

ACTIVE ELECTROSTATIC FILTERS FE

The Hi-Tech solution for ventilation systems

ENERGY EFFICIENCY

With the increase of atmospheric pollution there is a growing demand for better air filtration, while at the same time efforts are being made to keep down system energy consumption as much as possible, focusing on sustainable development: these requirements seem to be in conflict with one another, but active electrostatic filters are able to provide an efficient solution.

In fact, any kind of air filter of a “mechanical” type, whose efficiency depends primarily on phenomena of mechanical interference between the particles in transit and the fibrous filter matrix, undergoes a gradual increase in load loss, due to the accumulation of deposits transverse to the airflow.

For example, a medium-high efficiency paper filter, class F7-F8 according to EN 779, can present an initial load loss of 100-150 Pa, which can increase up to 450 Pa at the end of its working life. During this operating time, the increase in load losses results in an increase of the electric energy absorbed by the fans to ensure the foreseen flow rate, or a gradual reduction of flow in systems unable to perform correct compensation.

On the other hand, active electrostatic filters “remove” the suspended particles from the airflow and cause them to precipitate on manifold plates arranged in the transverse direction to the flow. Thanks to this property, electrostatic filters offer very low load losses, almost constant during their normal working life, which ends when the thickness of the deposit begins to disturb the electric field, instead of preventing the passage of the air, as occurs in mechanical filters. In the case of an active electrostatic filter FE by Expansion Electronic, for example, for the same efficiency class considered in the comparison with the “mechanical” filter, the load losses are constant, reaching values of about 30 Pa.

ACHIEVING THE FUNCTIONS OF THE PLANT

Several studies have shown that one of the main problems in ventilation systems appears to be the reduction of airflow that occurs after about 2-3 years of operation.

This fact is usually caused by the accumulation of dust and dirt on fans, batteries, channels and other components. Furthermore, this contamination is the ideal breeding ground for the proliferation of bacteria, microorganisms and moulds which, in turn, determine an unhealthy ventilation system. In addition, an airflow reduction means that the ventilation system does not satisfy one of its primary functions.

If it is true that the filtration system is the main defendant, then the solutions can be alternatively:

- a) Increase the maintenance schedule for cleaning the air handling unit, batteries, fans and channels.
- b) Improve the filtration system by using filters able to perform with good efficiency over the entire dust spectrum (coarse, fine and ultrafine).

The active electrostatic filter series FE by Expansion Electronic fully satisfies this second requirement.

SUSTAINABLE DEVELOPMENT

The achievement of targets for both environmental and economic improvement is increasingly a concern in the HVAC industry too. Considering filters of a “mechanical” type, we can say that the higher the filtration class, the more frequent must be the interventions for filter replacement, while the pollutant storage capacity is proportionally decreased.

FE active filters by Expansion Electronic have a threefold advantage over “mechanical” filters:

- a) The pollutant storage capacity is considerably higher. Considering a filter FE 600 (592x592), for example, its storage capacity is 600 g of DEHS ISO 12 103-A2 powder, about four times higher than an H10 filter. This reduces the frequency of maintenance operations and the resulting costs for disposal of “mechanical” filters.
- b) Unlike “mechanical” filters, active electrostatic filters can be regenerated and reintroduced into the plant. They are cleaned with water and detergent. If maintenance is carried out properly, active electrostatic filters can last for many years (average 10-15).
- c) As already explained above in the section devoted to energy efficiency, active electrostatic filters have considerably lower load losses, allowing significant energy savings.

GLOBAL HEALTH

In ventilation plants that install “mechanical” filters there may be a generation and release of toxic products resulting from microbial decomposition, such as endotoxins. On the contrary, an active electrostatic filter has a high antibacterial activity due to its high efficiency on submicron particles and to the action of the electric field. The results of some tests performed at the Institute of Air Hygiene ILH in Berlin and at the Policlinico San Matteo in Pavia show that Expansion Electronic's filtration systems are capable of eliminating airborne bacteria, yeasts and moulds with an efficiency ranging from 98.53% to 99.96%.

FILTRATION OF NANOPOWDERS

More and more frequently ultrafine powders (PM 1, PM 0.4 and lower) are found in indoor environments and in much higher concentrations than outside. This fact is mainly due to the accumulation of dust coming from the introduction of improperly treated outside air (especially in winter), and to the difficulties related to their elimination.

99.9% of all particles present in the atmosphere are smaller than 1 micron. Ultrafine powders and nanopowders have the highest health risk as they reach the lungs and from there pass into the bloodstream. They are the hardest to catch. A strong filtering action against ultrafine dust particles in the air allows decisive action to be taken to prevent many serious illnesses related to the effect of mineral nanopowders such as chromium, iron, lead, and others (see the new medical discipline nanopathology).

The choice to adopt filters particularly effective against ultrafine powders guarantees the decontamination of microorganisms (bacteria, viruses) present in the air and their decomposition, which is one of the major causes of the sick building syndrome.

FE active electrostatic filters by Expansion Electronic have a high filtration efficiency over the whole “dust spectrum”. For example, considering an airstream velocity through the filter of 1.5 m/s, an FE filter offers a filtration efficiency of 98.8% over a granulometry of 0.4 microns and of 98.4% on 0.13 microns.

To achieve this same performance level with a “mechanical” filter, it is necessary to switch to absolute filters.

CERTIFIED EFFICIENCY

Standard UNI 11254 classifies active electrostatic filters in four degrees of filtration (A, B, C, D).

The considered efficiency in this standard is the mean efficiency value E_m on DEHS granulometry up 0.4 microns.

A homogeneous comparison with “mechanical” filters is not possible, because the latter consider different classes of efficiency, such as:

- a) The mean filtration efficiency throughout the working life of the filter which is not constant, but increases as the filter becomes impregnated with powders, for particles with a granulometry of 0.4 microns (class F, EN 779).
 - b) The minimum filtration efficiency for particles having a granulometry of 0.3 microns (class H, EN 1822).
- However, FE filters can be compared to “mechanical” filters (F or H classes) considering their performance with regard to particle size.

In terms of performance, an FE filter offers an increasing filtration efficiency as the airflow velocity decreases. At a speed of 4 m/s, an FE filter will be comparable to a “mechanical” filter class F7, while at 1.5 m/s its filtration efficiency will make it comparable to an H12 filter class.

Therefore, in a plant with variable airflow with an active electrostatic filter, the minimum efficiency class will be the one obtained at maximum airflow capacity and will increase at lower airflow rates.

This characteristic does not apply to mechanical filters which retain the same class of efficiency at the different operating airflow rates, although the degree of efficiency is minimum when the filter is brand new.

SYNTHESIS OF TECHNOLOGY AND PERFORMANCES

Employing an unsuitable filter for the air handling unit will result in poor plant performance because most of the ultrafine powders suspended in the air pass through the filtration system and begin circulating. In the long run this causes fouling of the battery, the fan, the channels, and a high concentration of ultrafine powders that are difficult to eliminate from treated areas.

The choice of a high efficiency filter considerably reduces the effects mentioned above. The performance of active electrostatic filters by Expansion Electronic with fine (PM 2.5), ultrafine (PM 1) and nanoparticles (PM 0.4) makes it the ideal choice for those who seek a ventilation system with a high degree of air hygiene, markedly reduced maintenance costs, substantially low energy costs, large storage capacity (600g) and, last but not least, airflow rates and efficiencies that are constant over time.

Having a high efficiency over the whole dust spectrum means inducing a high indoor air quality, especially from the point of view of hygiene (bacteria, spores, moulds, viruses, etc.), as well as preservation of the plant (exchange batteries, channels, etc.) with important economic advantages in maintenance costs.

RETURN ON INVESTMENTS

The active electrostatic filter is a high precision filter, composed of expensive materials and it is not intended to be disposable.

The higher initial cost will be amortised over a period of 1.5 – 2.5 years thanks to:

- a) lower maintenance costs;
- b) reduced power consumption compared to a high degree of indoor air quality.

It can therefore be appreciated that active electrostatic filters allow a return on investment which must be considered in all respects an important parameter of choice.