$

Urban regions
Whether Shanghai or Stuttgart, in megacities and highly urbanized regions the main influences on air quality are industrial emissions, diesel soot and other combustion products, which lead to dangerous smogs. The supply air therefore needs to be cleaned with filters that reliably separate PM_{1} and $PM_{2,5}$ particles.

Between large cities and rural areas, levels of particulate matter in the ambient air can in some cases differ significantly. For this reason, we are happy to provide general recommendations for the design of filter stages. These are then based on the annual average values for $PM_{2,5}$ and PM_{10} in the respective regions. Talk to us about your specific case and we will analyze the environmental conditions around your plant.

REGION	RURAL AREA	RESIDENTIAL AREAS
Annual average PM_{10} [µg/m³]	10–20	20–25
Annual average $PM_{2,5}$ [µg/m³]	5–10	10–15

$PM_{2,5}$ PM_{10}

Coastal areas
Industrial plants sited close to the coast are particularly at risk from spray with a high salt content. For permanent protection against corrosion, the salt particles need to be filtered out of the air in addition to normal dusts.

$PM_{2,5}$ PM_{10}

Desert regions
In dry and near-desert regions, the air mainly transports whirled up sand and dusts. The permanent separation of the particulate fractions $PM_{2,5}$ and PM_{10} is essential in this environment.

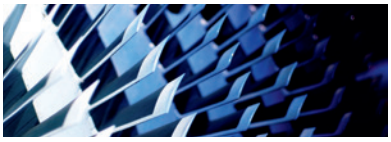
AREAS WITH LIGHT INDUSTRY	AREAS WITH HEAVY INDUSTRY	MEGACITIES	COASTAL REGIONS AND OFFSHORE PLATFORMS	DESERT AREAS	ARCTIC AREAS	HUMID, TROPICAL AREAS
25–30	25–50	>50	10–30	10–5,000	10–30	10–50
15–30	15–40	>30	5–20	10–1,000	5–20	5–30

CLOSER TO YOUR NEEDS

FILTER SOLUTIONS TAILORED TO INDUSTRIAL REQUIREMENTS

Your processes in focus

The most efficient filter solution depends on your specific process requirements. Creating the ideal filter system for your ventilation units is decisively influenced by the necessary degree of air purity. For this reason, you can enjoy permanent savings if you align your filter solution to your industrial applications as well as to local particulate matter pollution.



Gas turbines and compressors: Protect your system reliably against corrosion and dust accumulation. An optimized filter solution safeguards the constant performance of your machines, thus ensuring optimum efficiency and preventing unplanned system downtime.

Surface treatment: Avoid paint damage and airborne contaminants. The targeted filtration of the pollen and dust particle spectrum secures your quality standards and ensures the best process results.

Food and beverage: Ensure hygienic production through the highest clean air quality. The reliable removal of germs and harmful particles is achieved within the scope of the zone concept for hygienic production conditions.

We provide individual advice with e.FFECT

Our experts work with you to develop the best filter solution for your application. With the help of e.FFECT, the electronic Freudenberg Filter Efficiency Calculation Tool, you can discover which filter system best suits your location and process requirements. Using information such as the target cleanliness level of the supply air, local particulate matter pollution, annual operational performance or average volume flow, we calculate and compare the performance of various filter arrangements, even multi-stage. This makes it easy for you to select the filtration solution with the highest possible efficiency.

Your benefits from e.EFFECT

- Location- and requirement-specific selection of the filtration solution
- Full transparency and comparability thanks to a structured calculation protocol
- More powerful filtration solution
- Reduced downtime and less maintenance intensity for your systems
- Cost savings through individually optimized solutions

e.FFECT
electronic Freudenberg Filter Efficiency Calculation Tool

Talk to our customer advisors about e.FFECT!
Let us calculate the effectiveness of your system for you.

e.FFECT@freudenberg-filter.com
e.FFECT-Turbo@freudenberg-filter.com
(especially for gas turbines and compressors)

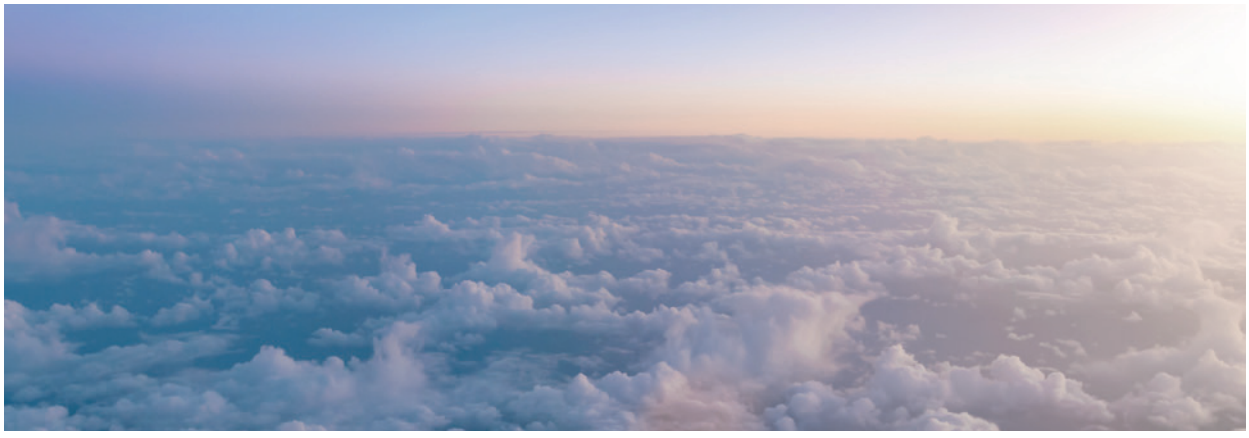
ONE ORIENTATION AID

THE COMPARISON OF FILTER CLASSIFICATIONS IN ONE BANDWIDTH ACCORDING TO EUROVENT 4/23 (2018)

Published in October 2018, EUROVENT 4/23 makes clear that filter classifications according to EN 779:2012 and ISO 16890 are not comparable and that filter classes according to EN 779 are not meaningful in terms of overall filter performance. EUROVENT Certita Certification (ECC) has evaluated real measurement results from over 90 different types of air filters from different manufacturers, which were tested in independent testing institutes. The results show, for example, that all measured F 7 air filters (classified according to EN 779) show a very wide range of between 40 % and 65 % when measured for ePM_1 according to ISO 16890. Similarly large fluctuation margins are evident in all other filter classes.

The current comparison chart published by ECC in October 2018 is intended for practical application. Based on real filtration data, it shows comparisons of the respective filter classifications. This enables you to clearly orient yourself in your daily work.

EN 779:2012	EN ISO 16890 – RANGE OF ACTUAL MEASURED AVERAGE EFFICIENCIES		
FILTER CLASS	ePM_1	$ePM_{2,5}$	ePM_{10}
M 5	5 – 35 %	10 – 45 %	40 – 70 %
M 6	10 – 40 %	20 – 50 %	60 – 80 %
F 7	40 – 65 %	65 – 75 %	80 – 90 %
F 8	65 – 90 %	75 – 95 %	90 – 100 %
F 9	80 – 90 %	85 – 95 %	90 – 100 %



CLOSER TO THE ACTUAL AIR CONDITIONS OF YOUR PLANT

ORIENT YOURSELF IN THE FUTURE ON THE RECOMMENDATIONS BASED ON EUROVENT 4/23 (2018)

Depending on the existing outside air conditions (ODA categories "Outdoor Air" according to EN 16798-3) and the requirements on supply air quality (SUP categories "Supply Air" according to EN 16798-3), EUROVENT 4/23 gives suggestions for selecting suitable air filters with corresponding minimum separation performance for the particulate matter fractions ePM_1, $ePM_{2,5}$ or ePM_{10}. The values given here describe the required overall efficiency for the respective particulate matter fraction, regardless of whether it concerns single-stage or multi-stage filtration.

An example of this is a production area without special hygiene requirements in the automotive industry (SUP 4), where outside air conditions have increased particulate matter pollution (ODA 2). The recommendation is to use air filters in the supply air system whose total efficiency for PM_{10} is at least 80 %.

Our experts will be pleased to advise you and use e.FFECT to calculate which filter solution will achieve this goal.

			SUPPLY AIR				
OUTDOOR AIR			SUP1*	SUP2* MEDIUM	SUP3** BASIC	SUP4	SUP5
			$PM_{2,5} \leq 2.5$ $PM_{10} \leq 5$	$PM_{2,5} \leq 5$ $PM_{10} \leq 10$	$PM_{2,5} \leq 7.5$ $PM_{10} \leq 15$	$PM_{2,5} \leq 10$ $PM_{10} \leq 20$	$PM_{2,5} \leq 15$ $PM_{10} \leq 30$
CATEGORY	$PM_{2,5}$	PM_{10}	ePM_1	ePM_1	$ePM_{2,5}$	ePM_{10}	ePM_{10}
ODA 1	≤ 10	≤ 20	70 %	50 %	50 %	50 %	50 %
ODA 2	≤ 15	≤ 30	80 %	70 %	70 %	80 %	50 %
ODA 3	> 15	> 30	90 %	80 %	80 %	90 %	80 %

Recommended min. ePM_x filtration efficiencies depending on ODA and SUP category.
Annual mean PM_x values in µg/m³
* Minimum filtration requirements ISO ePM1 50 % refer to a final filter stage
** Minimum filtration requirements ISO ePM2,5 50 % refer to a final filter stage

SUP1: Applications with high hygiene requirements e. g. hospitals, pharmacy, electronics and optical industry, supply air for cleanrooms, food & beverages (zones H).

SUP2: Applications with medium hygiene requirements e. g. in the production of food and beverages (zones M).

SUP3: Applications with normal hygiene requirements, e. g. in the production of food and beverages (zones B).

SUP4: Applications without hygiene requirements e. g. production areas in the automotive industry.

SUP5: Production areas in heavy industry e. g. steel mills, smelters, (laser) welding plants.

IMPACT OF ISO 16890 ON OTHER STANDARDS AND GUIDELINES

VDI 3803 Part 4 "Ventilation technology, equipment needs – air filter systems (VDI ventilation regulations)
Guideline VDI 3803 Part 4 is currently being revised and will probably not be published before 2019. Here the VDI describes filter applications in ventilation and air conditioning systems. The revision takes into account the new filter classifications according to ISO 16890.

VDI 6022 Part 1 "Room air technology, indoor air quality – hygiene requirements for ventilation and air conditioning systems and devices (VDI ventilation regulations)"
The guideline VDI 6022 Part 1 was published in the beginning of January 2018 in a revised form. Here, the VDI gives recommendations for compliance with the hygiene requirements for ventilation and air conditioning systems. The revision takes into account the new filter classification according to ISO 16890 and refers directly to the descriptions of VDI 3803 Part 4.

VDI

EHEDG Doc. 47
The European Hygienic Engineering & Design Group (EHEDG) provides information in the EHEDG Guideline no. 47 on the proper use of ventilation systems as part of the stringent hygiene requirements in the food and beverage industry. A revision is currently underway due to the new classification system in the ISO 16890 test standard.

EHEDG HYGIENIC ENGINEERING & DESIGN GROUP EUROPEAN COMPANY MEMBER 2018

EUROVENT
The certification of fine filters and their energy efficiency classification is currently carried out by EUROVENT according to the filter classification of EN 779. The EUROVENT Certification Company will revise its certification program and classification by autumn 2018 to provide powerful orientation for energy-efficient filter selection in the future.

EUROVENT CERTIFIED PERFORMANCE
AIR FILTERS CLASS M5 – F9
www.eurovent-certification.com

What else needs to be considered?

- Dust is not all the same and needs to be evaluated depending on your situation – PM matters!
- Beware of misinterpretations such as: "1 µm particles must be separated by ePM1 filters". In actual fact, an ISO ePM10 60 % filter restrains more than 10 percent of >1 µm particles and more than half of >2.5 µm particles.
- Does your filtration system protect machines and/or people and/or products? The quality requirements for the supply air determine the necessary filter efficiency of your system.
- Feel free to contact our filtration consultants to develop with them a filter solution that precisely meets your requirements.

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Freudenberg Filtration Technologies SE & Co. KG
69465 Weinheim, Germany
Phone +49 (0) 6201 80-6264 | Fax +49 (0) 6201 88-6299
viledon@freudenberg-filter.com
www.freudenberg-filter.com

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