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AIR FILTRATION

PRESENTATION APRIL 2021

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www.arimec.eu

AIR WATER ENERGY FIRE PROTECTION

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TOPICS

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3. FOUNDAMENTALS OF AIR FILTERS
4. OUTDOOR AIR CATEGORIES ODA & SUPPLY AIR CATEGORIES SUP
5. EUROVENT ENERGY EFFICIENCY CLASSIFICATION
6. COVID-19 INDUSTRY RECOMMENDATIONS
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1. INDOOR AIR QUALITY (IAQ)

Most people spend on average up to **90 % of their life indoors**. Not only at home, but in various places such as offices, schools, restaurants, shopping malls or cinemas. The exposure to air contaminants, from dust to spores, bacteria, viruses and chemical compounds has direct influence on people's immune systems and can cause , from **allergies** to **cancer** or even an **epidemic disease** like COVID-19.

Having a clean healthy air indoors is crucial for the health of the population as a whole and in particular vulnerable groups such as babies, children or elderly people

It is a necessity not only to avoid the direct spread of a virus, but to support peoples immune systems to withstand serious impacts by an aggressive disease.

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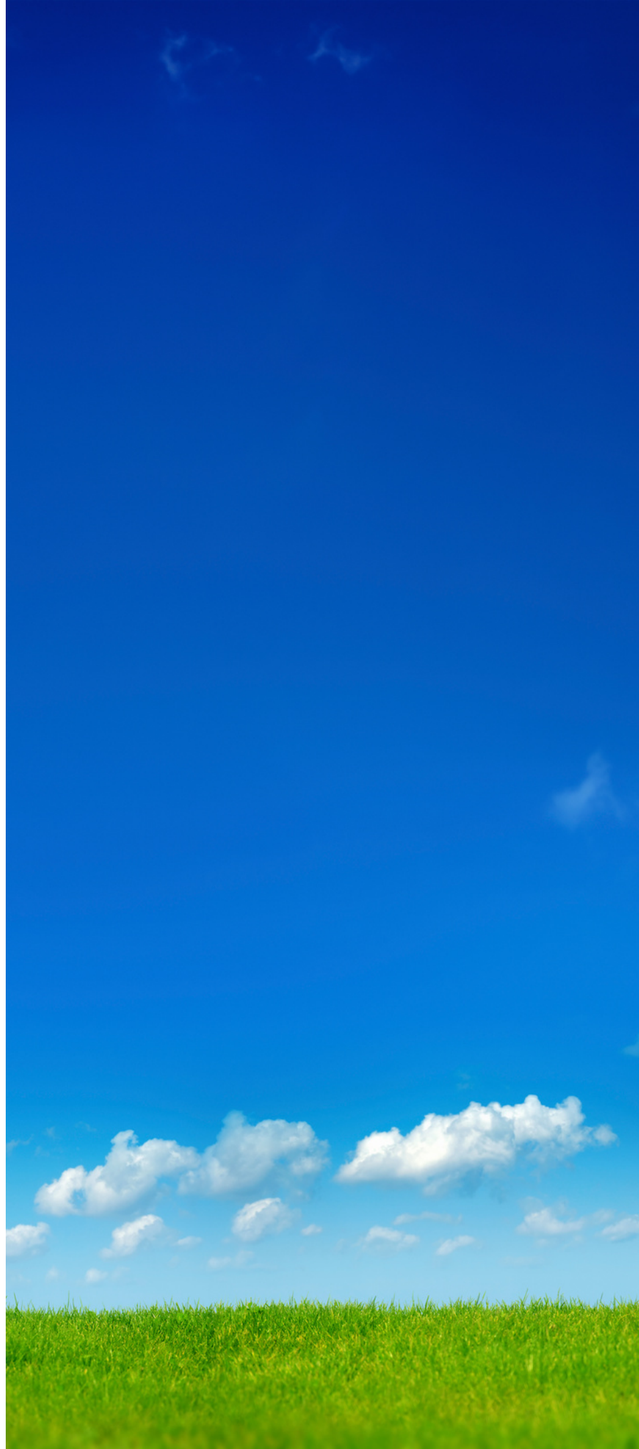
PARTICULATE MATTER (PM) CLASSIFICATION

The common technical classification of fine dust fractions is also based on the classification of particle sizes according to the areas they are deposited in the human respiratory system.

The classes are

PM10 (particles with an aerodynamic diameter of ‹ 10 µm), PM2.5 (‹ 2.5 µm) and PM1 (‹ 1 µm).

(There has been a recent addition to the established particle size classes: particle fractions with a diameter of ‹ 100 nm. Particles of this size are referred to as ultrafine particles (UFP) or nanoparticles.)



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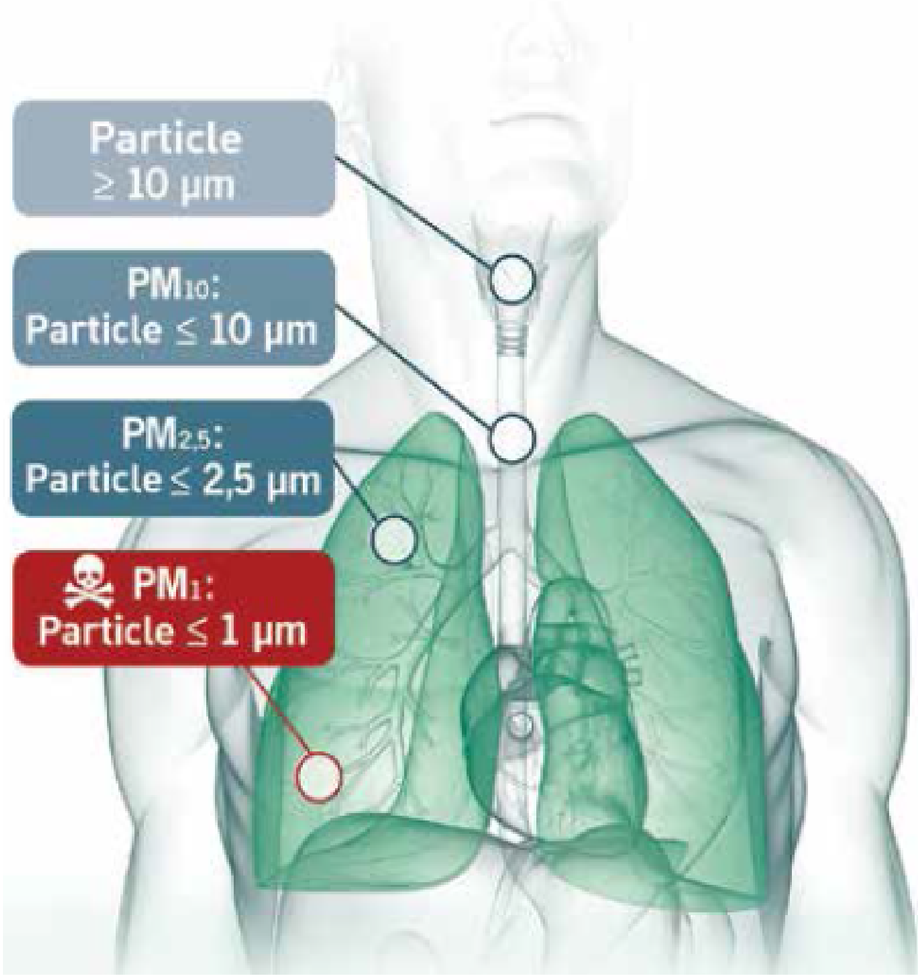
Studies have proven that

Particular matter (PM) affects more people than any other pollutant!

Components of PM are sulphate, nitrates, ammonia, sodium chloride, black carbon, mineral dust, combustion particles and water. It consists of a suspended complex mixture of solid and liquid particles of organic and inorganic substances.

The effects of PM are that fine dust can be a serious health hazard. **The most important diseases which have been associated with indoor air exposures due to PM contamination** are:

- Allergy & Asthma
- Lung cancer
- Cardiovascular diseases (CVD)
- Chronic obstructive lung disease (COPD)



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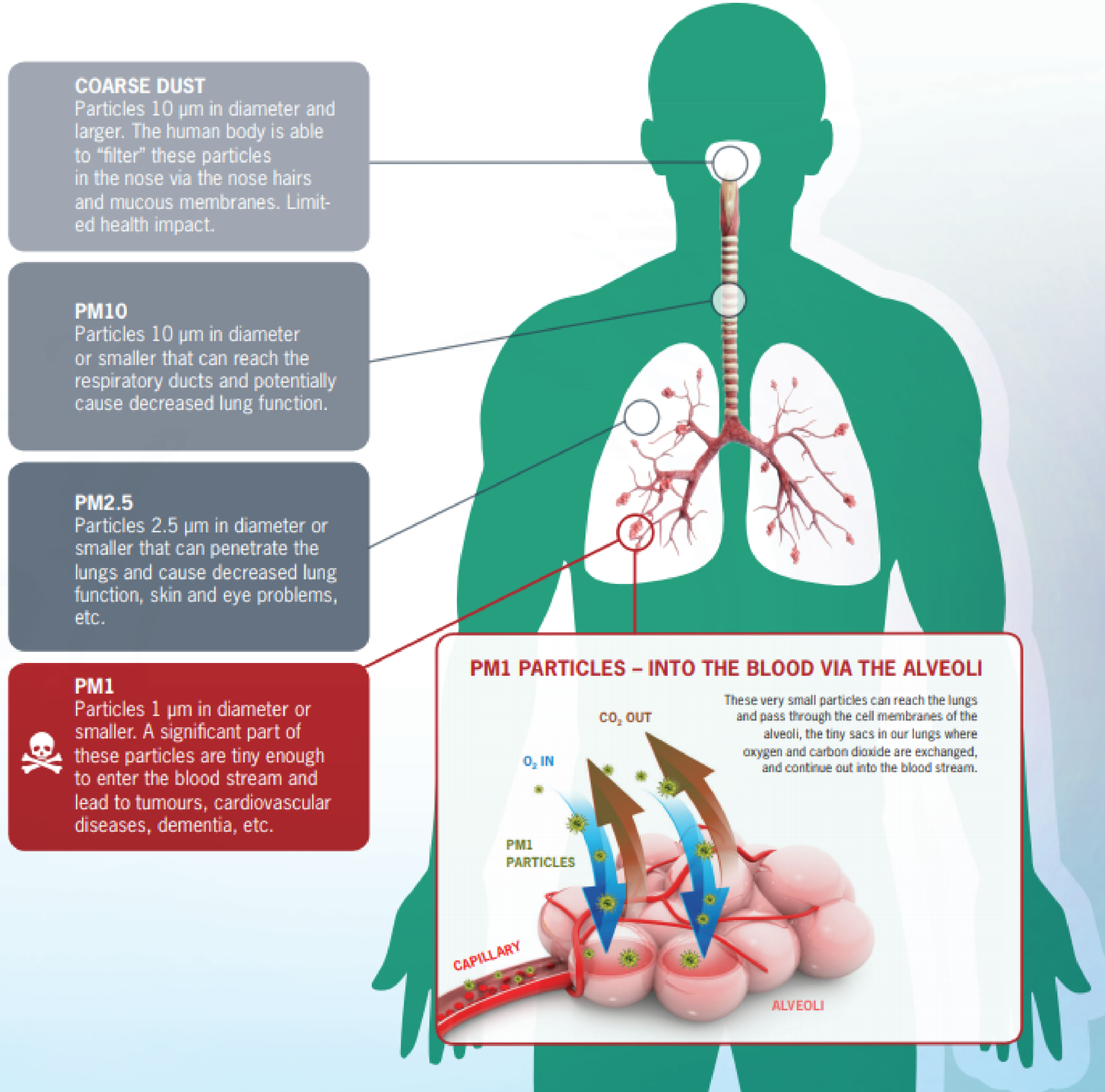
WE BREATHE UP TO 15 KG AIR PER DAY!

Humans eat 1 kg of food each day, drink 2 kg of fluids and breathe up to 15 kg of air per day. We take care about the food we eat and the water we drink but rarely do we consider the air we breathe.



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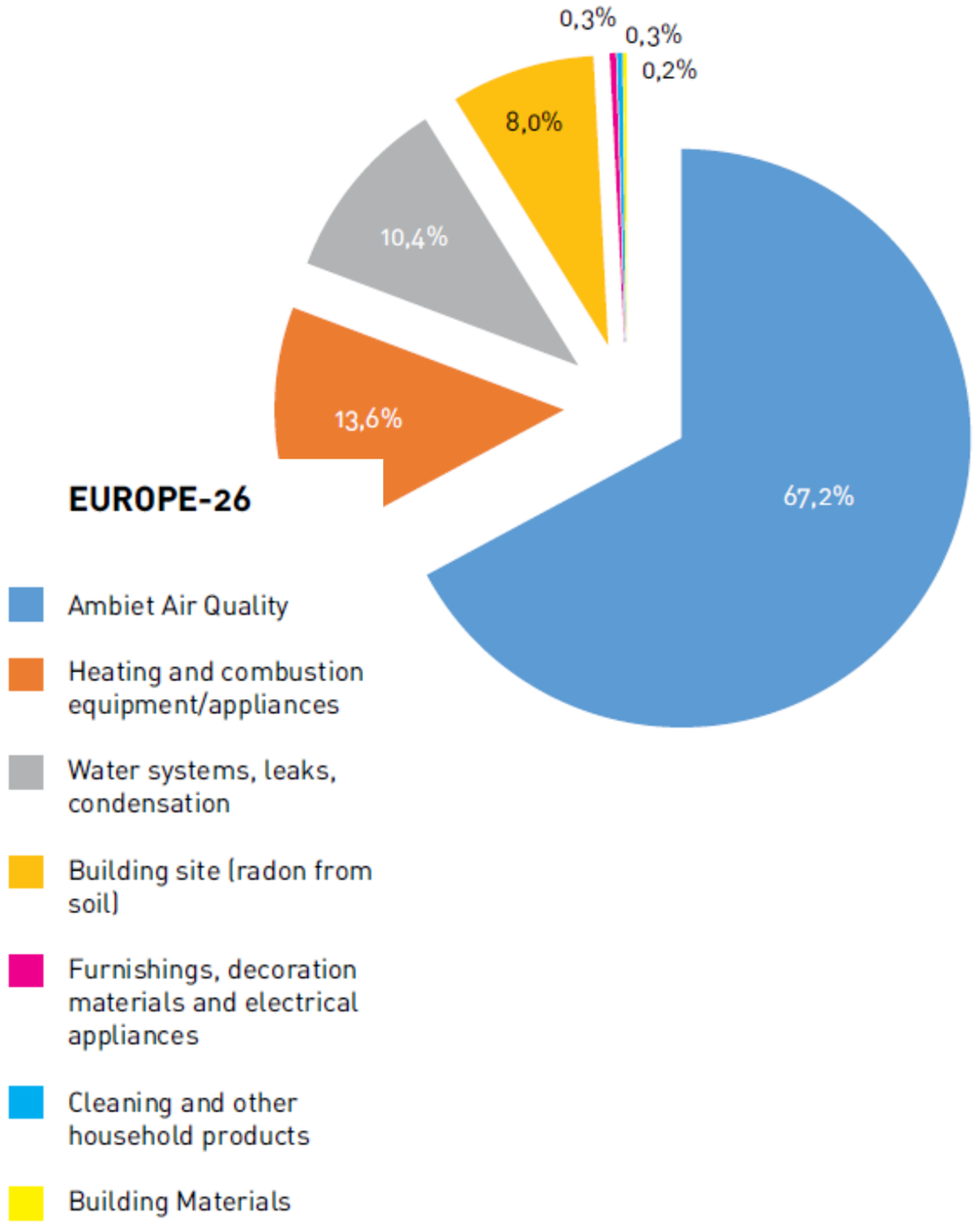
The impact of IAQ on the **burden of diseases** (BoD) is measured by the means of a so-called **disability-adjusted-life-year** (DALY). This time-based measure combines years of life lost due to premature mortality and years of life lost due to time lived in states of less than full health.

The total estimated burden of disease attributable to IAQ in the European Union is approx. 2 million DALYs per year, which means
that two million years of healthy life is lost annually. It is worth noticing that, according to latest estimation carried out by French economists, the cost of 1 DALY can amount up to 100 000 EUR.

Bad ambient air quality affects the burden of diseases (BoD) most

Outdoor air pollution plays a significant role for indoor air exposures. Due to ventilation providing continuous air exchange in buildings, the indoor air **exposure to fine PM** originates mostly from outdoor air, **especially in areas affected by heavy traffic.** The second most important source of exposure comes from the indoor combustion of solid fuels for cooking and heating (if present).

What is often not acknowledged is that in strongly polluted areas (e.g. heavy industry zones, city centres with heavy traffic) **without air filtration, over 90% of ambient PM levels monitored outdoors, occurs indoors**. Applying correctly selected, efficient air filters in ventilation systems can significantly reduce the impact of PM exposure on the Burden of Disease (BoD).



CLEAN AIR BENEFITS

Cleaner lungs

Improved Mood

Lower Medical Cost

Improved Productivity

Better Immune System

Longer Life Span

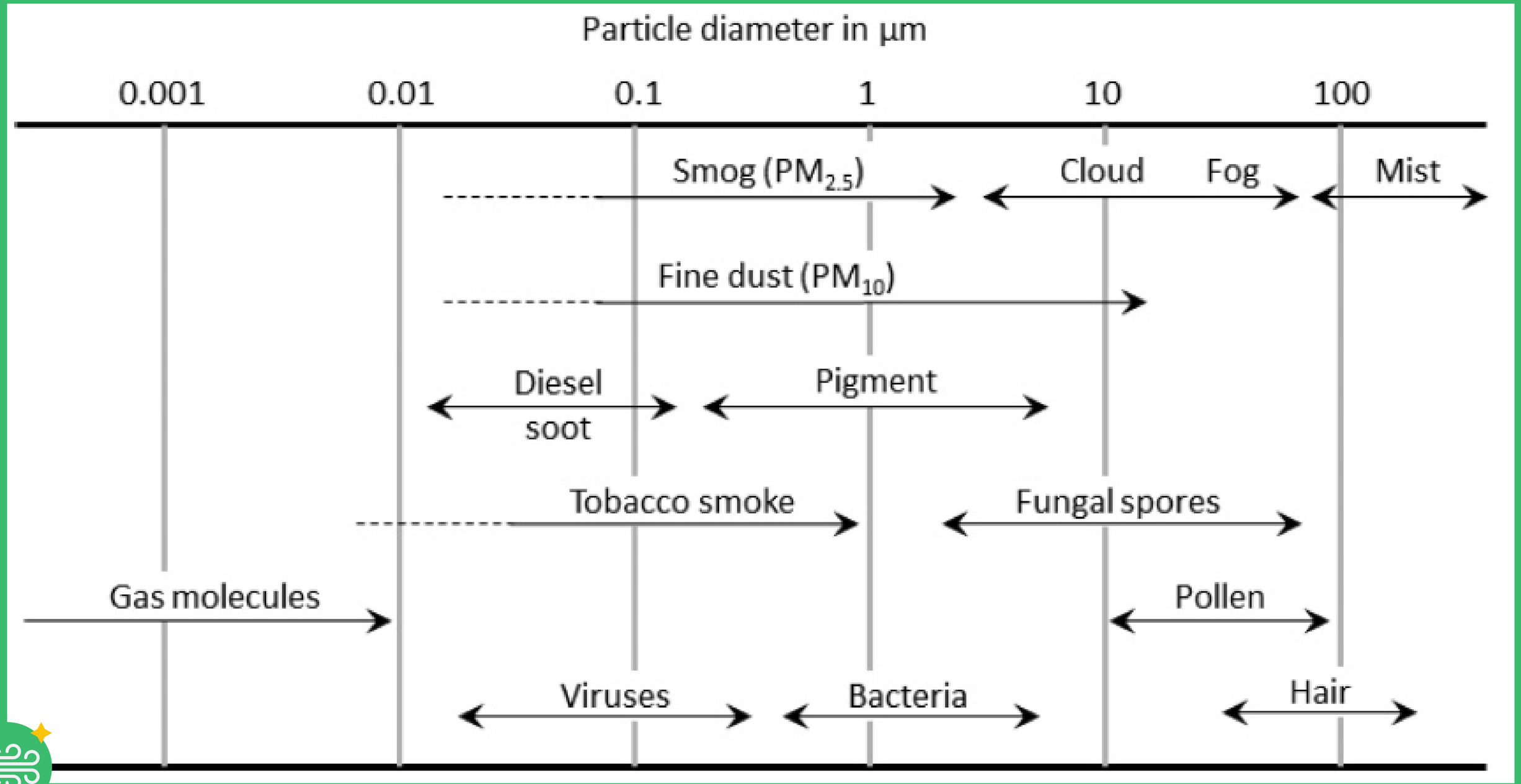
Better Sleep

Improved Digestion

Better For Your Blood Pressure

Reduced Allergies & Asthma Symptoms

General guide to particle size distribution of atmospheric air



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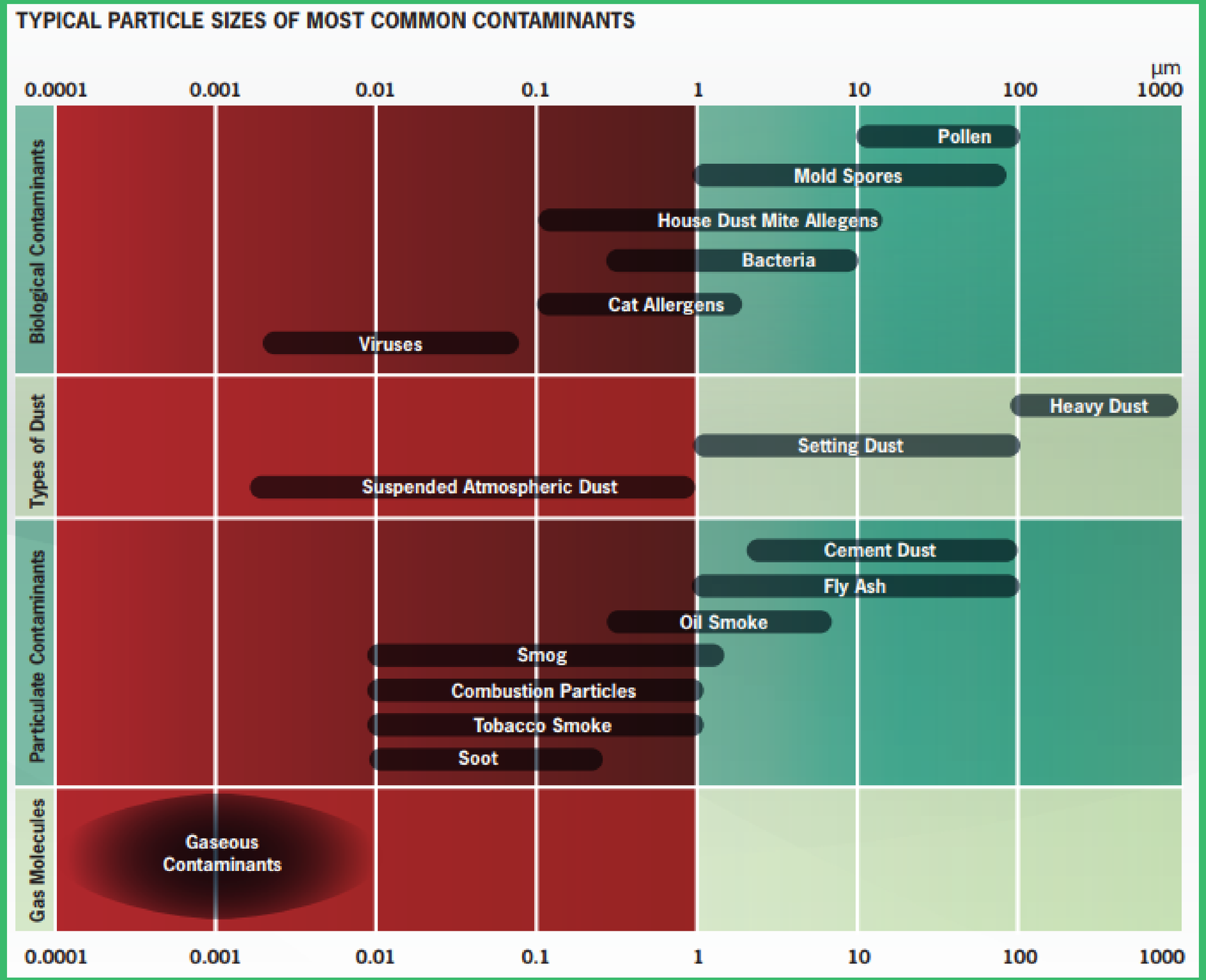
The naked eye can see objects as small as 40 microns.

As a point of reference, the diameter of a human hair is 70 microns, and a red blood cell is 8 microns



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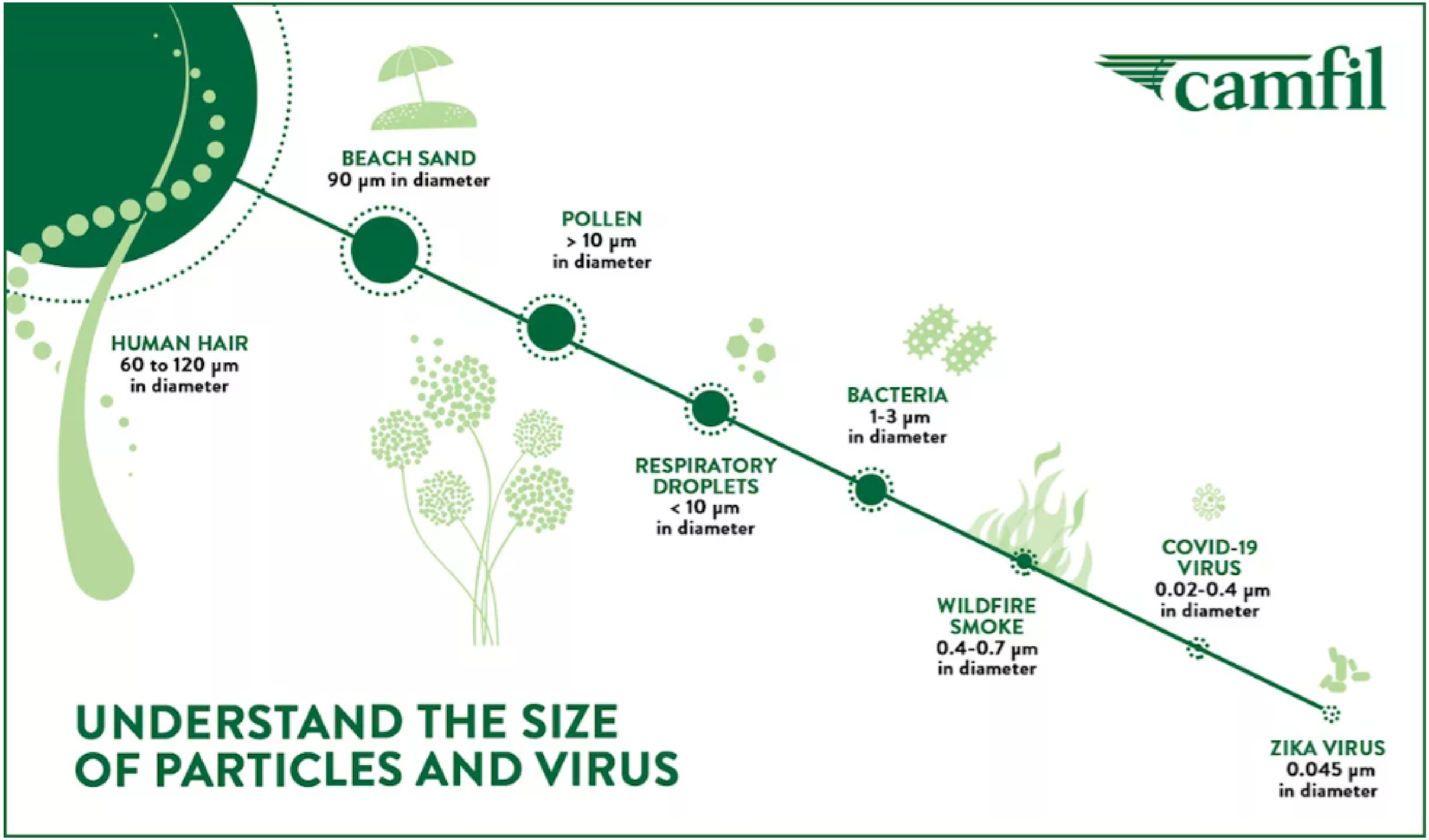
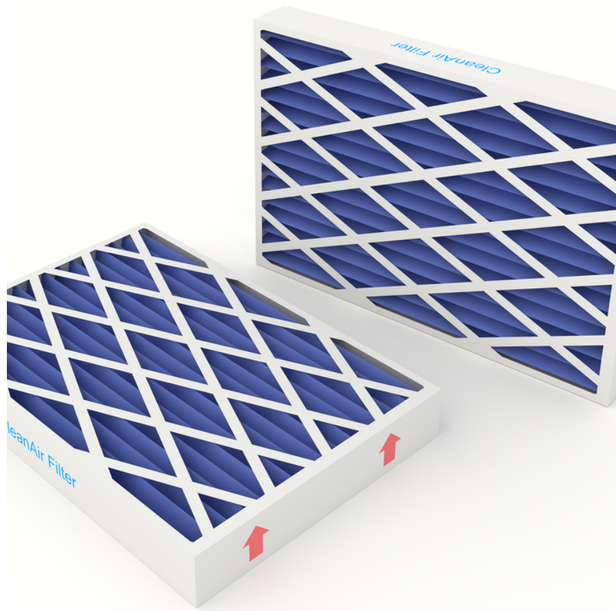


2. IMPORTANCE OF AIR FILTERS

Controlled air quality is necessary today more than ever .
Air filters ensure healthy indoor air **by removing harmful fine dust including pollen, bacteria, yeast and moulds along with other organic and inorganic material**. Air filters also serve to keep the air handling equipment itself clean and efficient.

Air purity requirements are continuously increasing. At the same time, the need to reduce energy consumption and carbon dioxide emissions is increasing, along with the pressure on costs. **Thus, buildings are more and more restricted from natural ventilation making Energy-efficient mechanical ventilation with air filtration solutions more important than ever before**



The aim of using air filters is to protect people's health by maintaining a good hygiene level in the ventilation system and clean indoor air quality (IAQ).

The urban air quality is nowadays polluted by small PM1 particles and gases coming from combustion and diesel engines, which city centres are crowded with. Additionally, for hygiene reasons, bacterial and fungal spores must be removed from the air stream, which are typically in a size range between 1 and 10 µm. Therefore, for the human health and indoor hygiene, it is important to clean the inlet air with sufficient air filters.

The most common air filters in comfort ventilation are ePM1, ePM2,5 and ePM10.

ePM1 is recommended in buildings such as schools, hospitals, office buildings, apartments and residential facilities.

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USING THE RIGHT FILTER

Using the right air filter will help you to maintain healthy indoor air quality and save energy (by using the Eurovent's new energy classifications.

Choose the right air filter for the lowest energy usage and highest indoor air quality.

Today, all air filters can be graded from A+ (lowest energy consumption) to E (highest) .

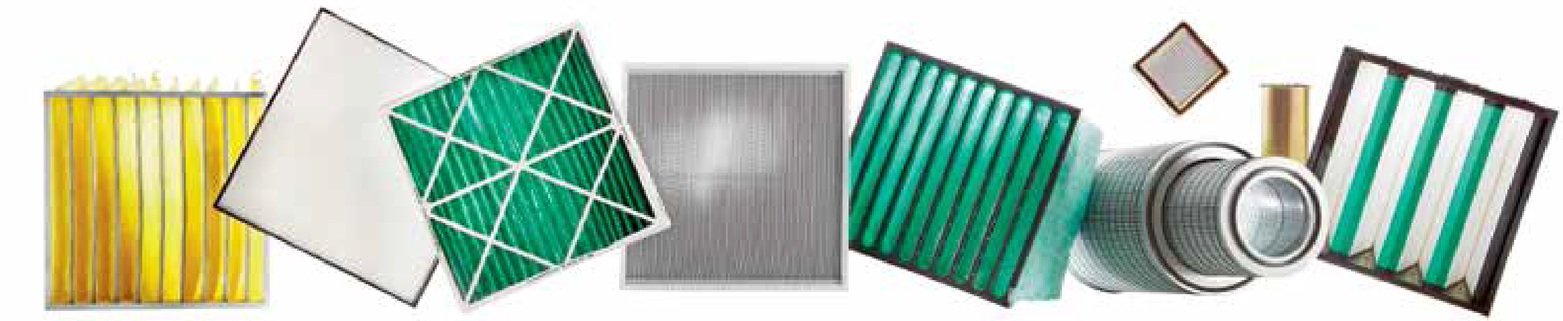
The classification, (EN IS016890) will give you: a filter's annual energy consumption, initial efficiency and minimum efficiency

3. FOUNDAMENTALS OF AIR FILTRATION

European standard defining the filtration performance of filters for general ventilation was the **EN 779:2012** till end of 2018 **.**

From 1/1/2019 we have the new global standard **EN ISO 16890:2016**.
Both standards deal with the evaluation of the filtration effect of coarse and fine dust filters used in general ventilation.
In EN 779:2012, the efficiency classification for medium and fine filters is based on 0,4 μm particles, while the new EN ISO 16890 defines the efficiency for various fractions of particle size: PM10, PM2.5 and PM1.

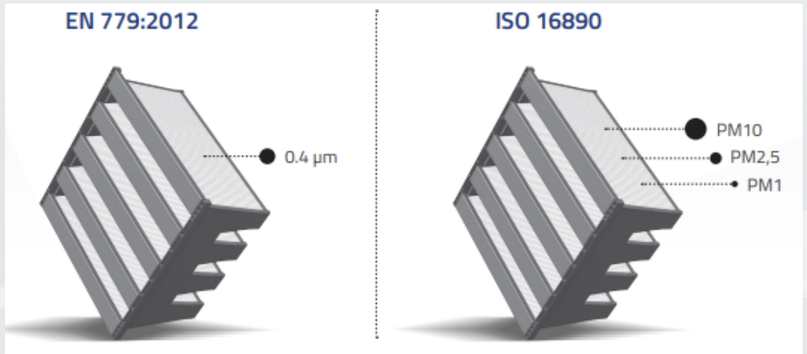
Both standards deal with the evaluation of the filtration effect of coarse and fine dust filters used in general ventilation.



Main differences in test method between EN 779:2012 and EN ISO 16890:2016

EN779:2012

- Efficiency based on one particle size, 0,4 µm
- Dust feeding and particle efficiency measure in steps up to 450 Pa final pressure drop gives average efficiency ex. 85%
- Discharging of a piece of filtermedia in IPA-liquid (Isopropanol), class F7 – F9
- Minimum Efficiency (ME) defines the filter in classes F7 – F9 Ex.: ≥ 35% is class F7
- Test dust: ASHRAE
- Air flow rate: 3400 m^3/h (0.944 m^3/s)
- No relation to real environment.



Reference particle sizes according to EN 779: 2012 and ISO 16890 standards

EN ISO16890:2016

- ePM_x – efficiency of particle fraction with a diameter ≥ 0,3 µm and x µm

Efficiency	Size range µm
ePM_{10}	$0,3 \leq x \leq 10$
$ePM_{2.5}$	$0,3 \leq x \leq 2,5$
ePM_1	$0,3 \leq x \leq 1$

- Average efficiency = average value of initial efficiency and discharged (conditioned) efficiency.
- Final pressure drop: 200 Pa (Coarse), and 300Pa (ePm_x)
- Discharge of a complete filter in IPA-vapor
- Test dust: ISO A2/AC Fine (≈ double dust holding in grams)
- Air flow rate: 3400 m^3/h (0.944 m^3/s)
- More equal to real environment.

EN 779:2012 Standard

Filter Type	EN 779 Class	Average Arrestance (Am) (%)	Average Efficiency (Em), 0,4 µm (%)	Final Test Pressure Drop (Pa)	Minimum Efficiency 0,4 µm (%)
Coarse filter	G1	$50 \leq Am < 65$	-	250	-
	G2	$65 \leq Am < 80$	-	250	-
	G3	$80 \leq Am < 90$	-	250	-
	G4	$90 \leq Am$	-	250	-
Medium filter	M5		$40 \leq Em < 60$	450	-
	M6		$60 \leq Em < 80$	450	-
Fine filter	F7	-	$80 \leq Em < 90$	450	35
	F8	-	$90 \leq Em < 95$	450	55
	F9	-	$95 \leq Em$	450	70

The quality of any filter essentially depends on the percentage of dust transported through the filter that is actually collected.

For coarse filters, the filter effect is evaluated by measuring the initial gravimetric arrestance when challenging the filter with synthetic test dust using ASHRAE-test dust.

For fine filters, the filter effect is evaluated by measuring the efficiency against 0.4 micron DEHS droplets.

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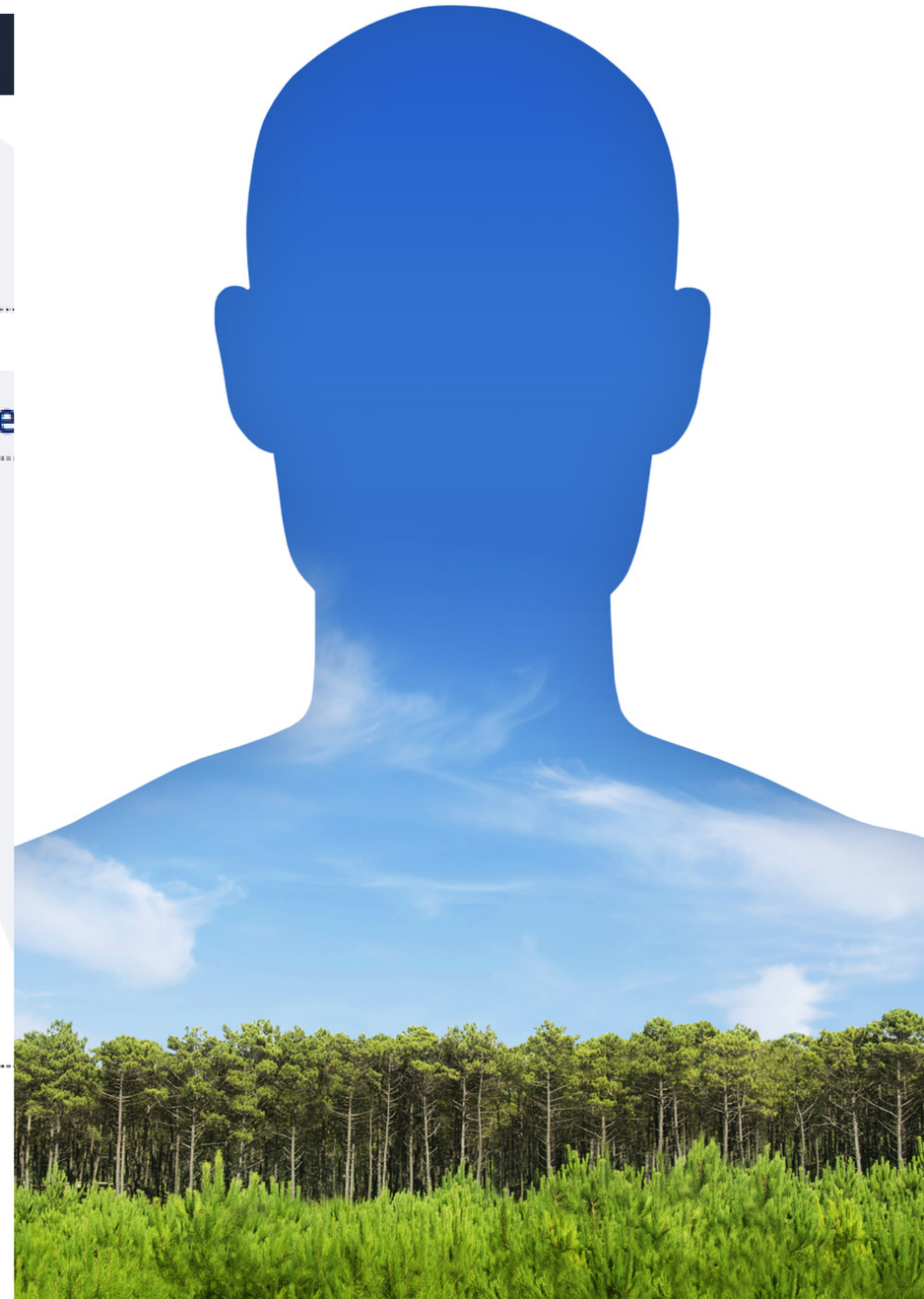
EN ISO 16890:2016 Standard

OLD STANDARD **EN 779**	NEW STANDARD **ISO 16890**
Filter classes F7-F8-F9 M5-M6 G2-G3-G4	Four ISO groups ISO ePM_1 ISO $ePM_{2,5}$ ISO ePM_{10} ISO Coarse

ISO ePM_1	ISO $ePM_{2,5}$	ISO ePM_{10}	ISO Coarse
ePM_1 95%	$ePM_{2,5}$ 95%	ePM_{10} 95%	ePM_{10} 45%
ePM_1 90%	$ePM_{2,5}$ 90%	ePM_{10} 90%	ePM_{10} 40%
ePM_1 85%	$ePM_{2,5}$ 85%	ePM_{10} 85%	ePM_{10} 35%
ePM_1 80%	$ePM_{2,5}$ 80%	ePM_{10} 80%	ePM_{10} 30%
ePM_1 75%	$ePM_{2,5}$ 75%	ePM_{10} 75%	ePM_{10} 25%
ePM_1 70%	$ePM_{2,5}$ 70%	ePM_{10} 70%	ePM_{10} 20%
ePM_1 65%	$ePM_{2,5}$ 65%	ePM_{10} 65%	ePM_{10} 15%
ePM_1 60%	$ePM_{2,5}$ 60%	ePM_{10} 60%	ePM_{10} 10%
ePM_1 55%	$ePM_{2,5}$ 55%	ePM_{10} 55%	ePM_{10} 5%
ePM_1 50%	$ePM_{2,5}$ 50%	ePM_{10} 50%	
Requirement ≥50% Initial Efficiency ≥50% Discharged Efficiency	**Requirement** ≥50% Initial Efficiency ≥50% Discharged Efficiency	**Requirement** ≥50% Initial Efficiency No discharge requirement	No discharge requirement



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EN 779: 2012	EN ISO 16890 – range of actual measured average efficiencies		
Filter class	ePM_1	$ePM_{2.5}$	ePM_{10}
M5	5% - 35%	10% - 45%	40% - 70%
M6	10% - 40%	20% - 50%	60% - 80%
F7	40% - 65%	65% - 75%	80% - 90%
F8	65% - 90%	75% - 95%	90% - 100%
F9	80% - 90%	85% - 95%	90% - 100%

Comparison of EN 779 and EN ISO 16890 rated filter classes

Sellection of EN 779 and EN ISO 16890 rated filter classes

Filter class		Remarks
EN 779:2012	EN ISO 16890-1:2016	
M5	ePM10 ≥ 50	
F7	ePM2.5 ≥ 65	If not the last filter stage
F7	ePM1 ≥ 50	If the last filter stage
F9	ePM1 ≥ 80	

HEPA FILTERS

In high risk environments, which include laboratories, hospitals, isolation rooms and quarantine space the use of **HEPA (High-Efficiency Particulate Air)** filters is mandatory!

HEPA filters also should feature a dedicated containment system (so called Bag-in-Bag-out) to facilitate their replacement without physical contact with contaminated material.

HEPA filters international standards is EN1822-1:2019 (part of ISO 29463)

Usually, each single HEPA filter is tested according to standards by the manufacturer before dispatching and comes with a test report and a label showing the test results.




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BS EN 1822-1 2019			ISO 29463-1 2017		
Filter class and group	Overall value		Filter class and group	Overall value	
	Efficiency (%)	Penetration (%)		Efficiency (%)	Penetration (%)
E10	≥ 85	≤ 15			
E11	≥ 95	≤ 5	ISO 15E	≥ 95	≤ 5
			ISO 20E	≥ 99	≤ 1
E12	≥ 99.5	≤ 0.5	ISO 25E	≥ 99.5	≤ 0.5
			ISO 30E	≥ 99.9	≤ 0.1
H13	≥ 99.95	≤ 0.05	ISO 35H	≥ 99.95	≤ 0.05
			ISO 40H	≥ 99.99	≤ 0.01
H14	≥ 99.995	≤ 0.005	ISO 45H	≥ 99.995	≤ 0.005
			ISO 50U	≥ 99.999	≤ 0.001
U15	≥ 99.9995	≤ 0.0005	ISO 55U	≥ 99.9995	≤ 0.0005
			ISO 60U	≥ 99.9999	≤ 0.0001
U16	≥ 99.99995	≤ 0.00005	ISO 65U	≥ 99.99995	≤ 0.00005
			ISO 70U	≥ 99.99999	≤ 0.00001
U17	≥ 99.999995	≤ 0.000005	ISO 75U	≥ 99.999995	≤ 0.000005

Filter efficiency is for most penetrating particle size (MPPS)

EPA
HEPA
ULPA

4.OUTDOOR AIR CATEGORIES ODA & SUPPLY AIR CATEGORIES SUP

World Health Organisation (WHO) set these annual mean Indoor Air Quality:

- Annual mean for PM2.5 < 10 µg/m3
- Annual mean for PM10 < 20 µg/m3

No recommendations for PM1 concentration.

In next tables we can see the **OUTDOOR AIR CATEGORIES ODA1 ODA2 ODA3** and then **SUPPLY AIR CATEGORIES**

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Category	Description	Typical environment
ODA 1	**OUTDOOR AIR, WHICH MAY BE ONLY TEMPORARILY DUSTY** Applies where the World Health Organisation WHO (2005) guidelines are fulfilled (annual mean for PM2.5 ≤ 10 µg/m^3 and PM10 ≤ 20 µg/m^3).	
ODA 2	**OUTDOOR AIR WITH HIGH CONCENTRATIONS OF PARTICULATE MATTER** Applies where PM concentrations exceed the WHO guidelines by a factor of up to 1,5 (annual mean for PM2.5 ≤ 15 µg/m^3 and PM10 ≤ 30 µg/m^3).	
ODA 3	**OUTDOOR AIR WITH VERY HIGH CONCENTRATIONS OF PARTICULATE MATTER** Applies where PM concentrations exceed the WHO guidelines by a factor of greater than 1,5 (annual mean for PM2.5 > 15 µg/m^3 and PM10 > 30 µg/m^3).	

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Supply air categories

SUP 1	refers to supply air with concentrations of particulate matter which fulfilled the WHO (2005) guidelines limit values multiplied by a factor x 0,25 (annual mean for PM2.5 ≤ 2.5 µg/m^3 and PM10 ≤ 5 µg/m^3).
SUP 2	refers to supply air with concentrations of particulate matter which fulfilled the WHO (2005) guidelines limit values multiplied by a factor x 0,5 (annual mean for PM2.5 ≤ 5 µg/m^3 and PM10 ≤ 10 µg/m^3).
SUP 3	refers to supply air with concentrations of particulate matter which fulfilled the WHO (2005) guidelines limit values multiplied by a factor x 0,75 (annual mean for PM2.5 ≤ 7.5 µg/m^3 and PM10 ≤ 15 µg/m^3).
SUP 4	refers to supply air with concentrations of particulate matter which fulfilled the WHO (2005) guidelines limit values (annual mean for PM2.5 ≤ 10 µg/m^3 and PM10 ≤ 20 µg/m^3).
SUP 5	refers to supply air with concentrations of particulate matter which fulfilled the WHO (2005) guidelines limit values multiplied by factor x 1,5 (annual mean for PM2.5 ≤ 15 µg/m^3 and PM10 ≤ 30 µg/m^3).

Recommended minimum efficiencies

Minimum filtration efficiencies refer to various PM particle size ranges, depending on the application. For the most demanding applications with high and medium hygienic requirements (SUP1 and SUP2), PM1 efficiencies are shown.

For premises with standard and low hygienic requirements (SUP3), PM2.5 efficiencies are recommended.

For applications with very low or without hygienic requirements (SUP4 and SUP5), PM10 efficiency is shown.

The recommended minimum efficiencies depending on ODA and SUP categories are summarised in Table below.

Note: As the task of air filters in HVAC systems is not only to protect ventilated rooms from too severe level of contamination, but also the HVAC system itself, **the minimum efficiency of a first stage filter (on fresh air inlet) should be at least PM10 50%**. Yet, if air humidification is applied in the system, the minimum efficiency of a filter located downstream the humidifier should be at least PM2.5 65%.

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			SUPPLY AIR				
OUTDOOR AIR			SUP 1* PM2.5 ≤ 2.5 PM10 ≤ 5	SUP2* PM2.5 ≤ 5 PM10 ≤ 10	SUP3** PM2.5 ≤ 7.5 PM10 ≤ 15	SUP4 PM2.5 ≤ 10 PM10 ≤ 20	SUP5 PM2.5 ≤ 15 PM10 ≤ 30
Category	PM2.5	PM10	ePM_1	ePM_1	$ePM_{2.5}$	ePM_{10}	ePM_{10}
ODA 1	≤ 10	≤ 20	60%	50%	60%	60%	50%
ODA 2	≤ 15	≤ 30	80%	70%	70%	80%	60%
ODA 3	> 15	> 30	90%	80%	80%	90%	80%

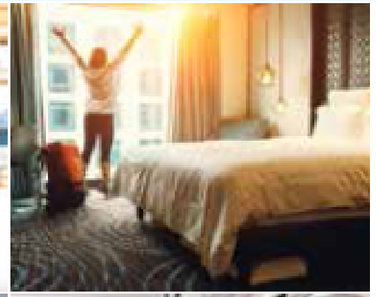
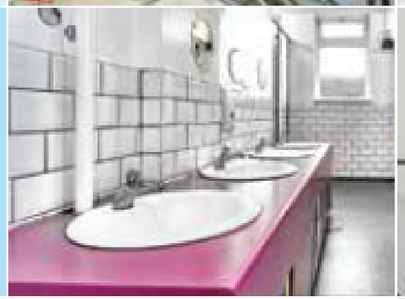
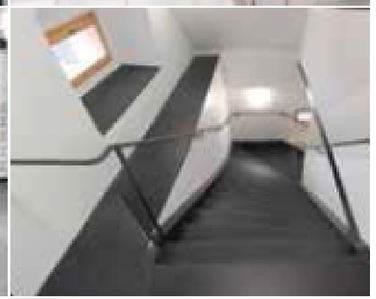
Table 3: Recommended min. ePMx filtration efficiencies depending on ODA and SUP category. Annual mean PMx values in $\mu g/m^3$

* Minimum filtration requirements ISO PM1 50% refer to a final filter stage

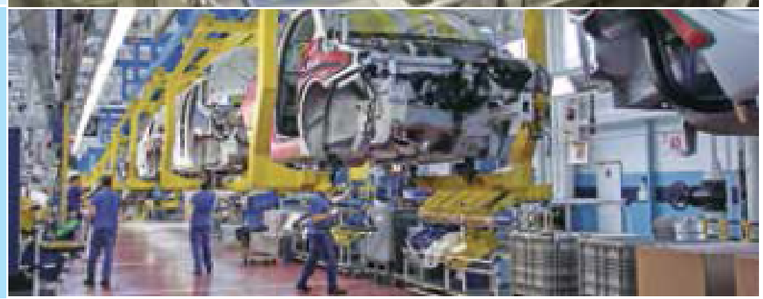
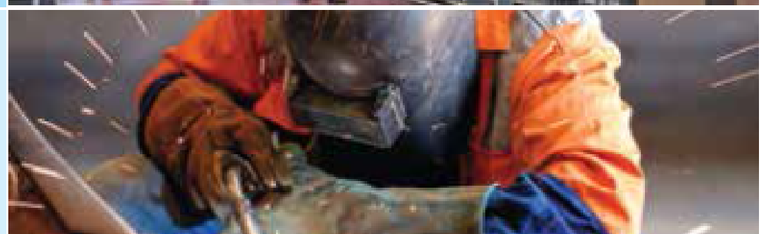
** Minimum filtration requirements ISO PM2.5 50% refer to a final filter stage

Presented efficiency values concern both single filter and multi-stage filtration systems with a cumulated efficiency.

Typical Applications corresponding to SUP categories

CATEGORY	GENERAL VENTILATION	
SUP 1	-	-
SUP 2	**Rooms for permanent occupation.** Example: Kindergardens, offices, hotels, residential buildings, meeting rooms, exhibition halls, conference halls, theaters, cinemas, concert halls.	 
SUP 3	**Rooms with temporary occupation.** Examples: Storage, shopping centers, washing rooms, server rooms, copier rooms.	 
SUP 4	**Rooms with short-term occupation.** Examples restrooms, storage rooms stairways.	 
SUP 5	**Rooms without occupation.** Examples: Garbage room, data centers, underground car parks.	 

Typical Applications corresponding to Industrial SUP categories

CATEGORY	INDUSTRIAL VENTILATION	
SUP 1	**Applications with high hygienic demands.** Examples: Hospitals, pharmaceutics, electronic and optical industry, supply air to clean rooms.	
SUP 2	**Applications with medium hygienic demands.** Example: Food and beverage production.	
SUP 3	**Applications with basic hygienic demands.** Example: Food and beverages production with a basic hygienic demand.	
SUP 4	**Applications without hygienic demands.** Example: General production areas in the automotive industry.	
SUP 5	**Production areas of the heavy industry.** Examples: Steel mill, smelters, welding plants.	

EFFICIENCY TABLES FOR CHOOSING FILTER

Supply air category	Description	Outdoor air (ODA 1) Rural	Outdoor air (ODA 2) Suburban	Outdoor air (ODA 3) Urban	Recirculation air efficiency	Recommended air changes
SUP1	Areas with high hygienic demands – Food and beverage production, hospitals, pharmaceutical, optics and microelectronics	ePM1 70%+	ePM1 80%+	ePM1 90%+	H13 or ePM1 80%+	9-12
SUP2	Medium hygienic demands or rooms of permanent occupancy – Offices, hotels, schools and commercial buildings	ePM1 60%+	ePM1 70%+	ePM1 80%+	H13 or ePM1 80%+	5-8
SUP3	Basic hygienic demands, short term occupation, shopping centres, server rooms and copier rooms	ePM1 50%+	ePM1 60%+	ePM1 60%+	H13 or ePM1 80%+	3-5

Outdoor Air (ODA) – The outdoor air quality is determined by WHO guidelines. Simplified this can be Rural, Suburban and Urban areas

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

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5. EUROVENT ENERGY EFFICIENCY CLASSIFICATION

THE ENERGY USE IN KWH/ANNUM IS CALCULATED DUE TO THE FORMULA IN **EUROVENT REC 4/21-2018**. Where we define qv = 0.944 m3/s, t = 6000 h/a and h = 0.5

$$W = \frac{q_v \cdot \overline{\Delta p} \cdot t}{\eta \cdot 1000}$$

ANNUAL ENERGY USE FOR FILTER CLASSES

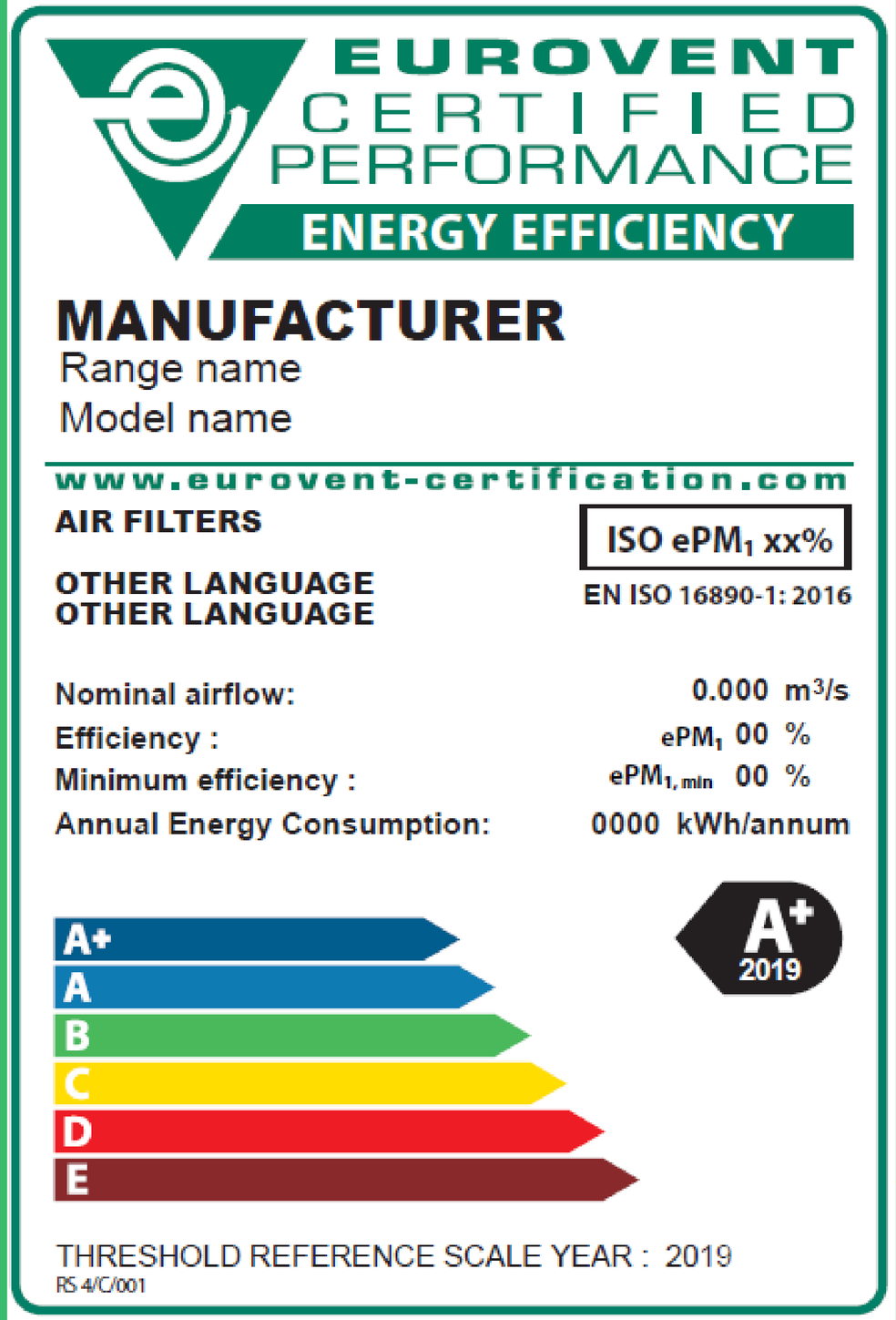
EUROVENT CERTITA RULES ALLOW ONLY 1% A+, 5% A, 15% B, AND 30% C CLASS FILTERS IN EUROPE. UPDATE OF EUROVENT ENERGY RATING EVERY 3 YEARS.

M_x = 200 g (AC Fine)	AEC in kWh/y FOR ePM_1 (ePM_1 and $ePM_{1,min} \geq 50\%$)					
	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_x = 250 g (AC Fine)	AEC in kWh/y FOR $ePM_{2.5}$ ($ePM_{2.5}$ and $ePM_{2.5,min} \geq 50\%$)					
	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

M_x = 400 g (AC Fine)	AEC in kWh/y FOR ePM_{10} ($ePM_{10} \geq 50\%$)					
	A+	A	B	C	D	E
50 & 55%	450	550	650	750	1100	>1100
60 & 65%	500	600	700	850	1200	>1200
70 & 75%	600	700	800	900	1300	>1300
80 % 85%	700	800	900	1000	1400	>1400
> 90%	800	900	1050	1400	1500	>1500

Illustration of the AIR FILTERS Energy Efficiency Label



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SOME EXAMPLES

SAVE ENERGY, MONEY AND THE PLANET

Using the right air filter will not only help you save money, but also maintain healthy indoor air quality. With the implementation of Eurovent´s updated and objective system for classifying energy efficiency, it will be easier for you to find the right air filter for the lowest energy usage and highest indoor air quality.

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 the filter test method **EN ISO16890:2016**, will give you a better understanding of annual energy consumption, average efficiency and minimum efficicency.

The energy consumption of air filters in general ventilation systems has become the focus of attention as energy prices increase, and as demands to reduce CO_2 emissions get tougher.

Classifying the air filters based on the new test standard will be more precise. Deciding the filter efficiency based on the indoor requirements is the first step in choosing the best energy efficient filter.

WHY A NEW ENERGY CLASSIFICATION?

The Eurovent energy classification was established 2011. There were a couple of upgrades during the past year including the grades A+ to E introduced in January 2015.

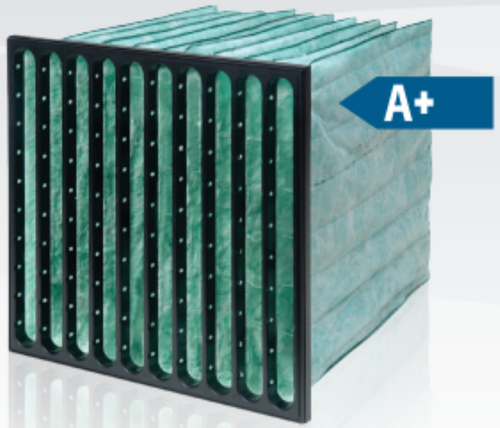
Air filter energy calculations were based on the EN779:2012 test reports. By introducing the global **ISO16890:2016**, an upgraded calculation method was needed.

During 2018, ISO16890:2016 became the only valid test standard in Europe. Beginning the 1st January, 2019, the energy classification for filters will be based on this standard.

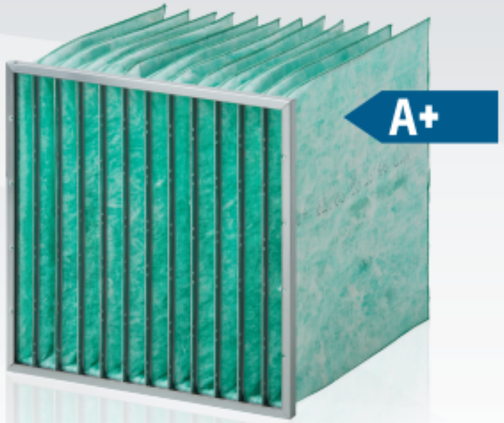
ALL AIR FILTERS REQUIRE A FULL TEST REPORT

More and more suppliers test their filters properly making i possible for customers to compare filter brands. By introduc ing the **2019 EUROVENT ENERGY CLASSIFICATION**, a participants of Eurovent Certita Certification are obliged t supply a full **EN ISO16890:2016 TEST REPORT,** as a bas to energy calculation, for every air filter sold in the market an published on Eurovent web site.

EUROVENT CERTIFIED PERFORMANCE ENERGY EFFICIENCY
CHECK ENERGY CLASS ON
www.eurovent-certification.com

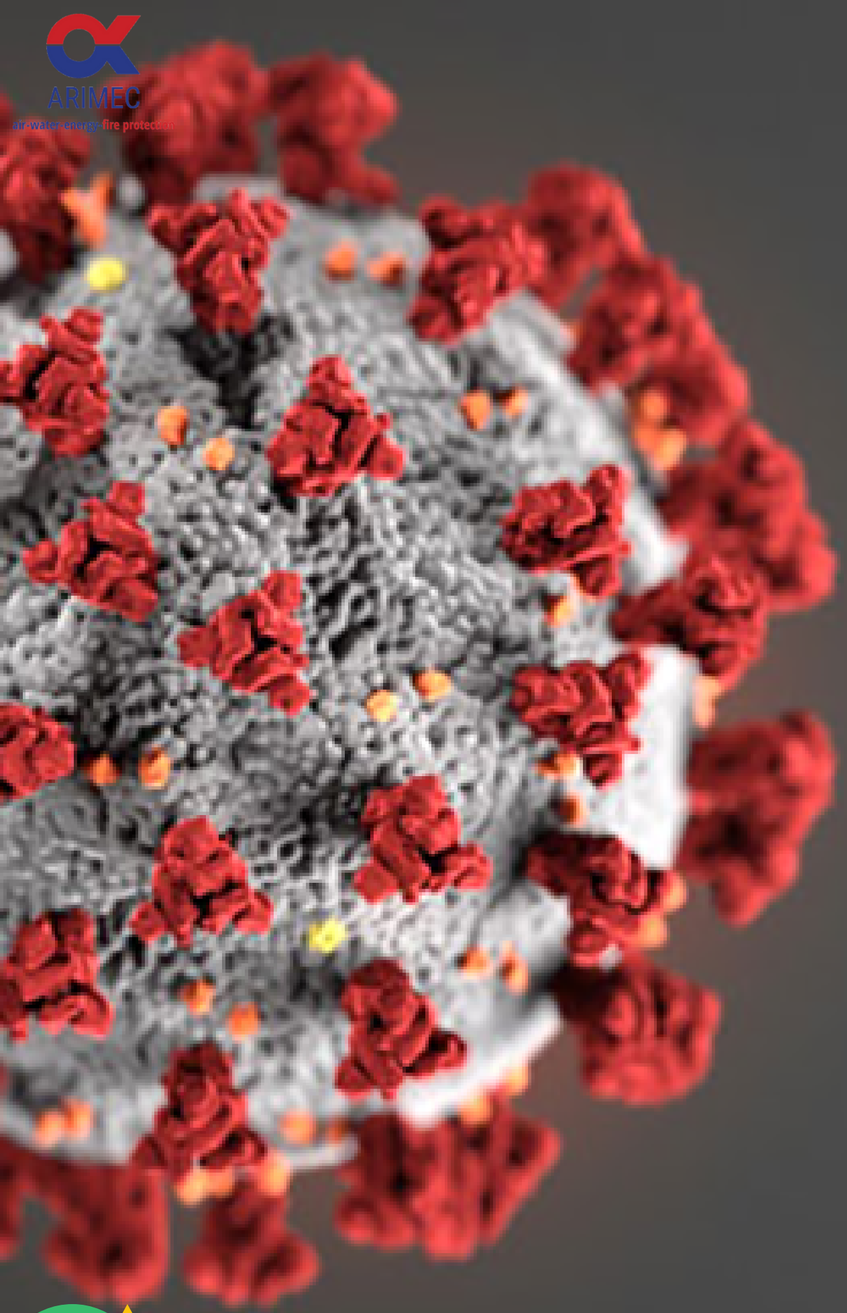


HI-FLO II XLT7/670 - ePM1 60% A+



HI-FLO M7 ES – ISO ePM1 60% A+

OPAKFIL ES7 – ISO ePM1 60% A+



COVID-19
INDUSTRY RECOMMENDATIONS

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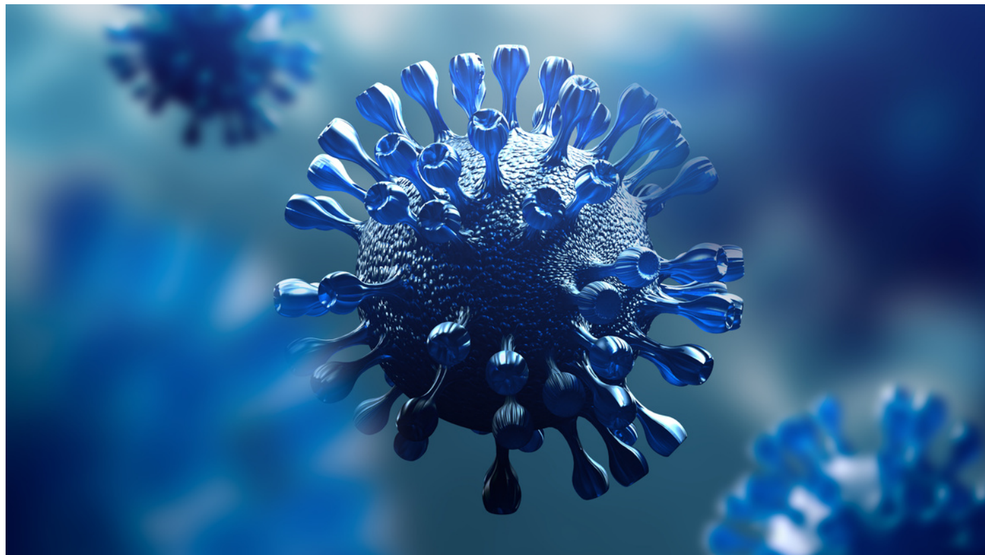
Air filtration is one of the ways to fight the impact of harmful pathogens such as **COVID-19.** Clean air should be introduced into our facility regularly to ensure a clean work environment. **A high-efficiency air filtration solution can prevent infections in the air because it can trap and remove flu viruses from the air**. The effectiveness depends on the efficiency of the air filter. But as infectious droplets generally are larger than 1 micrometer, the reduction of virus is significantly greater. **The virus captured in the air filter is strongly bound to the fibers in the filter media. Once the virus is captured it will stay in the air filter and eventually dry out and die (refers to as inactive).**



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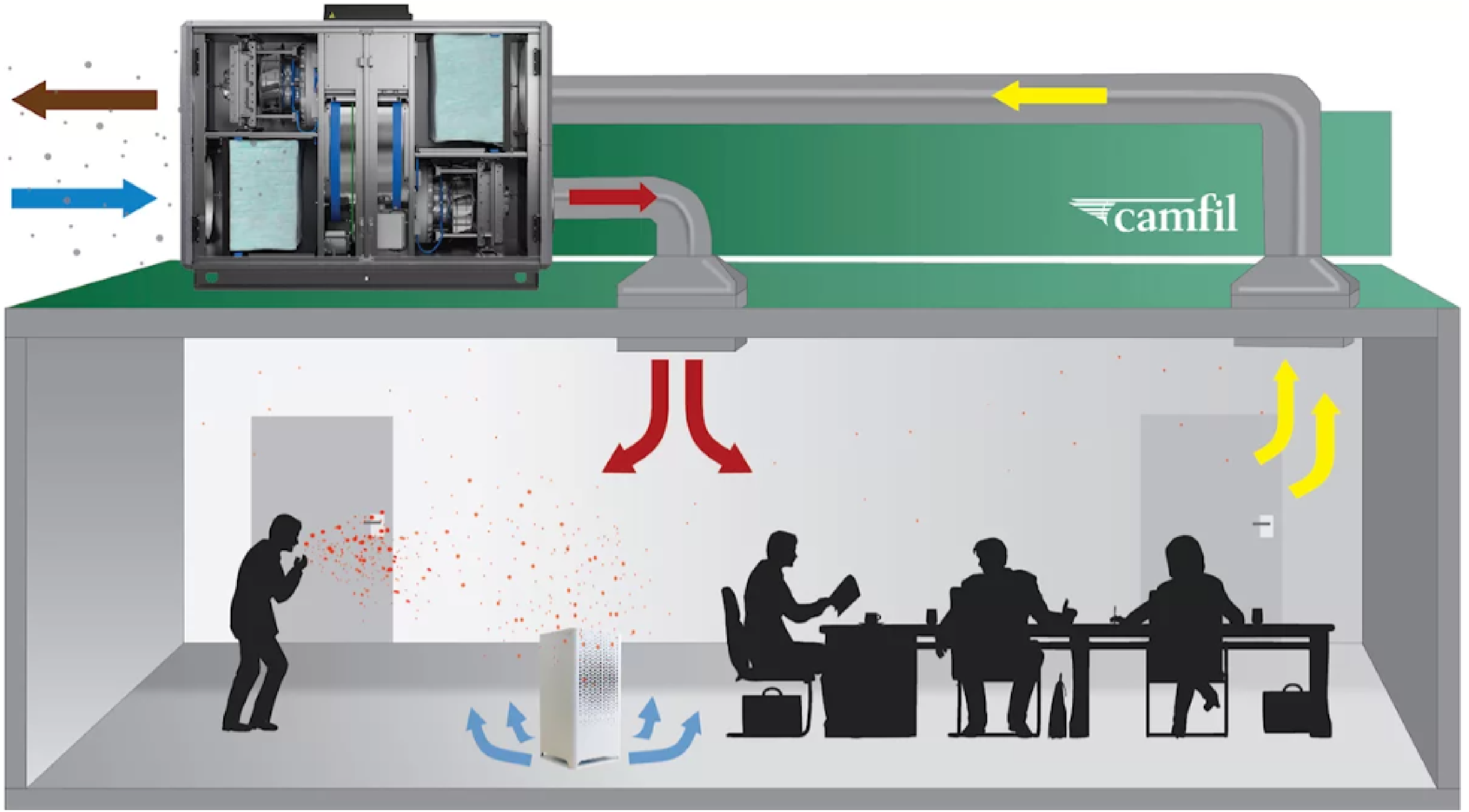
ENVIRONMENT EQUIPPED WITH PROPER AIR FILTRATION



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The selection of air filters depends on the application environment and should be carefully assessed. While regular air filters are not designed to prevent the spread of viruses, they are essential in minimising the risk as viruses tend to attach to airborne particulate matter and aerosols. Thus, regular filters with a high filtration efficiency (ePM1 filters) are crucial to reduce the risk of diseases transmitted through the air. **HEPA filters (High Efficiency Particulate Air) are mandatory in critical environments such as hospitals and healthcare facilities and can be also recommended for medium risk environments (high density of people) like airports, schools or other public spaces.**

In light of the COVID-19 problematic to severely affect the elderly and people with existing medical conditions, it is also recommended to **use HEPA filters in all facilities designed to support, help, house or care for these groups**. In general, the industry recommends increasing filter efficiencies for the duration of the epidemy.

DO NOT wash any kinds of filters, especially HEPA, EPA or ePM1 filters. Replace them!

Application Area	High Risk Environment	Medium Risk Environment	Low Risk Environment
Examples	Laboratories, Hospitals, Isolation Rooms, Quarantine Spaces	Other medical facilities, airports, schools, public areas	Small offices, businesses, personal space
Type of filter required	HEPA + Relevant Containment Equipment	HEPA (recommended) or EPA filters	EPA (recommended) or Fine Dust Filter
Recommendation	Special care needs to be given upon replacement of filters. Treat them as biohazards! (wear protective masks, suits and gloves)	Special care needs to be given upon replacement of filters. Treat them as biohazards! (wear protective masks, suits and gloves)	Do not wash filters. Replace regularly.
Filter Class as per EN1822:2009 ISO16890	Minimum H14	Minimum H13	ePM1 80% or higher

Viruses and your HVAC system

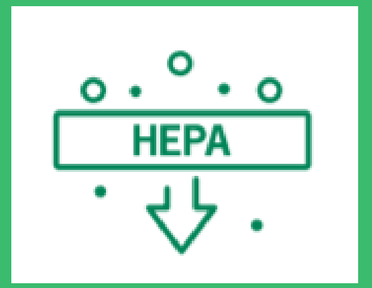
During the Covid 19 pandemic, **REHVA** (Federation of European ventilation and air conditioning association) released guidelines for businesses to follow to help protect them from the spread of airborne contaminants within buildings.

100 % supply air

Where possible, all ventilation systems should utilise 100% supply air. This will help the dilution factor within your building. Using the right HVAC filter will help reduce airborne particulates in the air.

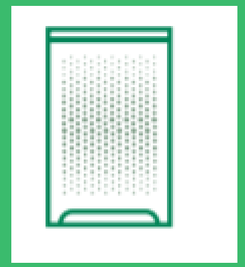
HEPA barrier

When recirculation is mandatory within your HVAC system a HEPA barrier should be put into place to reduce the spread of internal contaminants.



Air purification systems

These can be used to help supplement your HVAC system to increase air changes as well as reducing particulate levels generated by indoor contaminants.



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AIR PURIFIERS

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Technical especifications

Surface area covered: 100 m²

CADR*: 764,4 m³/h

Electrical supply: 220 - 240 VAC / 50 Hz

Consumed power: 68 W

Weight: 14 kg

Working temperature: 5 - 30 °C

Size A x B x C: 767,5 x 440 x 330 mm

HORIZON AIR Sensor: Temperature, humidity PM2.5 levels

Control APP: No

***: Volume of air with hazardous particles that the equipment is capable of purifying in one hour.**

HA-700

horizon AIR PURIFIER

FEATURES

Surface area covered:	100 m²
CADR*:	764,4 m³/h
Electrical supply:	220 - 240 VAC / 50 Hz
Consumed power:	68 W
Weight:	14 kg
Working temperature:	5 - 30 °C
Size A x B x C:	767,5 x 440 x 330 mm
HORIZON AIR sensor:	Temperature, humidity PM2.5 levels
Control APP:	No

*CADR: Volume of air with hazardous particles that the equipment is capable of purifying in one hour.

FEATURES

Suppression of ultra-thin particles (PM1.0)
Filtration of particles with up to 1 µm.

Double filtration
With a total of 8 filers installed in both sides of the equipment, it guarantees a clean air and a higher filtration rate.

Real-time air quality status
Air quality indicator pm 2.5 in a 4 colours led.
Blue – good (0 – 15 µg/m³)
Green – normal (16 – 50 µg/m³)
Yellow – bad (51 – 100 µg/m³)
Red – very bad (> 101 µg/m³)

Double air inlet and multiple discharge structure
The equipment sucks the air though two sides, filters it, and spreads it out towards multiple directions

Double ultraviolet led (UV)
Ultraviolet radiation damages the DNA of many microorganisms and prevents them from reproducing.
In this way, bacteria, viruses and fungi can be eliminated without leaving any residue.

Ions generator
The ions generator groups the noxious particles from the environment in order to facilitate their filtration.

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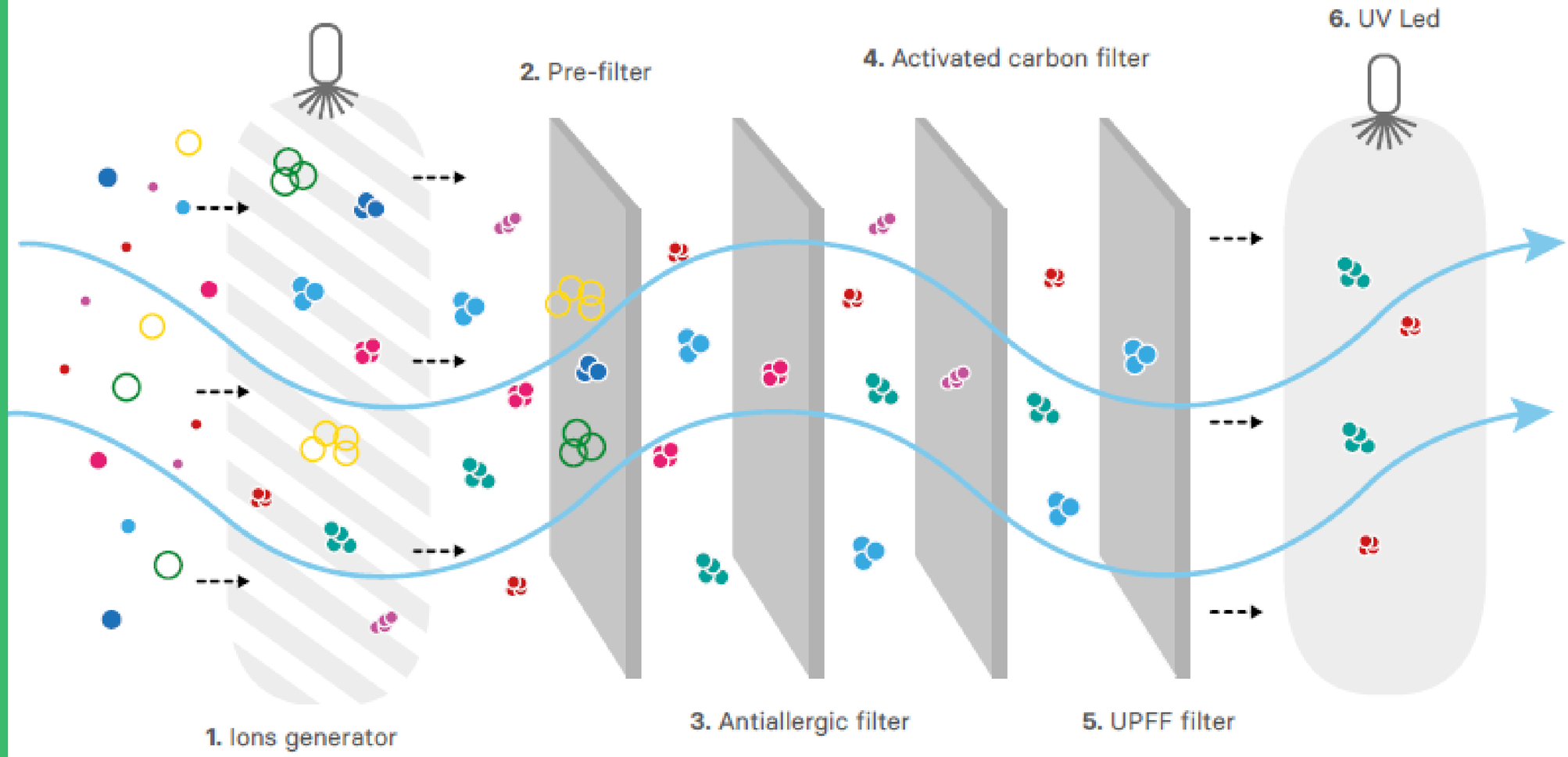

Pollen Mould Dust Pet hair and skin Germs Smoke Bacteria Viruses

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HA-700

The most powerful equipment of the collection able to maintain clean an area of up to 100 m² thanks to its double filtration system.
It also incorporates UV LED technology for the elimination of bacteria and viruses. An ideal system for the sanitization of the environment with people and animals.

BLUE
CORRECT:
0~15 μg/m³

GREEN
MOSTLY
CORRECT:
16~50 μg/m³

YELLOW
INCORRECT:
51~100 μg/m³

RED
VERY INCORRECT:
101~ μg/m³

APLICATIONS

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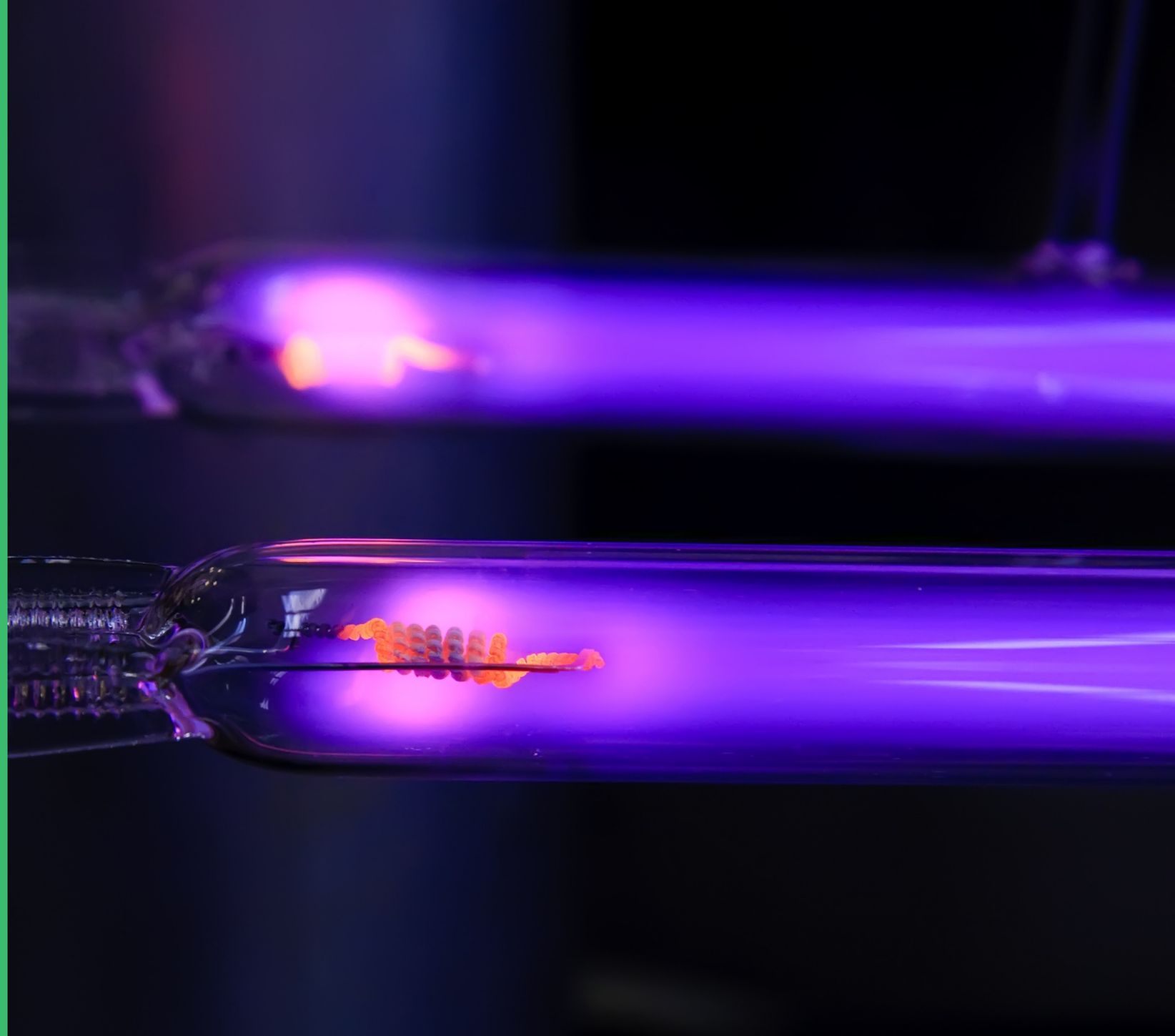
UV LAMPS



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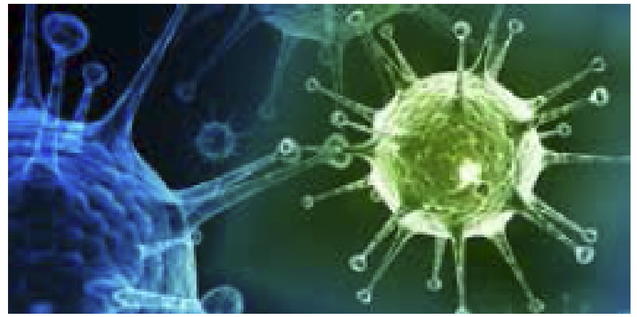

Οι μονάδες **DUV** των ULTRAVIOLET GERMICIDAL IRRADIATION (UVGI), είναι Μονάδες **ANTI-ΜΙΚΡΟΒΙΑΚΗΣ** υπεριώδους ακτινοβολίας (UVGI) **καθαρές από όζον**, και αποτελούν μια απλή λύση για την **απολύμανση του αέρα** και των **εσωτερικών επιφανειών** σε εγκαταστάσεις αεραγωγών, όπου δεν έχουμε πρόσβαση στο εσωτερικό τους. Είναι κατάλληλες για **εγκατάσταση** σε αεραγωγούς ή **Fan Coil Units** και διαθέτουν λαμπτήρες UV υψηλής απόδοσης για καλύτερο καθαρισμό του αέρα από μολυσματικά μικρόβια, με εξαιρετικά χαμηλό κόστος. Μπορούν πολύ εύκολα να εγκατασταθούν σε παλιά και νέα συστήματα αερισμού & κλιματισμού, σε **πλένουμ μονάδων**, στο τμήμα του **στοιχείου** ή στους αεραγωγούς προσαγωγής ή απαγωγής αέρα. Είναι κατάλληλα για χρήση σε εμπορικά κτίρια και κτίρια γραφείων, σε σπίτια, σε νοσοκομεία, σε φαρμακευτικές εταιρείες, σε σχολεία κ.λ.π.

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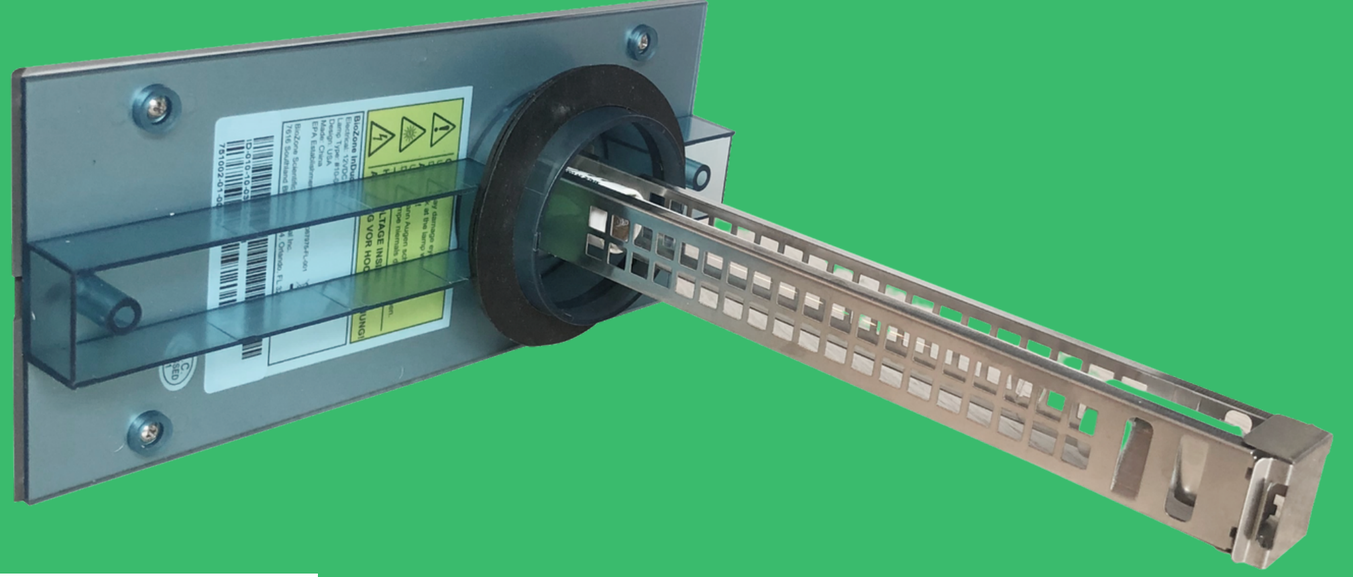
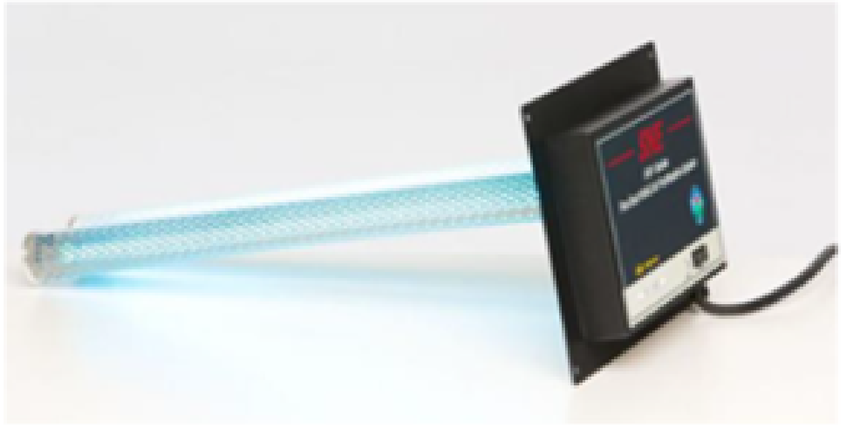


C. Vessel Sterilizing and Cleaning Equipment, Thermal Cameras

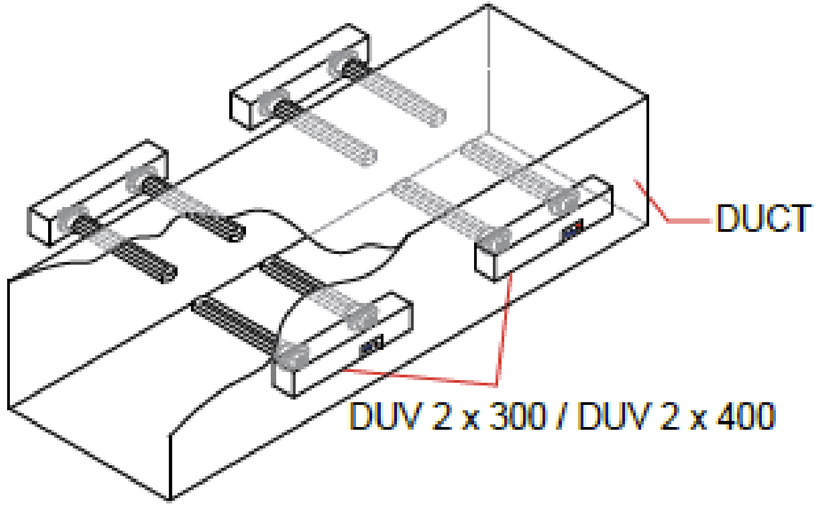
15. UV Air Treatment



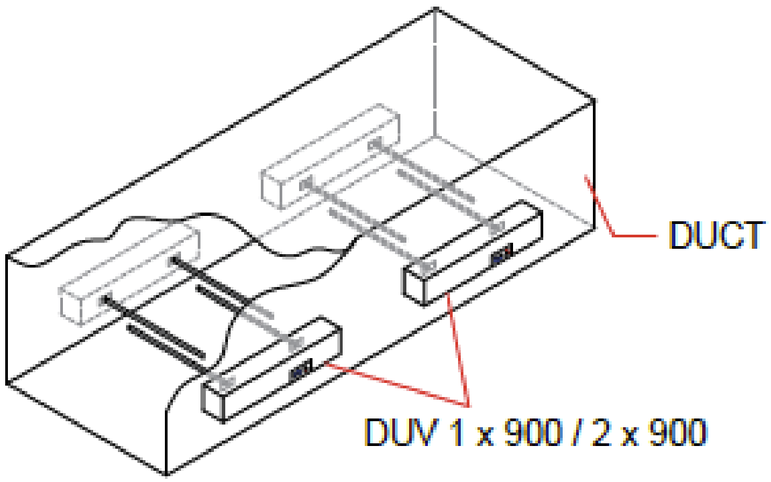
15 UV light treatment systems

15 Connection and (Scada) Control Skid

15 Spare lamp for UV light treatment systems



Τυπική εγκατάσταση
DUV 1 x 300 / 400. DUV 2 x 300 / 400



Τυπική εγκατάσταση
DUV 1 x 900. DUV 2 x 900

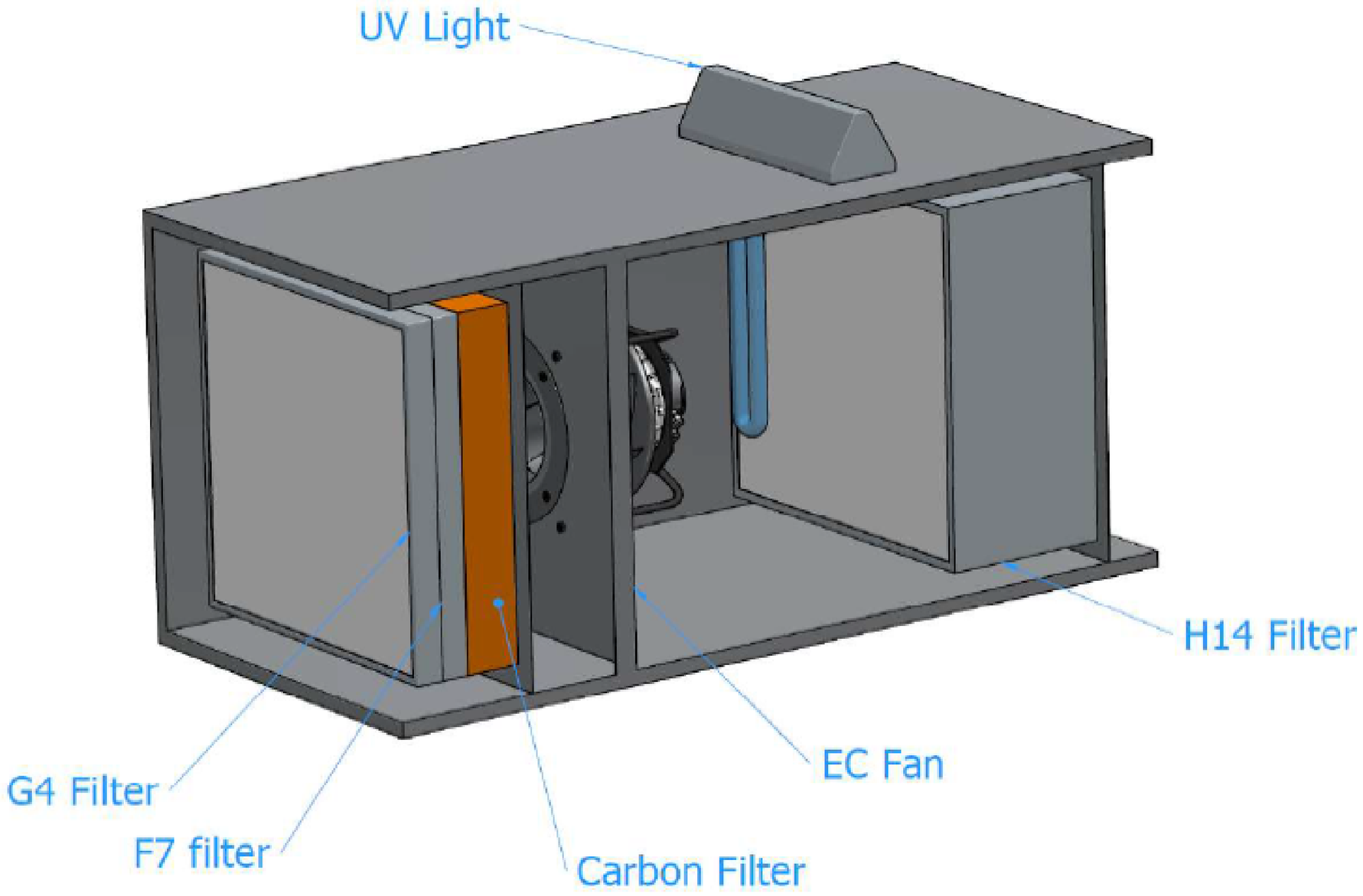
ΤΕΧΝΙΚΑ ΧΑΡΑΚΤΗΡΙΣΤΙΚΑ

- Λαμπτήρες U μήκους 300 & 400mm και T5 μήκους 900mm, με διάρκειας ζωής 12.000 ωρών.
- Πίνακας ελέγχου (Control Box) με φωτεινές ενδείξεις LED της λειτουργίας των λαμπτήρων και διακόπτη ON / OFF.
- Ακτινοβολία UV προς 360 μοίρες.
- Πολύ εύκολη & απλή εγκατάσταση. Ο πίνακας ελέγχου τοποθετείται εξωτερικά, στο κέλυφος του αεραγωγού ή του FCU.
- Εύκολη αντικατάσταση του λαμπτήρα με άνοιγμα του καλύμματος του πίνακα.
- Δεν είναι κατάλληλα για εξωτερική εγκατάσταση. Μόνο με σκέπαστρο βροχής.

		DUV 1 x 300	DUV 2 x 300	DUV 1 x 400	DUV 2 x 400	DUV 1 x 900	DUV 2 x 900
ΙΣΧΥΣ	W	1 x 45	2 x 90	1 x 60	2 x 60	1 x 75	2 x 75
ΠΑΡΟΧΗ ΑΕΡΑ *	m^3/h	1.300	2.200	1.700	2.900	2.500	4.000
ΠΑΡΟΧΗ ΑΕΡΑ **	m^3/h	650	1.100	850	1.450	1.250	2.000
ΜΗΚΟΣ ΛΑΜΠΤΗΡΑ	mm	300		400		900	
ΑΡΙΘΜΟΣ ΛΑΜΠΤΗΡΩΝ	Nr	1	2	1	2	1	2
ΤΙΜΗ ΤΕΜΑΧΙΟΥ	€	740,00	1.000,00	800,00	1.050,00	850,00	1.100,00

* σε Δοσολογία **3.100** microwatt S / cm2. Για να αυξηθεί η δόση UV, εγκαταστήστε πρόσθετες λάμπες.
** σε Δοσολογία **6.200** microwatt S / cm2. Για να αυξηθεί η δόση UV, εγκαταστήστε πρόσθετες λάμπες.

Filter box unit with UV lamp



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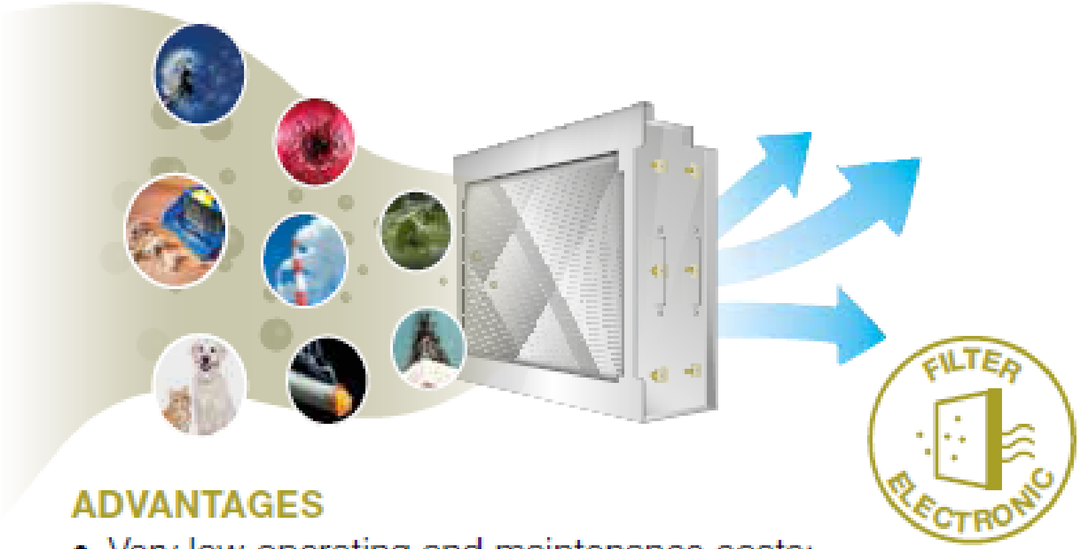
NEGATIVE IONISATION

ADVANTAGES

- Air side pressure drops close to zero;
- very low operating and maintenance costs;
- suitable for new systems;
- suitable for revamping existing systems;
- minimises contamination and colonisation of duct internal walls;
- suitable for installation on circular and rectangular ducts;
- suitable for installation inside air handling units:
- no ozone produced during operation;
- no danger when operating in the absence of ventilation.

ELECTRONIC FILTRATION



ADVANTAGES

- Very low operating and maintenance costs;
- very effective against viruses and bacteria;
- very effective against fine dusts;
- minimises contamination and colonisation of the internal walls of the ducts;
- ozone production 5 times lower than the legal limit as verified and certified by an external body.

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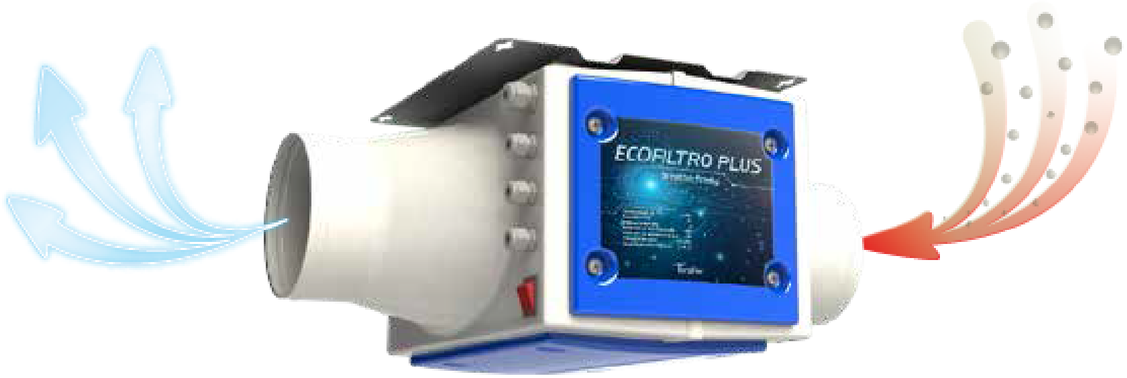
air-water-energy-fire protection

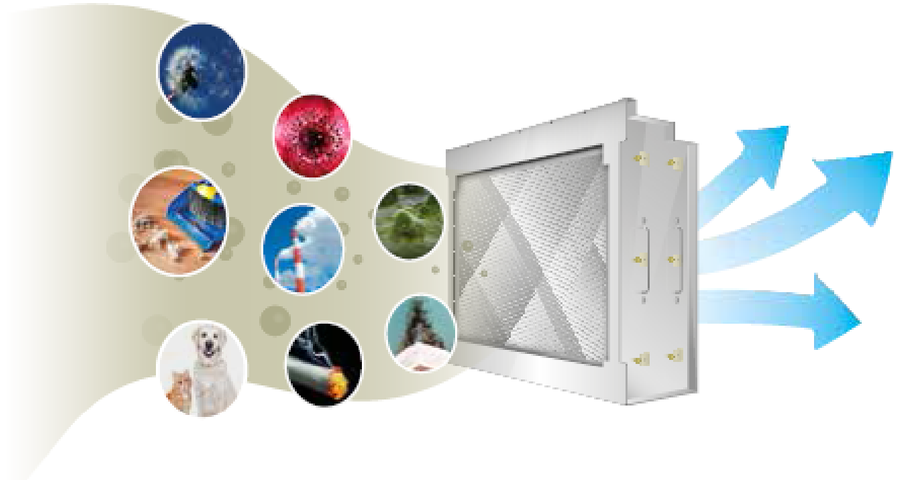
Electronic filter for installation on ducts in domestic MCV systems.

FILTER ELECTRONIC



ECOFILTRO PLUS

Voltage (V)	230
Frequency (Hz)	50
Nominal power (w)	9
Maximum air flow (mc/h)	420
Maximum air pressure drop (pa)	34
Efficiency UNI 11254 ePM2,5	95/90%
Bacterial filtration efficiency	> 90%



ADVANTAGES:

- Very low operating and maintenance costs;
- very effective against viruses and bacteria;
- very effective against fine dusts;
- minimises contamination and colonisation of the internal walls of the ducts;
- ozone production 5 times lower than the legal limit as verified and certified by an external body.

SP, ILH, ACCREDIA and ILAC-MRA certifications

SP Science Park

ILH BERLIN
INSTITUT FÜR LUFTHYGIENE

ACCREDIA
L'ENTE ITALIANO DI ACCREDITAMENTO

ilac-MRA

ARIMEC
air-water-energy-fire protection

Active antibacterial sanitisation system with negative ionisation without ozone emission.

• air side pressure drops close to zero;
• very low operating and maintenance costs;
• suitable for new systems; • suitable for revamping existing systems; • minimizes contamination and colonization of duct internal walls; • suitable for installation on circular and rectangular ducts;
• suitable for installation inside air handling units; • no ozone produced during operation;
• no danger when operating in the absence of ventilation.

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Power supply voltage	230VDC ±5%
Maximum electrical absorption	3W
Output voltage	8 ÷ 10kV DC
Output current	0,15mA
Output protection	Impedance 68MΩ
Ion emissions	>5'000'000 per cm^3 @ 100mm
Maximum air flow rate	2000 mc/h (per single module)

Possibility to increase the flow rate by mounting several modules in parallel

Typical installation

IONIZER

DOMESTIC MCV UNIT

Models	Flow rate m^3/h
RDCD25I	160
RDCD25SKI	180
RDCD25SKHI	250

Models	Flow rate m^3/h
RDCD25SKCI	180
RDCD25SKHCI	250

Models	Flow rate m^3/h
RDCD30SHI	227
RDCD50SHI	370

Models	Flow rate m^3/h
RDCD40SKI	320
RDCD50SKI	450

Models	Flow rate m^3/h
RDCD40SKCI	320
RDCD50SKCI	450

Models	Flow rate m^3/h
RDCD300HCI	300
RDCD300HCHI	300
RDCD500HCHI	500

DOMESTIC MCV PLENUM BOXES

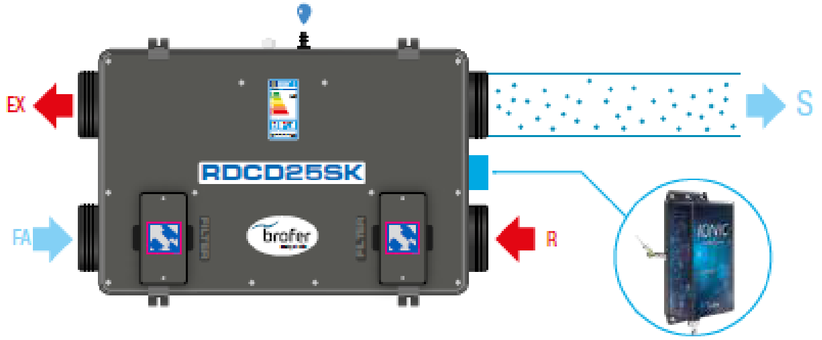
Models
PVMCSH6I
PVMCSH10I

Model
PVMCMRI

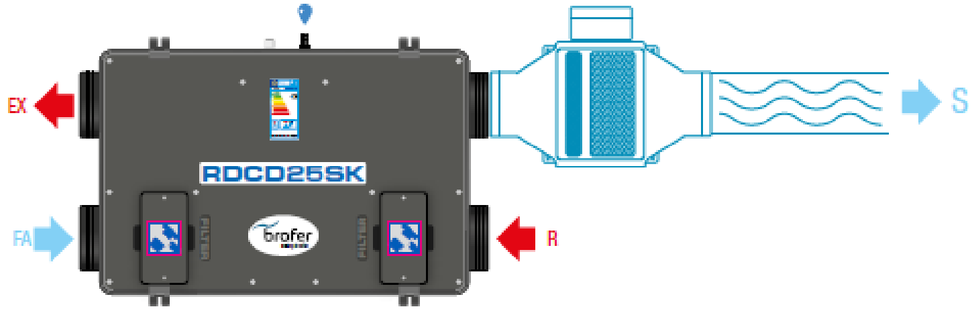
AIR DUCTS

Code
PAVMC
(Fixing plate)

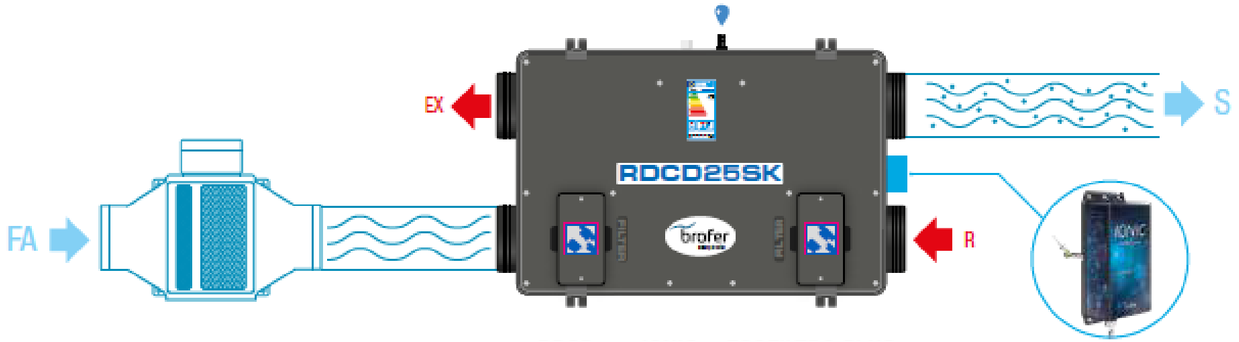
Type of installation



RDCD... + IONIC



RDCD... + ECOFILTRO PLUS



RDCD... + IONIC + ECOFILTRO PLUS

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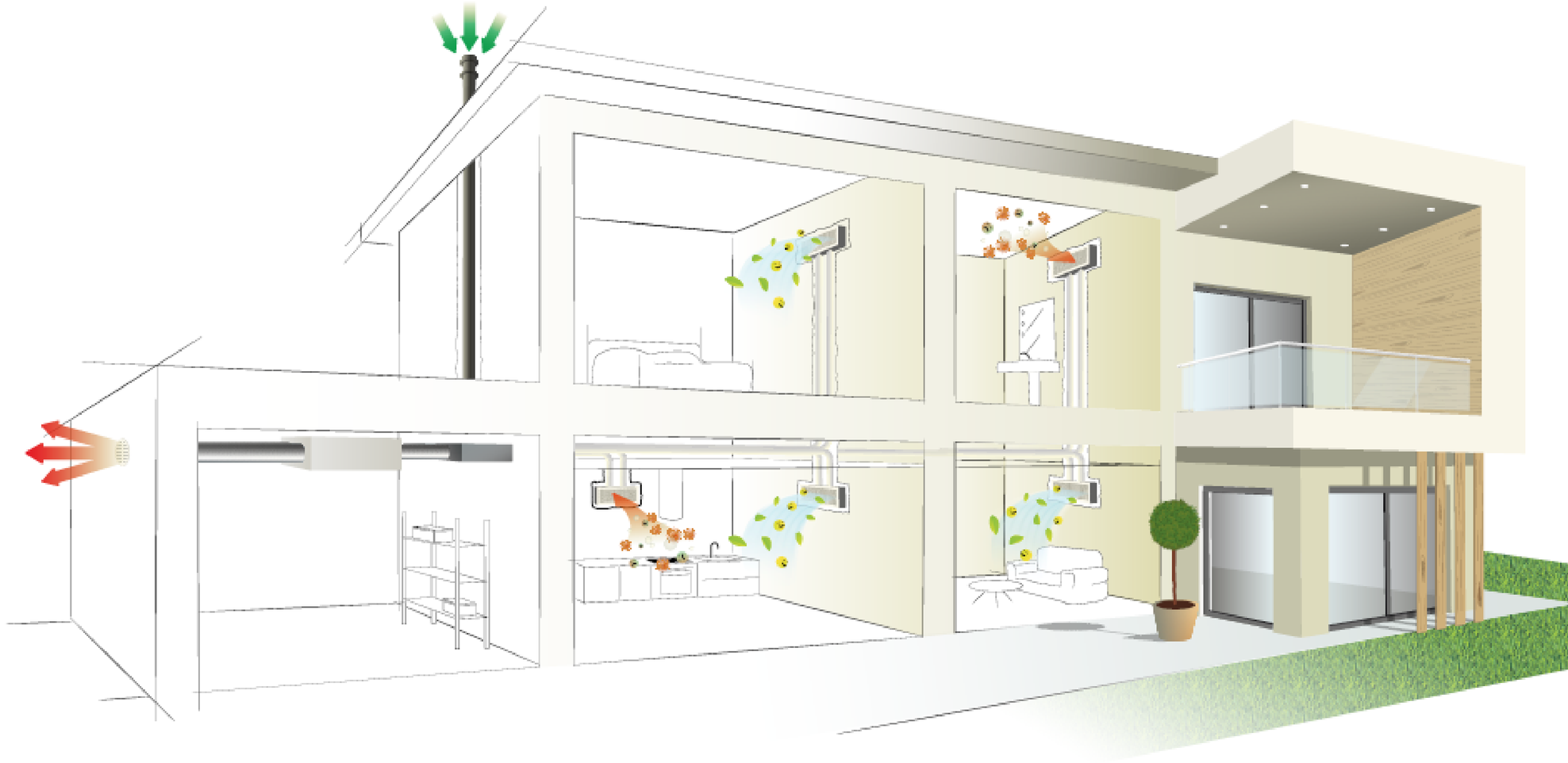
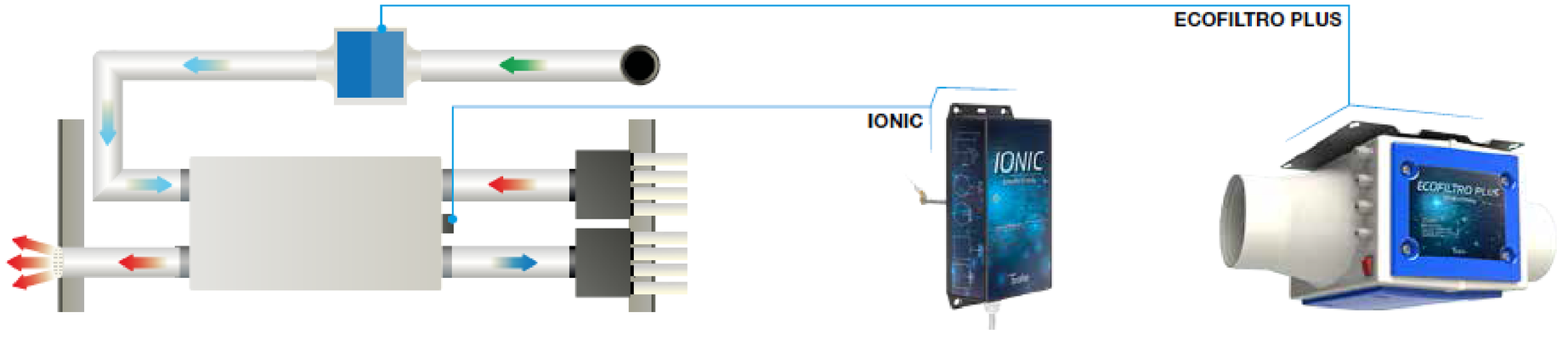
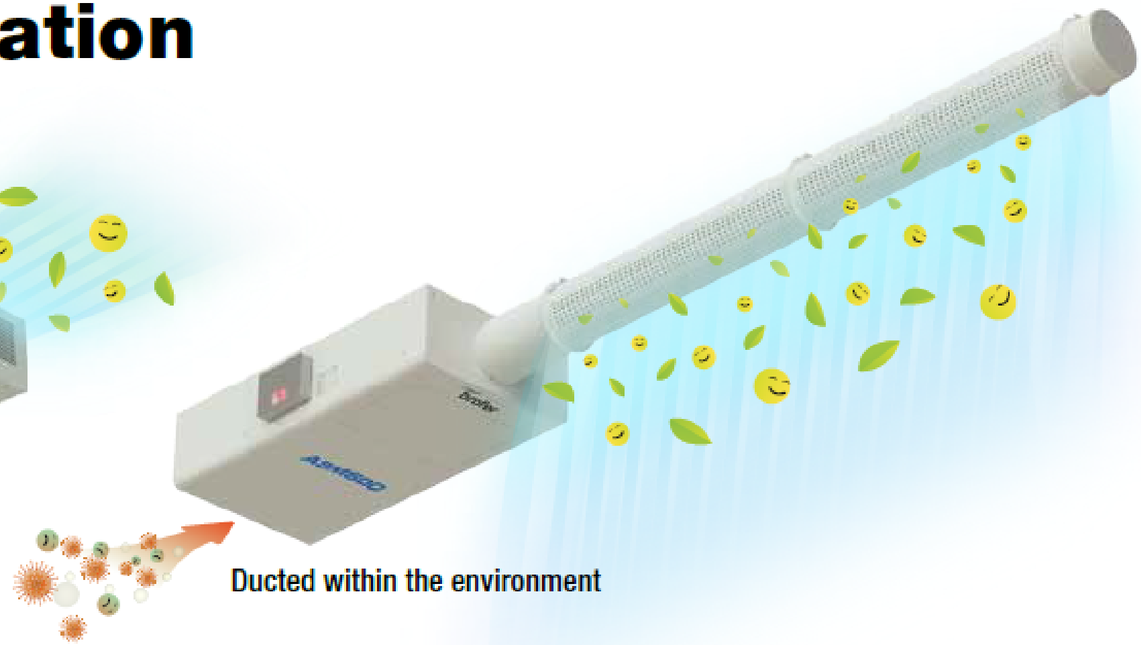


Component diagram



Type of installation

Not ducted



Ducted within the environment

False ceiling installation

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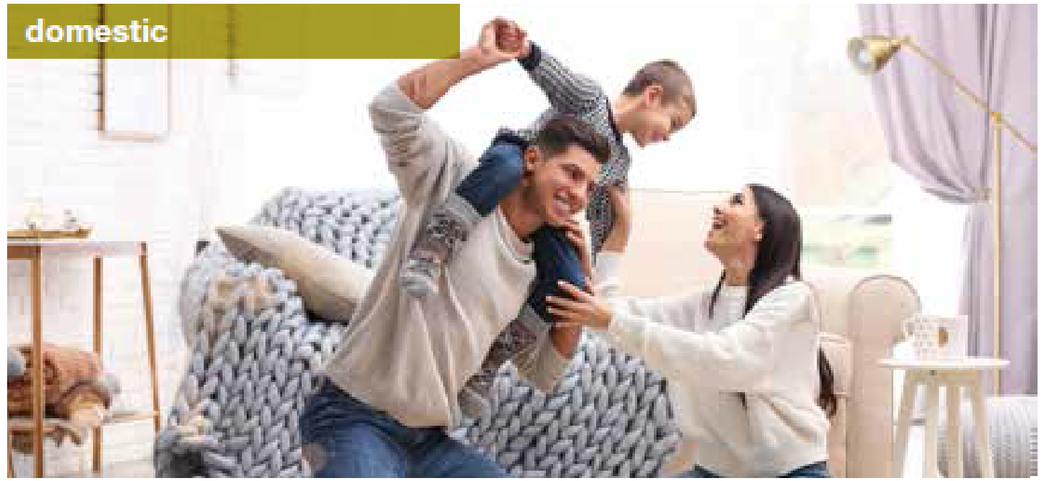
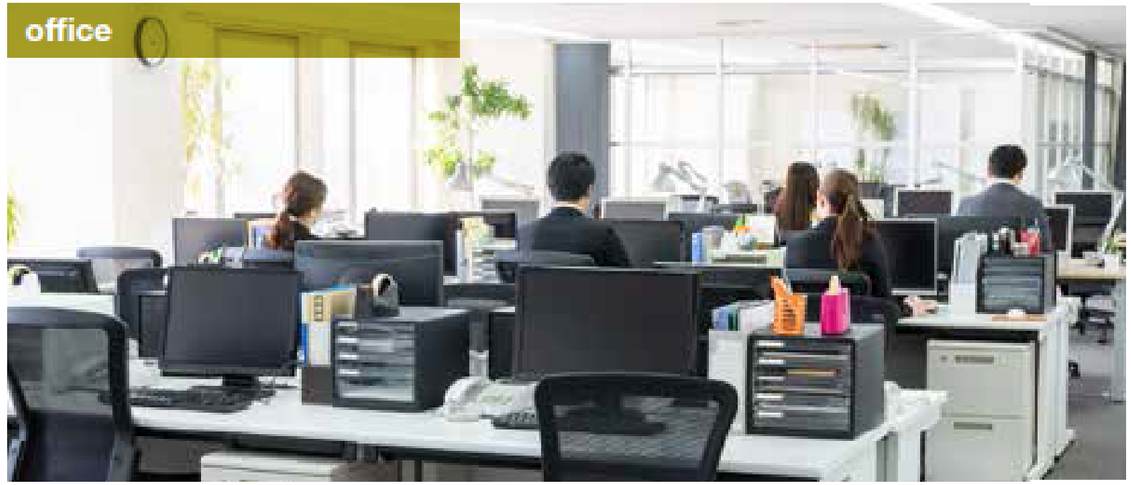
domestic



bar

office



shop

school

7. SOME CASE STUDIES

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CASE **STUDY**

Health Care

Client:
Deventer Hospital

Location:
Deventer, The Netherlands

Date:
June 2020

Sector:
Health care

DEVENTER HOSPITAL REMOVES FUME AND PARTICLES DUE TO FOSSIL FUEL WITH THE HELP OF UNIQUE 2-IN-1 AIR FILTER

FINE PARTICLES ALONG WITH INDEPENDENT VOC'S (ESPECIALLY FUME DUE TO DIESEL) WERE CAUSING BIG PROBLEMS IN THE PATIENT CARE AREAS AND LABORATORIES IN THE HOSPITAL. USING CAMFIL'S MOLECULAR AIR FILTERS, DEVENTER HOSPITAL CAN REMOVE FINE DUST, GASES, ODOURS, FUMES FROM THE INDOOR ENVIRONMENT.

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THE PROBLEM

A year back, the technical service department at Deventer hospital received complaints several times a year about **unwanted diesel odours** in different parts of the hospital building. **Headaches** was one the key problem among the laboratory staff.

In operating rooms, the problem was significant because the air is circulated directly from the exhaust vent onto the operating table. Despite sufficient filtration of particulate matter, harmful gases were entering the hospital building through the air conditioning system. The key factor in consideration is that solving the problem from the root level is impossible as we have no control over traffic/diesel fumes coming from outside. There are many neighboring building under construction or repair and dust and fumes coming
from different external sources here is unavoidable.
In addition, the emergency power generator is tested periodically, which then produces diesel fumes.

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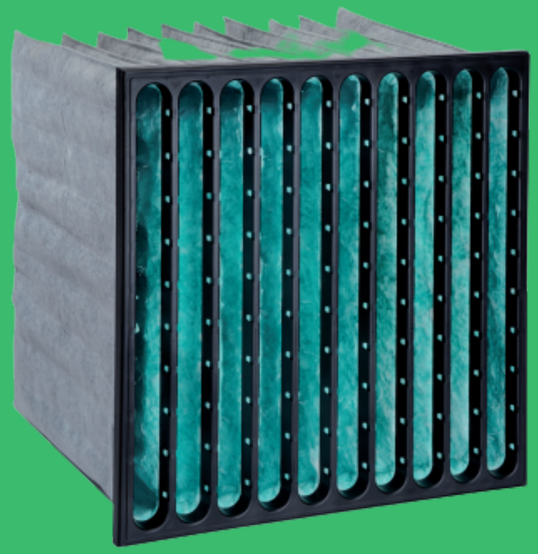
THE SOLUTION

Capturing gases and molecules is possible by using activated carbon in the air conditioning system. Activated carbon is at the heart of all successful molecular filtration solutions. Camfil has a selection of proven activated carbons to target as wide a range of odours, irritants, toxic and corrosive gases as possible. In this case, however, there is no space in the system to place an air filter with carbon media and the carbon filters entail extra resistance that is often not calculated with the fans. So, the ideal solution is a 2-in-1 filter installation at sections where the fine dust and fumes are the biggest concerns. This air filtration will save heavy investment in the air conditioning/ventilation system and removes harmful particulate matter from the indoor environment. This 2-in-1 filter doesn‘t involve extra resistance so there will be no load on the fan unit of the air conditioning system.



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CASE STUDY

Air Purifiers for Schools & Universities

Client:
Education Department of the Regional Government of Valencia

Location:
Valencian Community, Spain

Date:
January/February 2021

Sector:
Comfort/Schools & Universities

AIR FILTRATION DEFENSE SYSTEM AGAINST HARMFUL PARTICLES IN THE AIR TO ENSURE THE HEALTH AND WELL-BEING OF STUDENTS AND TEACHERS

THE EDUCATION DEPARTMENT OF THE REGIONAL GOVERNMENT OF VALENCIA HAS INSTALLED AIR FILTRATION SOLUTIONS IN SCHOOLS AS PART OF THEIR STRATEGY FOR PREVENTATIVE MEASURES AGAINST COVID-19

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THE SITUATION

The Valencian Government has collaborated with experts and researchers from the Institute of Environmental Assessment and Water Research and the MESURA Association. This collaboration has led to the publication of “The Guide to Classroom Ventilation”. This guide is based on the latest research carried out by the scientific community on the transmission of the SARS-CoV-2 virus that causes COVID-19.

It concludes that **the infection risk is reduced by decreasing the emission and exposure to airborne particles, also called aerosols, which are likely to contain the virus.**

Exposure to airborne particles can be reduced with the use of masks, increasing social distance, and by improving ventilation or using air purification equipment with HEPA filters to eliminate or reduce the concentration of virus in the air. Given that there are many schools and classrooms with insufficient or non-existent ventilation, the installation of air purification systems with HEPA filters is the most practical and effective solution.

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THE SOLUTION

Camfil carried out an indoor air quality study at the La Patacona Secondary School in Valencia. By using “City M” purifiers equipped with HEPA H14 filters, the air quality observed in a 50m2 classroom with 20 students reached ISO8 levels (according to ISO 14644) and PM2.5 concentrations lower than 3µg. The solution proposed by Camfil was to install and use the “City M” air purifier, incorporating 2 x HEPA H14 filters and Active Carbon.

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CASE STUDY

Air Purifiers for Sports Centers

Client:
GO fit Gyms

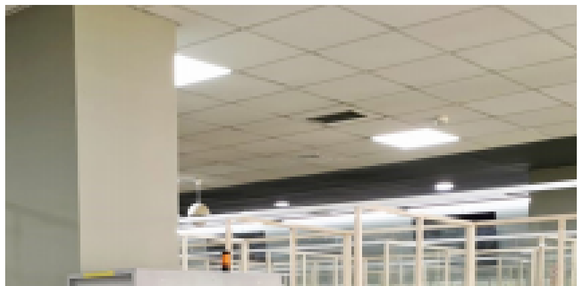
Localization:
Spain and Portugal

Date:
June 2020

Sector:
Comfort / Sport centers

CONTROLLING MICROORGANISMS IN THE SPORTS CENTER

ONE OF THE LARGEST GYM CHAINS IN SPAIN AND PORTUGAL IS NOW EQUIPPED WITH CAMFIL'S ADVANCED AIR FILTRATION TECHNOLOGY, REDUCING THE RISK FROM AIRBORNE VIRUSES, BACTERIA AND ePM1 PARTICULATE



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THE SITUATION

GO fit Sports Centers were forced to close all its centers in March 2020 when the state of emergency was announced in Spain to tackle the COVID-19 pandemic

. Ingesport Group the parent company of the GO fit brand and an existing customer of Camfil, contacted us to provide a comprehensive solution to reduce the risks of airborne transmission and infection, facilitating a safer indoor environment when they were permitted to re-open.

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SOLUTION

Air Purifiers that are equipped with HEPA Absolute ™ H13 filters, which guarantees efficiency over 99.95% for all types of contaminants, in combination with molecular filtration. The Absolute HEPA filter is EN1822 certified to ensure optimum performance while themolecular filter is tested to ISO 10121.
Camfil´s technical specialists calculated the required volume and intensity of air filtration required in each center and custom solutions were installed depending on the density of the area. Our filtration solution together with other measures adopted by GO fit,has allowed all centers in Spain and Portugal to obtain a score of 7.4 out of 8 in ANTI COVID-19 measures.
GO fit has the ANTI COVID-19 GoodPractice Certification issued by AENOR.

The Spanish Association for Standardization and Certification (AENOR)

RESULTS

- IMPROVED AIR QUALITY
- PROTECTED ENVIRONMENT
- ALLOWED CENTRES TO REOPEN
- ENHANCED ATHLETE PERFORMANCE
- SCORE OF 7.4 OUT OF 8 IN ANTI COVID-19 MEASURES (GO fit has the ANTI COVID-19 Good Practice Certification issued by AENOR).

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References

Eurovent

Camfil

Brofer

Puricom Europe

Cla-Utek

Thank you for your attention!