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ISO 16890 - THE GLOBAL AIR FILTRATION STANDARD

Meeting your energy efficiency
and IAQ requirements

09 JUNE 2021

10:00H (GST) | 11:30H (IST) | 14:00H (SST)

Moderator



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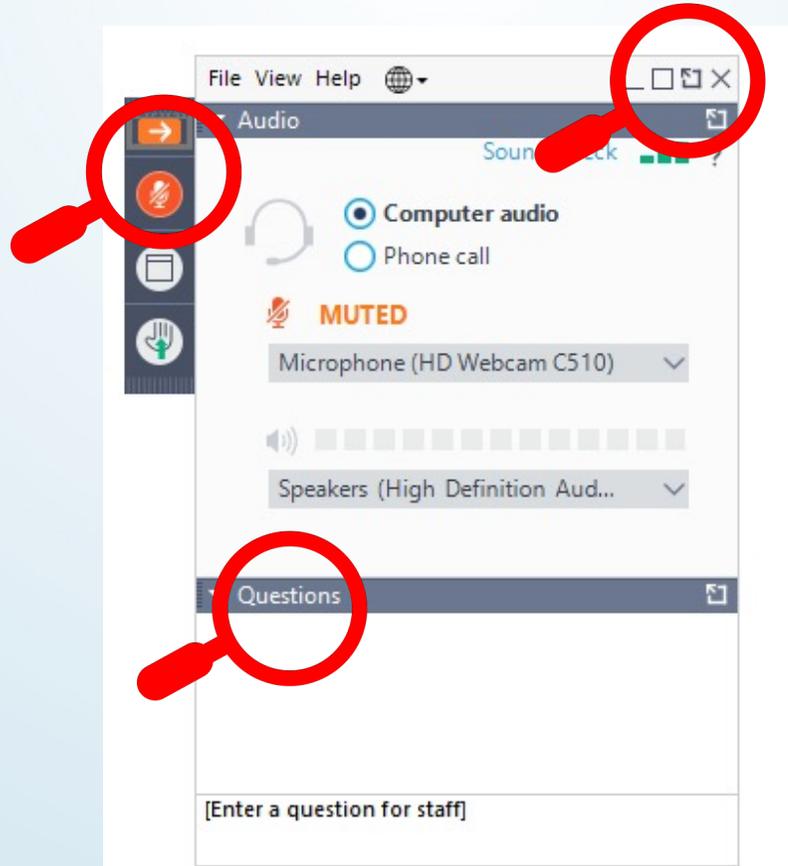
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climate control ^{MIDDLE EAST}

KEY PERSPECTIVES ON THE REGION'S HVACR INDUSTRY

Technicalities



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- Handouts available

Handouts

Eurovent Air Filters Guidebook



Eurovent Recommendation 4/23





Roadmap

1. **Welcome remarks and introduction**
2. ISO 16890: The global air filtration standard
3. Eurovent 4/23: Guidance to the application of ISO 16890
4. Energy efficiency and filter certification
5. Summary of key takeaways
6. Panel discussion and Q&A

Speakers



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REHVA
3E
REHVA
COVID-19
GUIDANCE
version 4.1
How to operate HVAC and other building service systems to prevent the spread of the coronavirus (SARS-CoV-2) disease (COVID-19) in workplaces

Articles

Recommendation from the Nordic Ventilation Group

Criteria for room air cleaners for particulate matter



Introduction

Portable air cleaners can be used to reduce the concentration of particulate matter in rooms air. They may also reduce the risk of infections due to pathogens in the indoor air, as a significant amount of viral material is spread as small droplets or dried droplets which behave like small airborne particles. These viral particles can be removed from room air using portable air cleaners, by circulating the air through the unit. To be safe and effective the cleaner must fulfill certain performance criteria. If they produce ozone or hydrogen peroxide then they may pose safety concerns.

For this, the following parameters must be considered:

- Clean air delivery rate (CADR)
- Noise
- Energy efficiency
- Placement of the air cleaner
- Service and maintenance
- Generation of pollutants (the possible negative effect of the air cleaner on the indoor air quality, such as ozone generation).
- Operation
- Service

General information

The air purifier must meet all regulatory requirements and be approved from an electrical safety point of view by the European Union or national authorities.

Data which demonstrates the safe and effective performance of the unit must be obtained from third party testing and presented by a third-party certification body. An example of a certification program that operated by Eurovent Certita Certification [1] and [2].

Clean air delivery rate (CADR)

"Clean air delivery rate-CADR" is the air flow, free of specific pollutant, which is supplied to the room by the cleaner. It can be estimated as a product of air flow through the unit and the removal efficiency of the unit for a specific pollutant (usually particulate matter). Regarding the removal efficiency of the cleaner, the most critical size for particulate matter is 0.3-0.5 μm .

Particle removal efficiency is calculated by subtracting the measured average ratio of downstream-to-upstream particle concentrations from unity.

CADR can be expressed for any other pollutant as well. Eurovent Certita Certification has identified [2] the following pollutants: particles of 0.3 μm to 0.5 μm , particles of 1.0 μm to 2.0 μm , particles of 3.0 μm to 5.0 μm etc. Acetone, Acetaldehyde, Heptane, Toluene, Formaldehyde, *Staphylococcus epidermidis*, *Aspergillus niger* and *P64-DV* cat allergen.

The effect of CADR for the unit(s) placed in the room on the overall level of pollutants present in the room depends on the size and ventilation rate (outdoor air) of the room.

To achieve a meaningful additional reduction of viral particles in the indoor air CADR (measured for particle size of 0.3-0.5 μm) should be two times greater than the outdoor air flow by the ventilation system [2] in rooms with a ventilation rate more than 1 ACH. This CADR reduces the concentration of a pollutant by 70%. In rooms with a lower ventilation rate (lower than 1 ACH) the CADR must be at least 2 ACH.



Safe operation of buildings and HVAC systems during the COVID-19 pandemic (v1 autumn 2020)

Module 1

The first module of the course aims at familiarising the participants with the scientific concepts of SARS-CoV-2 transmission, risk mitigation and the key role of air quality, air distribution solutions and adequate ventilation in infection control.

1.1 Boost your IQ on IAQ & COVID-19

1.1 provides a general overview of the fundamentals and definitions of Indoor Air Quality (IAQ) and Indoor Environmental Quality (IEQ), along with its relevance to the COVID-19 pandemic, highlighting some real-life examples.

1.2 COVID-19 in the light of IAQ concepts

1.2 goes deeper in the nature of the virus and its physics, such as the relation between the size of the droplet and its behaviour in space.

1.3 COVID-19 transmission routes, airborne transmission and infection control pyramid

1.3 explains the different transmission routes of the virus, providing a further analysis on the airborne route and virus kinetics in indoor environments, underlining the important role of adequate ventilation.

1.3.1 Faecal-Oral Transmission

1.3.1 sheds light on the less known faecal-oral route of the virus and its unique characteristics, providing some evidence from anecdotic cases and practical recommendations to minimise transmission risk.

1.4 The role of HVAC systems during COVID-19

1.4 analyses evidence of the significant role of source control of the virus, illustrating the impact of HVAC systems on reducing the risk of aerosol infection.



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ISO 16890: The global air filtration standard



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Background



International
Organization for
Standardization



BIS IS 7613 : 1975(R2017)



METHOD OF TESTING PANEL TYPE AIR FILTERS FOR
AIR CONDITIONING AND VENTILATION PURPOSES

Published date: 12-01-2013

Publisher: Bureau of Indian Standards



Let's first understand some basics

ISO 16890-1:2016
What is it all about?

And why is it so necessary to change!

Reasons for global preference for ISO 16890

Greater emphasis on Indoor Air Quality

- **New medical findings**
- **Particulate matter**
- **Fine dust**
- New medical findings – Different approach to testing and classification
- Issued by ISO to improve IAQ with fine particulate matter
- Increased focus on 1 & 2.5 Microns particle size effects
- Comprehensive test procedure and classification method

Led to change in approach to ‘Method of Air Filter Testing’

Reasons for global preference for ISO 16890

Greater emphasis on what we breathe

- **New Medical Findings**



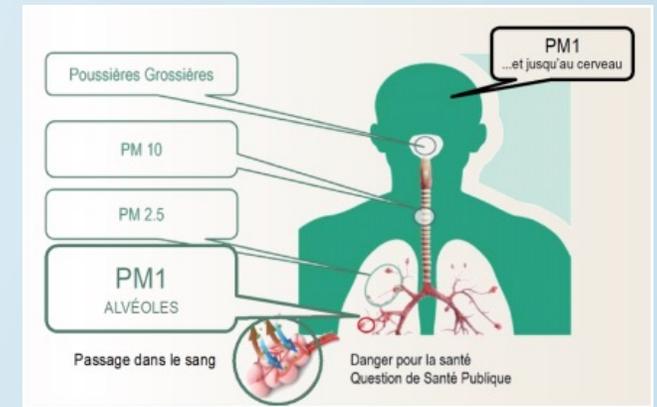
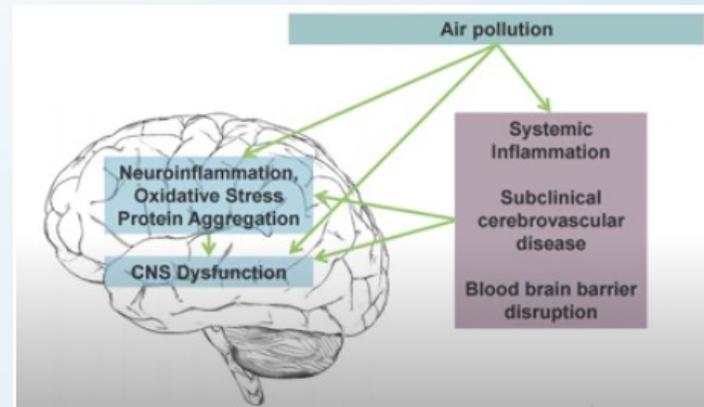
International
Organization for
Standardization



- Cardiovascular issues due to small particles
- Effect on nervous system due to small fine dust
- ISO standard take notice of this
- New regulations by WHO in keeping with Standards

Reasons for global preference for ISO 16890

Greater emphasis on Indoor Air Quality

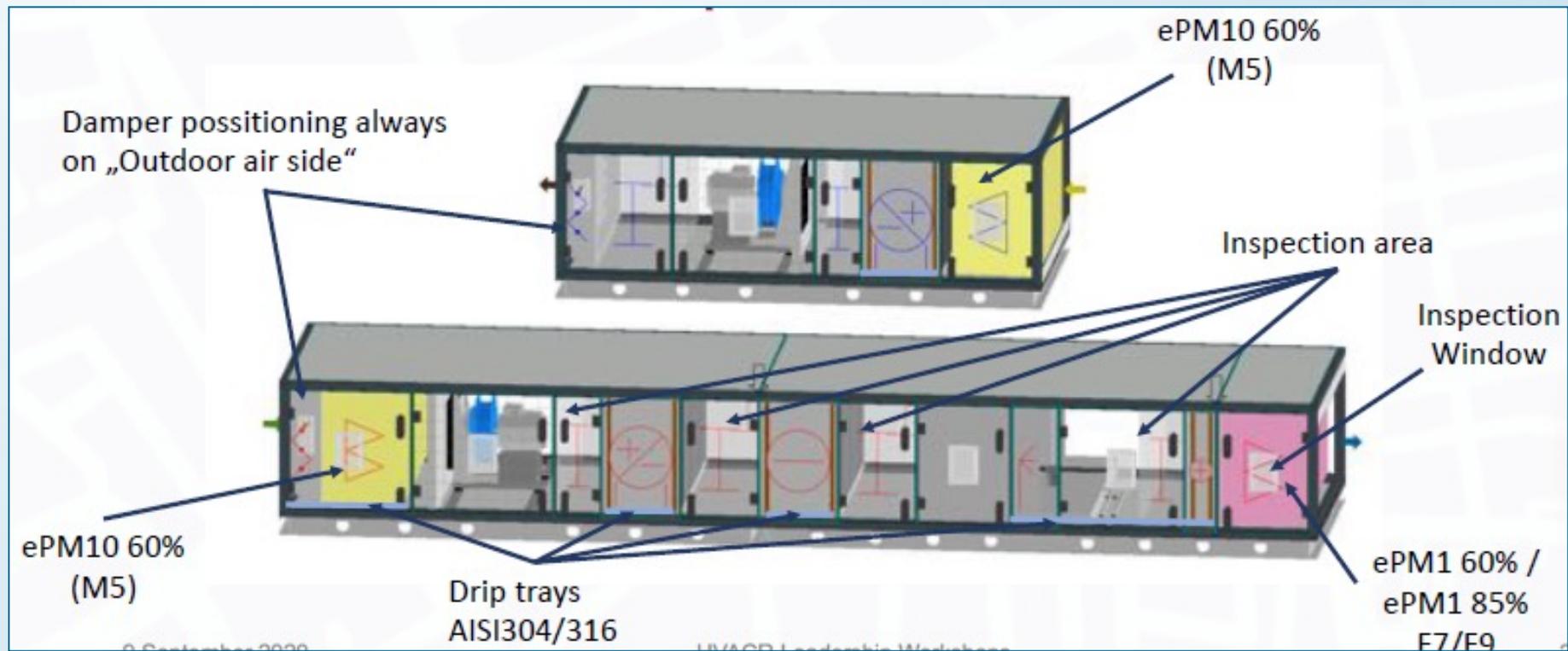


| PM ₁₀ | PM _{2.5} | PM ₁ |
|---|---|---|
| Particles 10 µm in diameter or smaller can reach the respiratory ducts and potentially cause decreased lung function. | Particles 2.5 µm in diameter or smaller can penetrate the lungs and cause decreased lung function, skin and eye problems. | Particles 1 µm in diameter or smaller are most dangerous. They are tiny enough to enter the bloodstream and lead to cancer, cardiovascular diseases and dementia. |

Most parameters now related to PM1, PM2.5, PM10

Deconstructing the nomenclature

Filter nomenclature example - ePMxx vv%



MERV filter ratings ASHRAE 52.1 & 52.2

Understanding how air filters work

The MERV (Minimum Efficiency Reporting Value) rating of a filter describes the size of the holes in the filter that allow air to pass through. The higher the Merv rating, the smaller the holes in the filter, the higher the efficiency.

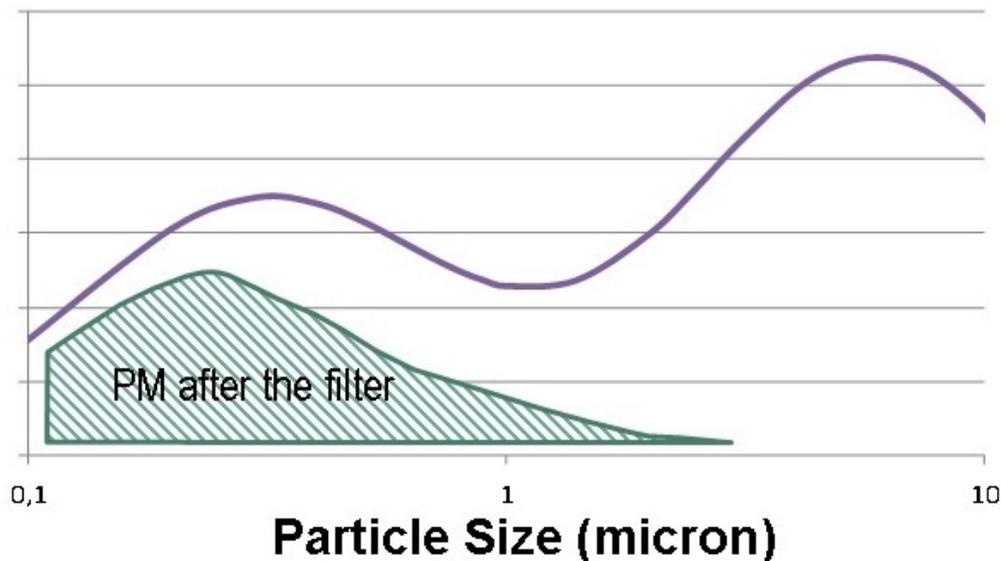
ASHRAE in the process of modifications based on particle size

Reference:  MERV FILTER TESTING EXPLAINED

Reasons for global preference for ISO 16890

Most IAQ standards now relate to PM1, PM2.5 and PM10 and their removal requirement

Particulate Matter (PM) Size Distribution



743

Table 5 Threshold values for indoor air quality parameters

| Parameters | Units | Classification | | | |
|------------------------------|----------------------------------|--------------------|------------------|------------------|---------------|
| | | Class A | Class B | Class C | |
| Basic IAQ parameters | CO ₂ | ppm | Ambient + 350 | Ambient + 500 | Ambient + 700 |
| | PM 2.5 | µg/m ³ | <15 | <25 | <25 |
| | CO | ppm | <2 | <9 | <9 |
| Complementary IAQ parameters | TVOC (equivalent to isobutylene) | µg/m ³ | <200 | <400 | <500 |
| | PM 10 | µg/m ³ | <50 | <100 | <100 |
| | CH ₂ O | µg/m ³ | <30 | <100 | - |
| | SO ₂ | µg/m ³ | <40 | <80 | - |
| | NO ₂ | µg/m ³ | <40 | <80 | - |
| | O ₃ | µg/m ³ | <50 | <100 | - |
| | Total Microbial Count | CFU/m ³ | Indoor ≤ ambient | Indoor ≤ ambient | - |
| Occupant Satisfaction | % | 90 | 80 | - | |

ISHRAE IAQ Standard

Meeting your energy efficiency and IAQ requirements



- Provide guidelines on the selection of EN ISO 16890 rated air filter classes
- Outline differences between EN 779 and EN ISO 16890
- Increase awareness on the energy efficiency of air filters

How to recommend the correct fresh air filter

Outdoor Air Quality – Eurovent Recommendation 4/23

| Category | Description | Typical environment |
|----------|--|---|
| ODA 1 | <p>OUTDOOR AIR, WHICH MAY BE ONLY TEMPORARILY DUSTY</p> <p>Applies where the World Health Organisation WHO (2005) guidelines are fulfilled [annual mean for $PM_{2,5} \leq 10 \mu g/m^3$ and $PM_{10} \leq 20 \mu g/m^3$].</p> |  |
| ODA 2 | <p>OUTDOOR AIR WITH HIGH CONCENTRATIONS OF PARTICULATE MATTER</p> <p>Applies where PM concentrations exceed the WHO guidelines by a factor of up to 1,5 [annual mean for $PM_{2,5} \leq 15 \mu g/m^3$ and $PM_{10} \leq 30 \mu g/m^3$].</p> |  |
| ODA 3 | <p>OUTDOOR AIR WITH VERY HIGH CONCENTRATIONS OF PARTICULATE MATTER</p> <p>Applies where PM concentrations exceed the WHO guidelines by a factor of greater than 1,5 [annual mean for $PM_{2,5} > 15 \mu g/m^3$ and $PM_{10} > 30 \mu g/m^3$].</p> |  |

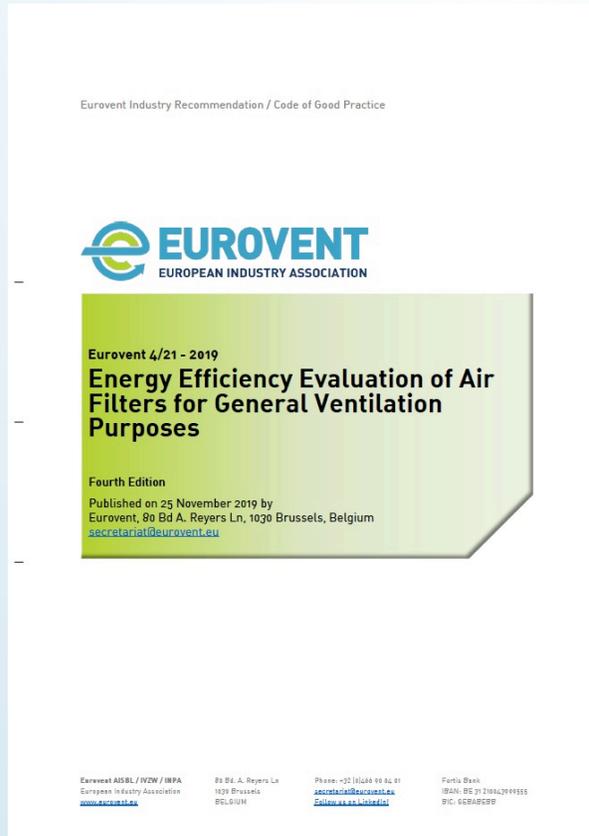
How to recommend the correct fresh air filter

Indoor Air Quality – Eurovent Recommendation 4/23

| | | | |
|-------|---|---|--|
| SUP 2 | Rooms for permanent occupation. Examples: Kindergartens, 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. |  |  |

| | | |
|-------|--|---|
| SUP 1 | Applications with high hygienic demands. Examples: Hospitals, pharmaceuticals, electronic and optical industry, supply air to clean rooms. |  |
| SUP 2 | Applications with medium hygienic demands. Examples: Food and beverage production. |  |
| SUP 3 | Applications with basic hygienic demands. Examples: Food and beverages production with a basic hygienic demand. |  |
| SUP 4 | Applications without hygienic demands. Examples: General production areas in the automotive industry. |  |

Energy evaluation of air filters



- Define energy efficiency of air filters for general ventilation purposes
- Define energy efficiency evaluation methods
- Implement the ISO 16890 classification and testing methods in place of EN 779

Replacement of old filters

There is no equivalence between EN 779 & ISO filters - Quick guide for replacement

First determine from application your critical particle size

| 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% |

Pressemitteilung der Expertengruppe

| Filterklasse nach EN 779 | Filterklasse nach ISO 16890 | Abscheideleistung |
|--------------------------|-----------------------------|-------------------|
| M5 | ISO ePM ₁₀ | ≥ 50 % |
| F7 | ISO ePM _{2,5} | ≥ 65 % |
| oder: | ISO ePM ₁ | ≥ 50 % |
| F9 | ISO ePM ₁ | ≥ 80 % |

Empfehlung der Expertenarbeitsgruppe Luftfiltration zu Anforderungen an die neuen Luftfilter für Komfort-Raumlüftungsanlagen (Filterklasse nach ISO 16890 verglichen mit Filterklasse nach EN 779). In der letzten Filterstufe muss mindestens ein Filter ISO ePM₁ ≥ 50 % eingesetzt werden.

Programme to help provide desired filtration level

Consulting engineer decides exact requirements



Identification: ECP 11 FIL

Revision 0 – February 2020

(This version cancels and replaces any previous versions)

Approbation date: 10/02/2020

Comes into effect from: 10/02/2020

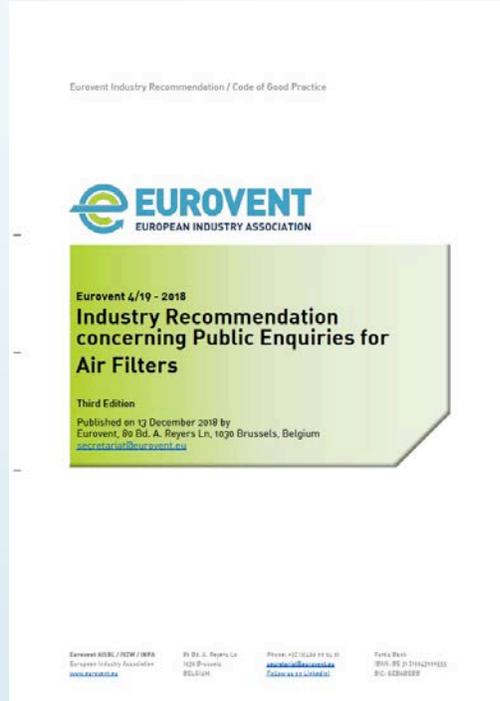


Areas with good filtration requirement



Guidance

Programme to help provide desired filtration level



Conclusion

- The WHO findings bring out the importance of fine dust and the medical findings associated with fine dust particles. The ISO 16890 takes this into consideration.
- ISO and WHO findings are based on PM1, PM2.5 and PM10. Environmental and IAQ standards globally refer to PM1, PM2.5 and PM10.
- Filter nomenclature needs to be easy to understand by all involved with IAQ and airside HVAC. Filter nomenclature should relate to particle size and the removal efficiency of the filter.
- With the addition of Eurovent Guidebooks and Recommendations, the programme becomes more holistic and enables engineers to select the correct filters for maintaining desired IAQ levels with data on energy spent annually to achieve the required IAQ.

Thank you!



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Eurovent 4/23: Guidance to the application of ISO 16890



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Chairman of the Eurovent Product
Group 'Air Filters'

Eurovent Recommendation 4/23

Third edition, November 2020

EUROVENT 4/23 - 2020

SELECTION OF EN ISO 16890 RATED AIR FILTER CLASSES FOR GENERAL VENTILATION APPLICATIONS

THIRD EDITION

Published on 1 November 2020 by
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secretariat@eurovent.eu

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ISO 16890 testing and classification



Step 1

Filter **efficiency is measured** on 0,3 to 10 μm of the clean not conditioned filter.

Step 2

The **filter is conditioned (discharged)** in an isopropanol vapor atmosphere to eliminate particle filtration based on electrostatic forces.

Step 3

Filter **efficiency is measured again** on 0,3 to 10 μm – now of the conditioned (discharged) filter.

Step 4

Actual **efficiency per PM size is calculated** as the average of the conditioned **and** the unconditioned filter. **Important:** The filter needs to show a minimum efficiency of 50% for the unconditioned **and** the conditioned filter.

Step 5

Values are allocated to ISO groups.

| | |
|------------------------|---|
| ISO coarse | $> 10 \mu\text{m}$ |
| ISO ePM ₁₀ | $0,3 \mu\text{m} \leq x \leq 10 \mu\text{m}$ |
| ISO ePM _{2,5} | $0,3 \mu\text{m} \leq x \leq 2,5 \mu\text{m}$ |
| ISO ePM ₁ | $0,3 \mu\text{m} \leq x \leq 1 \mu\text{m}$ |

Step 6

Reporting value is defined. The reporting value for the filter is the highest possible ISO group with at least 50% of efficiency – always rounded down in 5% steps.

Example for filter classification

A filter is showing following average efficiency values:

| Efficiency class | Value |
|------------------------|-------|
| ISO ePM ₁₀ | 89% |
| ISO ePM _{2,5} | 63% |
| ISO ePM ₁ | 49% |

- Minimum efficiency of 50% is achieved for **ISO ePM₁₀** and **ISO ePM_{2,5}** – with 49% requirement for **ISO ePM₁ is not fulfilled**
- Highest possible ISO group is therefore **ISO ePM_{2,5}**
- **ISO ePM_{2,5}** value of 63% is rounded down to **60%**

As a result, the filter is classified as

an ISO ePM_{2,5} 60% filter

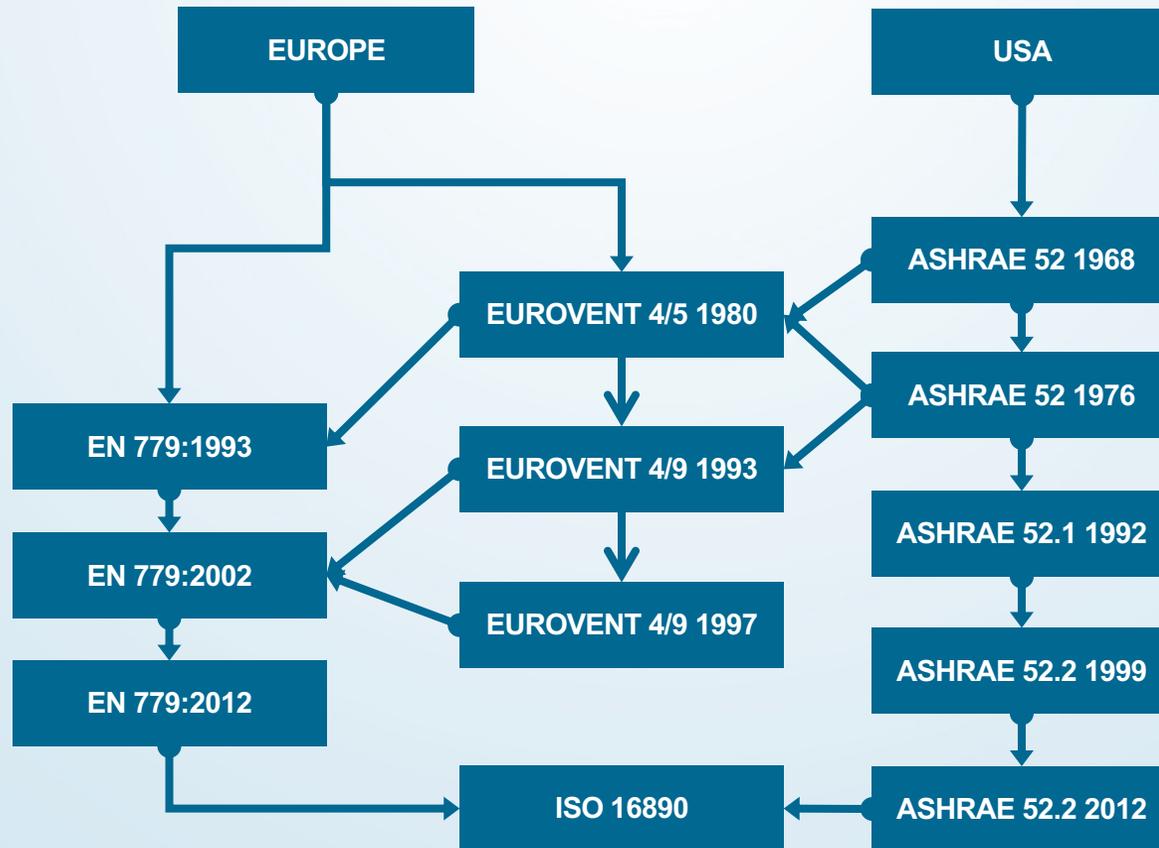
Meaning this filter is able to capture 60% of the particles smaller or equal 2,5 micron!

ISO 16890 test duct and discharge chamber



State-of-the-art ISO16890 test duct and discharge chamber in AAF filter lab in Trencin (Slovakia).

History of filter standards

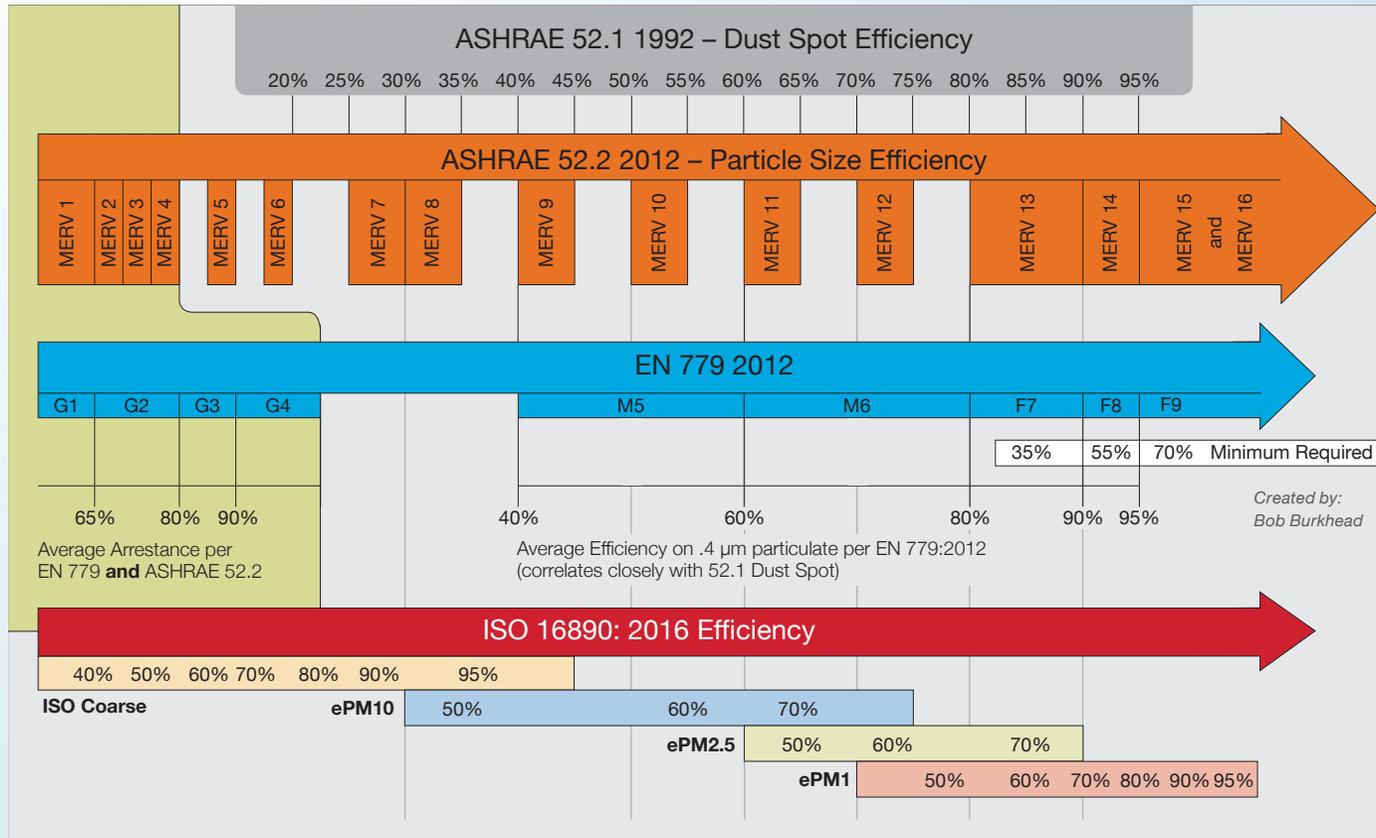


- In 1968, ASHRAE published the first unified standard which measured the arrestance as well as the dust-spot efficiency with artificial test dust.
- In 1976, ASHRAE Standard 52-76 was published introducing the atmospheric dust-spot efficiency.
 - Dust spot efficiency
 - Arrestance
 - Dust holding capacity
- Initial efficiency as function of a particle size (MERV: Minimum Efficiency Reporting Value).
- This standard had many improvements over time. Some of the improvements found in the ANSI/ASHRAE 52.2 standard. The improvement of the 52.2 standard allowed for the 52.1 standard to be retired.

Comparison of filter standards

| Standard | ASHRAE 52.2:2012 | ISO 16890 | EN 779:2012 |
|----------------------------------|---|---|------------------------------------|
| Aerosol | KCl | DEHS/KCL | DEHS |
| Aerosol Range | 0.3 to 10.0 µm | DEHS: 0.3 to 1.0 µm KCL: 1.0 to 10 µm | 0.4 µm |
| Particle sizes for rating | E1: 0.3 – 1.0 µm E2: 1.0 – 3.0 µm E3: 3.0 – 10.0 µm | PM1: 0.3 – 1.0 µm PM2.5: 0.3 – 2.5 µm PM10: 0.3 – 10 µm | 0.4 µm |
| Loading Dust | ASHRAE 52.2 Dust | ISO Fine | ASHRAE 52.2 Dust |
| Conditioning | Optional: Appendix J (whole filter) | Mandatory: IPA Vapor (whole filter) | Mandatory: IPA Liquid (flat sheet) |
| Conditioning substance | 0.03 µm KCL | IPA Vapor | IPA Liquid |
| Conditioning Time | Efficiency measured after minimum increments of 6.4×10^7 particles/cm ³ min. Conditioning stops after no further significant drop in efficiency. | 24 h | 2 min soak |
| Classification | MERV 4 – MERV 16 | ePM1, ePM2.5, ePM10 | G1 – G4, M5 – M6, F7 – F9 |
| Rating | Worst case | Average of initial and discharged condition | Worst case |

Correlation – no conversion!



Outdoor Air (ODA) categories

| Category | Description | Typical environment |
|----------|--|--|
| ODA1 | <p>Outdoor air which maybe only temporarily dusty Applies where the World Health Organization WHO (2005) guidelines are fulfilled:</p> <p>Annual mean for $PM_{2,5} \leq 10 \mu g/m^3$ and $PM_{10} \leq 20 \mu g/m^3$.</p> |  |
| ODA2 | <p>Outdoor air with high concentrations of particulate matter Applies where PM concentrations exceed the WHO guidelines by a factor of up to 1,5:</p> <p>Annual mean for $PM_{2,5} \leq 15 \mu g/m^3$ and $PM_{10} \leq 30 \mu g/m^3$.</p> |  |
| ODA3 | <p>Outdoor air with very high concentrations of particulate matter Applies where PM concentrations exceed the WHO guidelines by a factor of more than 1,5:</p> <p>Annual mean for $PM_{2,5} > 15 \mu g/m^3$ and $PM_{10} > 30 \mu g/m^3$.</p> |  |

Supply Air (SUP) categories

| Category | Description | General Ventilation | Industrial Ventilation |
|----------|--|--|---|
| SUP1 | 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). | - | Applications with high hygienic demands Hospitals, pharmaceuticals, electronic and optical industry, supply air to clean rooms... |
| SUP2 | 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). | Rooms for permanent occupation Kindergardens, offices, hotels, residential buildings, meeting rooms, exhibition halls, conference halls, theaters, cinemas, concert halls... | Applications with medium hygienic demands Food and beverage production... |
| SUP3 | 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). | Rooms with temporary occupation Storage, shopping centers, washing rooms, server rooms, copier rooms... | Applications with basic hygienic demands Food and beverages production with a basic hygienic demand... |
| SUP4 | WHO (2005) guidelines limit values (annual mean for PM2.5 ≤ 10 µg/m ³ and PM10 ≤ 20 µg/m ³). | Rooms with short-term occupation Restrooms, storage rooms stairways... | Applications without hygienic demands General production areas in the automotive industry... |
| SUP5 | WHO (2005) guidelines limit values multiplied by a factor x 1.5 (annual mean for PM2.5 ≤ 15 µg/m ³ and PM10 ≤ 30 µg/m ³). | Rooms without occupation Garbage room, underground car parks... | production areas of the heavy industry Steel mill, smelters, welding plants... |

Selecting filter efficiency

Better SUP

Supply Air Quality (SUP)

| | | Annual mean | | | Supply Air Quality (SUP) | | | | |
|----------------|---------------------------|----------------------------|---------------------------|---|--|--|---|---|------|
| | | | | | SUP1* | SUP2* | SUP3** | SUP4 | SUP5 |
| | | PM2.5 µg/m ³ | PM10 µg/m ³ | PM2.5 ≤ 2.5 µg/m ³ PM10 ≤ 5 µg/m ³ | PM2.5 ≤ 5 µg/m ³ PM10 ≤ 10 µg/m ³ | PM2.5 ≤ 7.5 µg/m ³ PM10 ≤ 15 µg/m ³ | PM2.5 ≤ 10 µg/m ³ PM10 ≤ 20 µg/m ³ | PM2.5 ≤ 15 µg/m ³ PM10 ≤ 30 µg/m ³ | |
| | | | | ePM1 | ePM1 | ePM2.5 | ePM10 | ePM10 | |
| worse ODA ↓ | Outdoor Air Quality (ODA) | ODA1 | ≤ 10 | ≤ 20 | 70% | 50% | 50% | 50% | 50% |
| | | ODA2 | ≤ 15 | ≤ 30 | 80% | 70% | 70% | 80% | 50% |
| | | ODA3 | > 15 | > 30 | 90% | 80% | 80% | 90% | 80% |

*min. filtration requirement ePM1 50% at final stage | **min. filtration requirement ePM2.5 50% at final stage

Filter classes meeting recommended minimum efficiency

| | | SUP1 | SUP2 | SUP3 | SUP4 | SUP5 |
|------|-----------|----------------------------|----------------------------|----------------------------|------------|------------|
| ODA1 | 2 stages* | ePM10 50% + ePM1 60% | ePM1 50% | ePM2,5 50% | ePM10 50% | ePM10 50% |
| | 1 stage | ePM1 70% | - | - | - | - |
| ODA2 | 2 stages* | ePM1 50% + ePM1 60% | ePM10 50% + ePM1 60% | ePM1 50% | ePM2,5 50% | ePM10 50% |
| | 1 stage | ePM1 80% | ePM1 70% | ePM2,5 70% | ePM10 80% | - |
| ODA3 | 2 stages* | ePM1 50% + ePM1 80% | ePM1 50% + ePM1 60% | ePM10 50% + ePM1 60% | ePM1 50% | ePM2,5 50% |
| | 1 stage | ePM1 90% | ePM1 80% | ePM2,5 80% | ePM10 90% | ePM10 80% |

Handouts

Eurovent Air Filters Guidebook



Eurovent Recommendation 4/23



Thank you!



Marc Schmidt, Ph.D.

Vice President Technologies
Europe, AAF

Chairman of the Eurovent Product
Group 'Air Filters'

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Roadmap

1. Welcome remarks and introduction
2. ISO 16890: The global air filtration standard
3. Eurovent 4/23: Guidance to the application of ISO 16890
4. **Energy efficiency and filter certification**
5. Summary of key takeaways
6. Panel discussion and Q&A

Certification

Energy and filtration efficiency



Sylvain Courtey

Technical Director

Eurovent Certita Certification

Why certification

It is not a question of manufacturers' size, country of origin or brand name

Fair comparison using a standard benchmark

Increase Consumer confidence



Ensures performance before purchase!

Eliminates over-sizing due to under performing uncertainty

Eliminates expensive customer Verification tests

Avoids excessive system operating costs

Building confidence



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Filter certification by independent third party*:

- Reduces risk of inefficient and unsafe ventilation system
- Guarantees original design's energy consumption
- Avoids performance downgrade by maintenance with non-certified spares

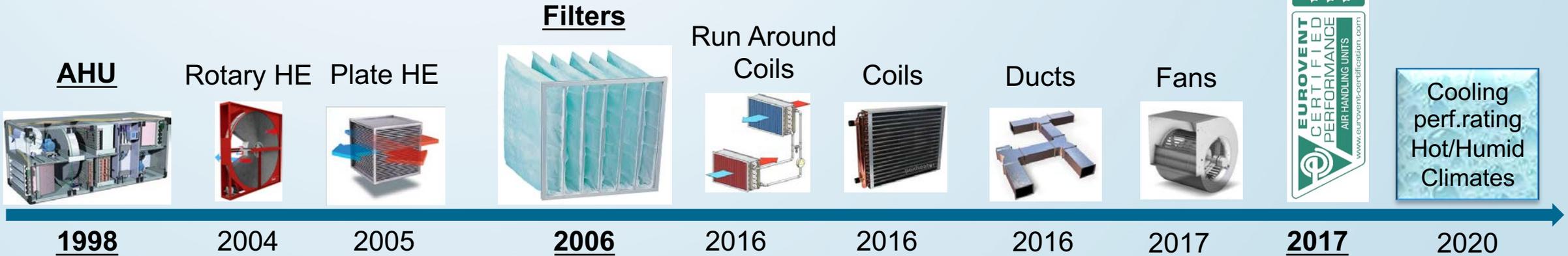
**Under ISO 17065 Accreditation*



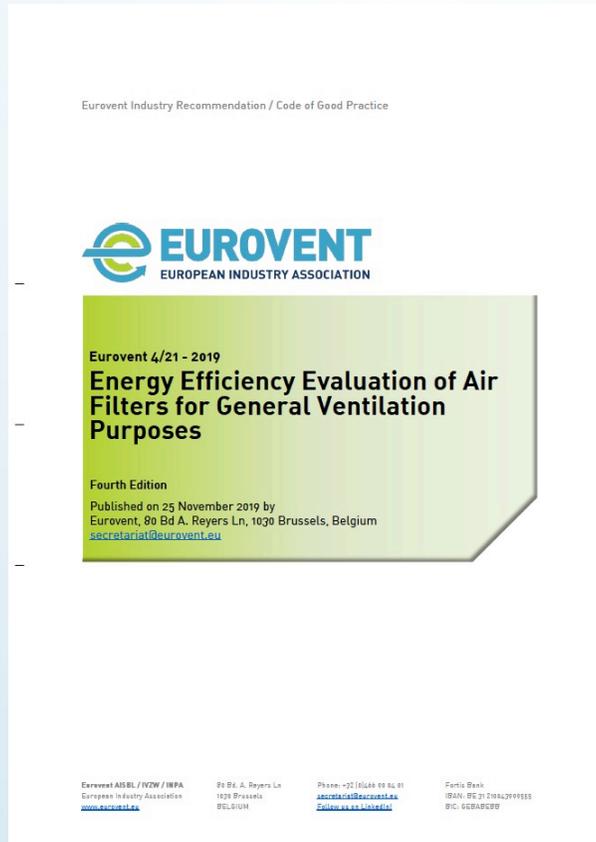
Filter and AHU Performance



Key milestones for holistic AHU certification



Background



- Eurovent has been the first organisation in the world to propose a method for rating the energy efficiency of air filters **since 2013**
- **Eurovent 4/21** – Energy Efficiency Evaluation of Air Filters for General Ventilation Purposes (2019) is currently the latest version of the document describing the method
- This method can be used in combination with **ISO 16890**

Principle

- Air filters cause energy consumption (W) due to their pressure drops (Δp)
- Following standard values are considered:
 - Nominal airflow: $q_v = 0,944 \text{ m}^3/\text{s}$ (3400 m^3/h)
 - Operation time: $t = 6000 \text{ h/a}$
 - Fan efficiency: $\eta = 0,5$

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

$$W = 11.33 \frac{\text{kWh / a}}{\text{Pa}} \cdot \overline{\Delta p}$$

Testing method

1. Carry out an ISO 16890-1 test at 0,944 m³/s for a full size filter (592mm x 592mm)
2. Load the filter with AC fine dust acc. to ISO 16890-3 until the amount of dust defined in the table on the right is reached
3. Calculate the average pressure drop
4. Calculate the yearly energy consumption W

| ISO group | Amount of dust fed M_x |
|------------------------|--------------------------|
| ISO ePM ₁ | 200g |
| ISO ePM _{2,5} | 250g |
| ISO ePM ₁₀ | 400g |

Energy classification

Energy efficiency classes are defined in the Air Filter Technical Certification Rules:

| | AEC in kWh/y for ePM1 | | | | | |
|----------|-----------------------|------|------|------|------|-------|
| | 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 |

| | AEC in kWh/y for ePM10 | | | | | |
|----------|------------------------|-----|------|------|------|-------|
| | 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 |

| | AEC in kWh/y for ePM2.5 | | | | | |
|----------|-------------------------|------|------|------|------|-------|
| | 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 |



EUROVENT CERTIFIED PERFORMANCE ENERGY EFFICIENCY

MANUFACTURER
Range name
Model name

www.eurovent-certification.com

AIR FILTERS ISO ePM₁ xx%

OTHER LANGUAGE EN ISO 16890-1: 2016
OTHER LANGUAGE

Nominal airflow: 0.000 m³/s
Efficiency: ePM₁ 00 %
Minimum efficiency: ePM_{1, min} 00 %
Annual Energy Consumption: 0000 kWh/annum

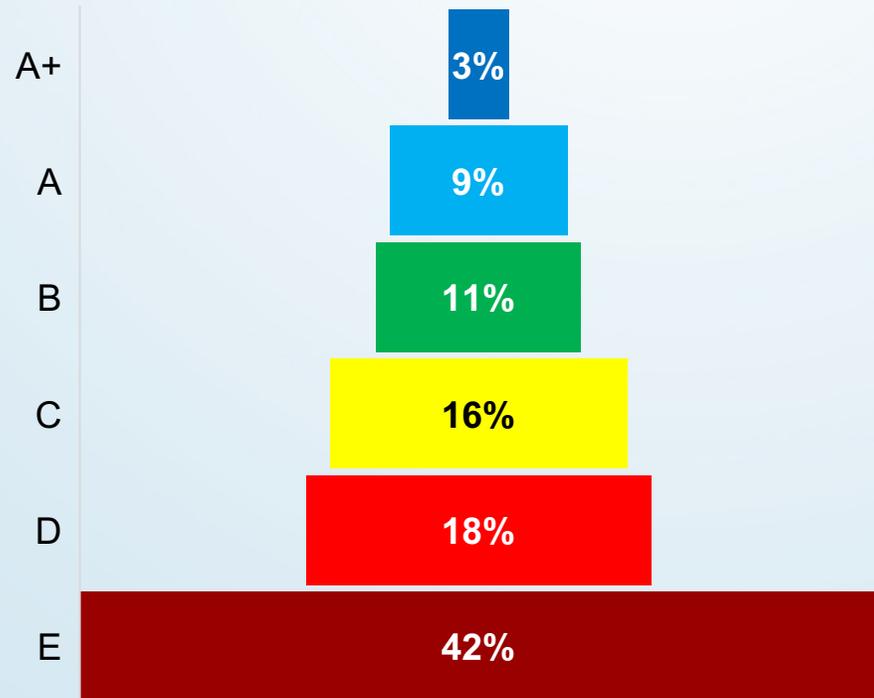


A+
2019

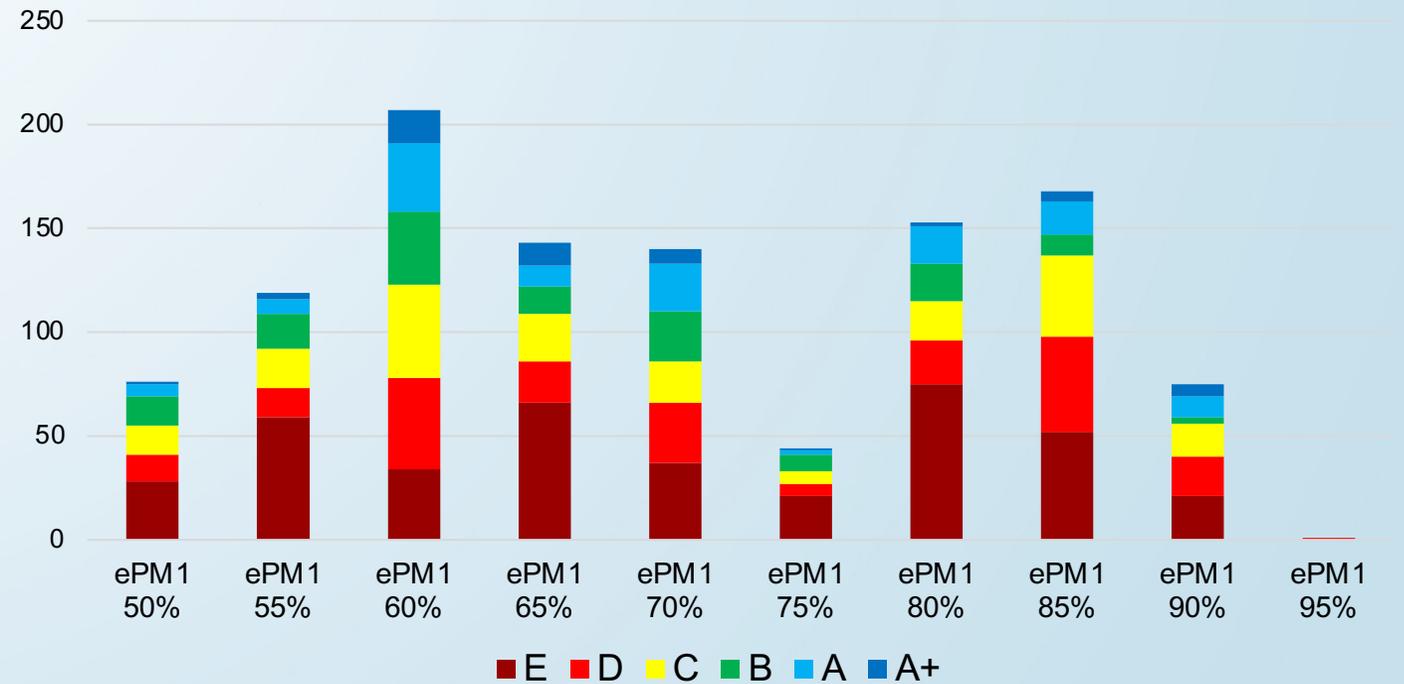
THRESHOLD REFERENCE SCALE YEAR : 2019
RS 4/C/001

Analysis

Distribution of energy efficiency classes



ePM1



Conclusion

Selection rules:

1. Define the target filter efficiency group (ePM1, ePM2.5, ePM10) and efficiency value in % (e.g. using Eurovent 4/23)
2. Define the target energy efficiency class (A+, A, B, etc.)
3. Use new [Eurovent Certita Certification online selection tool for certified air filters](#)

The screenshot shows a web-based selection tool for air filters. At the top, it says "Close filters ^" and "Please select one product family and one product type." There are two "Air filters" tags with an 'x' to remove them. On the right, there are links for "New search" and "Let us guide you".

| | | |
|-----------------------------|-------------------------------------|-----------------------------|
| Product family ✓ | Basic design | Basic design ▾ |
| Product type ✓ | Media | Filter Media ▾ |
| Brand | Nominal airflow rate | Nominal Airflow Rate ▾ m³/s |
| Model name / Certificate N° | Filter class according to ISO 16890 | Filter class acc. to ISO1 ▾ |
| Advanced search criteria | Energy efficiency class | Energy Efficiency Class ▾ |

At the bottom, there are buttons for "Clear all filters" and "Apply (2009)". A link "Help on search criteria?" is also visible.

Thank you!



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Key takeaways



Vanshaj Kaul

Country Representative India,
Eurovent Certita Certification

Public Policy professional

Summary

- Health concerns have been rising and all stakeholders now recognise the importance of the air we breathe.
- People spend 90% of their time indoors, therefore focus on IAQ and relating to PM levels is important.
- ISO 16890 offers harmonisation which is welcomed by all stakeholders
- Understanding filter nomenclature & efficient tools is important to size and design the right components including filters for both Indoor and Outdoor Air Quality.
- Energy efficiency and filter efficiency do not contradict each other
- **‘ISO 16890 empowers to choose the right filter’**

Reference documents

- <https://eurovent.eu/?q=content/eurovent-423-2020-selection-en-iso-16890-rated-air-filter-classes-third-edition-english>
- <https://eurovent.eu/?q=content/eurovent-421-2019-energy-efficiency-evaluation-air-filters-general-ventilation-purposes>
- <https://eurovent.eu/?q=content/eurovent-419-2018-industry-recommendation-concerning-public-enquiries-air-filters-third>
- <https://eurovent.eu/?q=content/eurovent-air-filters-guidebook-first-edition>

Thank you!



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Panel / Q&A



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Prabhat PK Goel



Dr. Marc Schmidt



Ilinca Nastase



Sylvain Courtey



Vanshaj Kaul

Moderator: Markus Lattner

Notes



Webinar recordings will be available on the Eurovent and Eurovent Middle East YouTube channels



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climate control ^{MIDDLE EAST}

KEY PERSPECTIVES ON THE REGION'S HVACR INDUSTRY



Thank You!