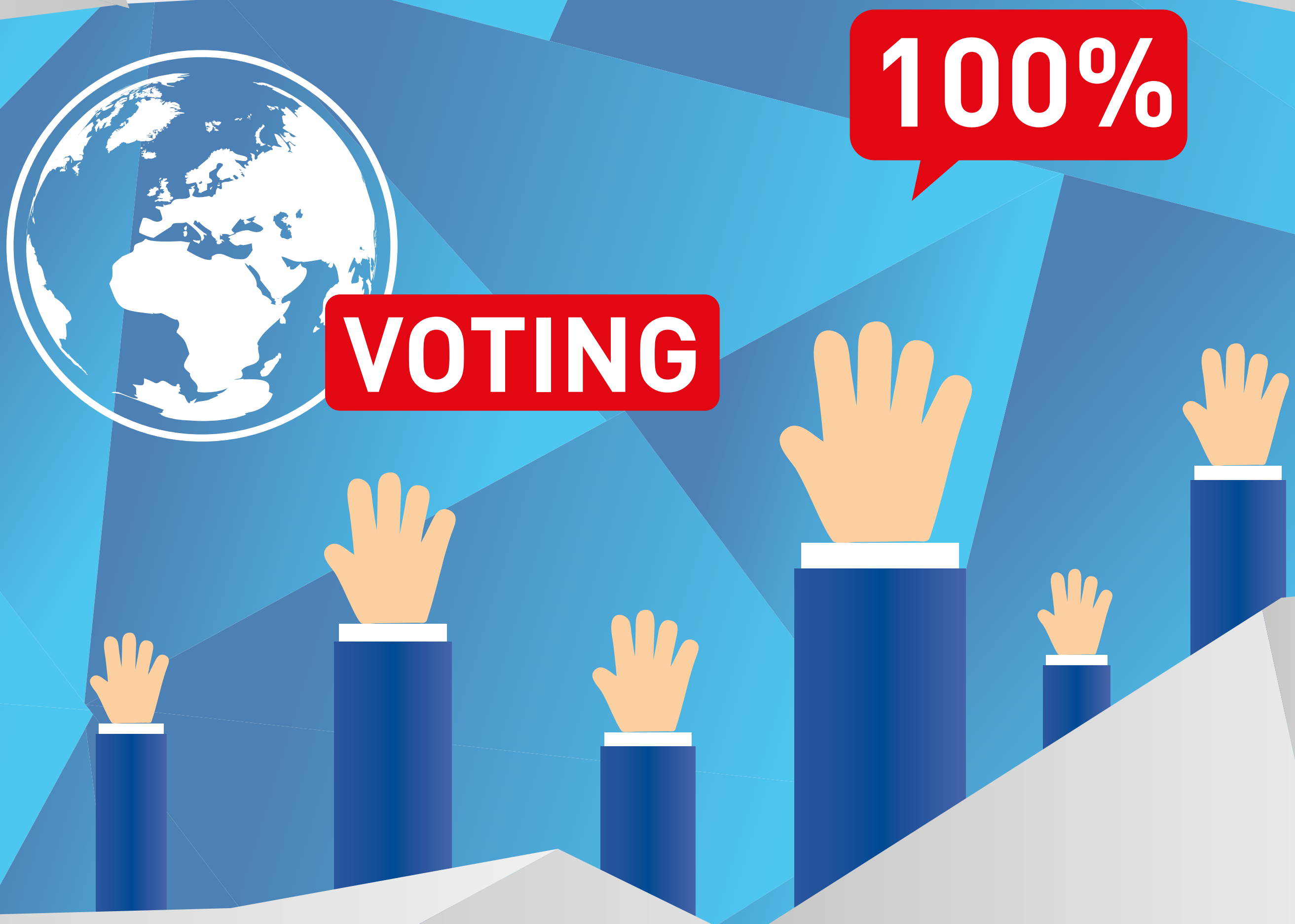
UNI EN ISO 16890

THE REVOLUTION IN AIR FILTRATION



FE SYSTEM: air filter in energy class A+ that is constant over time

expansion® electronic

BETTER AIR FOR A BETTER QUALITY OF LIFE

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INTRODUCTION

The introduction of the new global standard **UNI EN ISO 16890,** which classifies the air filters on the basis of their ability to retain the dispersed airborne particulate matter (PM10, PM2,5 and PM1), is generating a general revolution in the air filtration sector.
It replaces the previous and obsolete EN 779:2012 standard (F7, F8, F9), anti-dust air filters for general ventilation.

The table 1 shows the classification on the different particulate dimensions according to the new standard.

CARACHTERISTICS OF EN ISO 16890

1. It replaces an existing standard from more than 20 years.
2. The efficiency refers to the particle size of fine powders.
3. The classification of a filtration element in a ePMx group is based on the minimum value of efficiency.
4. New procedure for the electrostatic charge on the entire filter.
5. Two different aerosols for the test: DEHS and KCL.

Classes	Minimum Efficiency	Type of particulate
ISO ePM 1	e(PM1),min ≥ 50 %	Virus, nanoparticles, gas
ISO ePM 2.5	e(PM2.5),min ≥ 50 %	Bacteria, molds and pollens
ISO ePM 10	e(PM10),min ≥ 50 %	Pollens, sand and dust
ISO Coarse	e(PM10),min ≤50 %	Hair

Table 1

ADVANTAGES OF EN ISO 16890

1. The filters will be more suitable for the real conditions of the desired application.
2. Easier to correlate with international organizations such as WHO (World Health Organization) thanks to the same nomenclature.
3. Possibility to calculate in an engineering way a filtration system.
4. Improvement of the Indoor Air Quality.
5. The norm will be valid worldwide.

The main difference between the previous EN 779 standard and the new **EN ISO 16890**, for the users, lays in the classification system of the HVAC filters efficiency.

In order to be classified as PM1, PM2,5 or all other PM size classes, a filter must prove a minimum efficiency of 50% compared to the class concerned. So, with this norm a filter can have up to four efficiency classes if it reaches minimum 50% of efficiency in the PM class (n). (Table 2)

In the end, for coarse filters, the new standard will include the filters that capture less than 50% of particles in the PM10 range, which will be called Coarse ISO and will show the performances of PM10 (for example PM Coarse 45%).

ISO GROUP	Minimum requirement			Declared value
	ePM_{1min}	$ePM_{2,5min}$	ePM_{10min}	
ISO Coarse	-	-	< 50 %	Eff. In initial mass
ISO ePM10	-	-	≥ 50 %	ePM10
ISO ePM2,5	-	≥ 50 %	-	ePM2,5
ISO ePM1	≥ 50 %	-	-	ePM1

Table 2: **$ePM_{x'min}$** is the minimum efficiency between the initial one and that measured after the elimination of the electric charge.

Example:
An air filter that operates at 64% on PM1 particles is classified ePM_1 60%.
An air filter that operates st 66% on PM2.5 particles is classified $ePM_{2.5}$ 65%.

COMPARISON FOR THE CLASSIFICATION OF THE FILTERS
EN 779 VS EN ISO 16890

In the EN 779 standard, the efficiency towards coarse and fine powders was based on particles with an aerodynamic diameter of 0,4 µm.
In the ISO EN 16890, the efficiency is defined on the basis of particulate having different dimensions: PM10, PM2,5 and PM1.

	EN 779:2012	EN ISO 16890
Particle size for classification	0,4 µm	from 0,3 to 1 µm (PM1) from 0,3 to 2,5 µm (PM 2,5) from 0,3 to 10 µm (PM10)
Test aerosol	DEHS	DEHS → from 0,3 to 1 µm KCL* → from 2,5 to 10 µm
Electrostatic discharge with IPA (isopropanol)	Sample is fully immersed	Sample (entire filter) is conditioned with IPA vapour
Efficiency of discharged filter	Comparison of simple and filter	Average efficiency of treated and untreated (conditioned) filter
Dust feed for classification	Incremental dust feed	Classification without dust feed
Test dust for ISO Coarse and energy efficiency	ASHRAE	ISO fine
Dust feed	70 mg/m^3	140 mg/m^3
Test final differential pressure	G1, G2, G3, G4 = 250 Pa	PM 10 < 50 % = 200 Pa
	M5, M6, F7, F8, F9 = 450 Pa	PM 10 ≥ 50% = 300 Pa
Classification	from G1 to G4 from M5 to M6 from F7 to F9	ISO Coarse ISO ePM 10 ISO ePM 2,5 ISO ePM 1

Table 3
*potassium chloride

ENERGETIC COMPARISON
POCKET FILTER VS ELECTROSTATIC FILTER

With the new **UNI EN ISO 16890**, the **FE SYSTEM** electrostatic filter of Expansion Electronic **is the only air filter with energy classification A+** that is real over time.

	Pocket filter	Electrostatic filter
Pressure drop	They increase as more synthetic powder is added during the test.	At 300g of injected powder, the pressure drops remain constant. The variations are so low that the energy costs are certain.
Energy Class	A+ only if the filter is replaced with a high periodic frequency.	Energy class A+ guaranteed and constant.
Replacement	To maintain the class A+, the filter must be replaced when it reaches 90 Pa of pressure drops. If the filter is not replaced, it is downgraded as energy consumption increases.	To maintain the class A+ the filter can reach 300g of dust accumulation keeping the pressure drops constant at 62 Pa. With an accumulation of 600g, the pressure drops have a variation of only 20 Pa, still guaranteeing the energy efficiency class A+.

Table 4

EVALUATION OF ENERGY CONSUMPTION

Formula of energy cost in relation to pressure drop

$$\mathbf{E} = \frac{q \bullet \Delta p \bullet t}{\eta \bullet 1000} \ \text{[Kwh/year]}$$

q: air flow (m^3/s) Variable
Δp: avarage pressure drop (Pa) Variable
t: work time (h/year) 6000
η: efficiency / performance 0,5

Electrostatic filter **FE 600**

ePM_1: 70%

$$\mathbf{E} = \frac{0{,}944 \bullet 62 \bullet 6000}{0{,}5 \bullet 1000} \ \text{Kwh/year}$$

$$= \frac{351168}{500} = \text{702 Kwh/year}$$

Pocket filter

ePM_1: 70%

$$\mathbf{E} = \frac{0{,}944 \bullet 215 \bullet 6000}{0{,}5 \bullet 1000} \ \text{Kwh/year}$$

$$= \frac{1217760}{500} = \text{2435 Kwh/year}$$

Comparing an electrostatic filter with a pocket filter of equal efficiency, we can see that the annual energy consumption of the pocket filter is 3 time higer.

KEP: KEY ENERGY PERFORMANCE

An additional indicator of filters performance is the KEP (Key Energy Performance) related to Energy Performance. The KEP is an indicator that represents the goodness of a filter. The higher the indicator is, the lower the environmental impact of the filter will be.

$$\textbf{Kep} = \frac{-\log(1-ePMx)}{\Delta p - Cx} \bullet 100Pa$$

ePMx: certificated efficiency of the filter (ePM_1=70% = 0.7)
Δp: average pressure drop
Cx: constant = 35 Pa

Electrostatic filter **FE SYSTEM**

Energy class A+
ePM_1: 70%
ΔP: 62

$$\textbf{Kep} = \frac{-\log(1-0,7)}{62 - 35} \bullet 100Pa$$

$$= \frac{0,522}{27} \bullet 100 = \mathbf{1,94}$$

Pocket filter

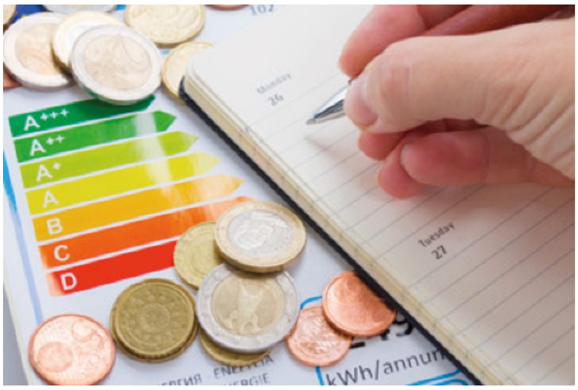
Energy class A+
ePM_1: 70%
ΔP: 130

$$\textbf{Kep} = \frac{-\log(1-0,7)}{130 - 35} \bullet 100Pa$$

$$= \frac{0,522}{95} \bullet 100 = \mathbf{0,55}$$

CONCLUSION

The medical-scientific community also recognizes the problem about micro-particulate and is paying special attention to PM 1, which is considered the most dangerous fraction of PM for human health. This new standard will therefore lead to an improvement in indoor air quality for the benefit of the health and well-being of people and production processes.



Thanks to their properties, the active electrostatic filters of Expansion Electronic offer very low pressure drops, constant during normal operating life. When the maximum degree of dirt is reached, the electrostatic filter can be maintained by washing with a special detergent that regenerates it and guarantees its normal functionality again.

The active electrostatic filter is a high precision filter composed of noble materials and is not intended for "disposable". The return on initial investments is guaranteed in a few months thanks to:

- lower energy consumption that still guarantees a high Indoor Air Quality;
- lower maintenance costs;
- no filter replacement costs.

The FE SYSTEM filter range generates saving on energy costs of 25%.
The reliability and performance of Expansion Electronic filters, in fact, ensure low running costs throughout the entire life cycle of the plant.

Expansion- Electronic undertakes to use renewable and recyclable materials, preserving the environment thanks to products with a long life cycles.

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