The Hi-Tech solution for ventilation systems

Energetic efficieny

The growth of atmospheric pollution has led to a need to develop better air filtration systems. The active electrostatic filter contributes to creating an efficient solution for ventilation systems.

In fact, any kind of “mechanical” air filter, whose efficiency primarily depends on mechanical interference phenomena between the particles in transit and the fibrous matrix filter, undergoes a gradual increase in pressure drop, due to the accumulation of “transversal” deposits caused by the air stream.

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

Active electrostatic filters, instead, “remove” the suspended particles from the air stream and cause them to precipitate on collector plates, which are arranged along the crossing direction of the air. Thanks to this property, electrostatic filters offer very low pressure drops, almost constant during the normal operating life, which ends when the storage thickness begins to disturb the electric field, by NOT preventing the passage of the air, as with mechanical filtration. With an active electrostatic filter like the EFX from AP, for example, for the same class of efficiency compared to “mechanic” filters, the pressure losses are constant and attested at 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, ducts and other components. Furthermore, this contamination is the ideal breeding ground for the proliferation of bacteria, microorganisms and molds which, in turn, determine an unhealthy ventilation system. In addition, a reduction in airflow means that the ventilation system does not satisfy one of its primary functions.

If it’s true that the filtration system is the main defendant, then the solutions are to be found in one or several of the following alternatives:

a. Increase the frequency of maintenance in cleaning the AHU, batteries, fans and duct.
b. Improve the filtration strategies/systems by using filters which are efficient over the entire spectrum of dusts (coarse, fine and ultrafine).

The active electrostatic EFX filter from AP fully satisfies this second requirement.

Sustainable development

The achievement of targets for both environmental and economic improvement is more and more becoming a concern in the HVAC industry.

When it comes to the filters of “mechanic” typology, we can state that the higher the class of filtration, the more frequent is the intervention for the replacement of the filter and, consequently, a reduction of the storage capacity of the pollutant.

The active EFX filters from AP have a threefold advantage over “mechanic” filters:

a. Storage capacity of pollutant is considerably

higher. A filter like the EFX 600 (592x592), for example, has a storage capacity of 600 g of DEHS ISO 12 103-A2 powder, which is about four times higher than that of a H10 filter. This reduces the frequency of maintenance interruptions and costs for disposal of "mechanic" filters.

b. Unlike "mechanic" filters, active electrostatic filters are re-generable and re-introduceable in the plant. Their cleaning is done with water and detergent. If maintenance is carried out properly active electrostatic filters can last for many years (on an average 10-15).

As already explained above in the section devoted to energy efficiency, active electrostatic filters have significantly lower pressure drops, allowing significant savings in energy.

Global Health

In ventilation plants where "mechanical" filters are mounted it happens that they generate and release toxic products coming from microbial decomposition, such as endotoxins. The electrostatic filter, on the contrary, has a high antibacterial activity due to its high efficiency of submicron particles and of the action of the electric field.
The results of some tests performed at the Institute of Air Hygiene ILH Berlin and at the Policlinico San Matteo of Pavia show that the AP filtration systems are capable of eliminating airborne bacteria, yeasts and molds with an efficiency ranging from 98.53% to 99.96%.

Filtratrion of Nanopowders

More and more ultrafine powders (like PM 1, PM 0.4 and lower) are found in indoor environments and in much higher concentrations than outdoors. This fact is mainly due to the accumulation of dust coming from the introduction of not properly treated outdoor 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 are the most dangerous to your health as they reach the lungs and from there into the bloodstream. They are the hardest to catch, too. A strong filtering action against ultrafine air particles in dusts allows them to act decisively in favour of the prevention of many serious illnesses related to the effect of nano-mineral powders such as chromium, iron, lead, etc. (see the new medical discipline nanopathology).

The choice of adopting filters particularly effective against ultrafine powders means that there is a guarantee against the decontamination of microorganisms (bacterial viruses) present in the air and their decomposition, which is one of the major causes of the sick building syndrome.
The Active electrostatic EFX filters from AP have a high filtration efficiency over the whole "dust spectrum". As an example, consider an airstream with a velocity through the filter of 1.5 m / s, the EFX filter offers a filtration efficiency of 98.8% over a granulometry of 0.4 µm and of 98.4% on 0.13 µm.
To achieve the same performance level with a "mechanic" filter, it is necessary to switch to absolute filters.

Certified Efficiency

The UNI 11254 standard classifies active electrostatic filters in four degrees of filtration (A, B, C, D). The considered efficiency in this standard is the average efficiency value of Em on DEHS granulometry up 0.C (As a point of reference, a human hair is approximately 50 microns in diameter)
An homogeneus comparison with "mechanic" filters is not possible, since these have different classes of efficiency, such as:

a. The medium filtration efficiency along the operating life of the filter is not constant, but increases with the storage level of powders

made by the filter itself, towards particles of granulometry 0.4 µm (class F, EN 779)
b. The minimum filtration efficiency for particles having a granulometry of 0.3 µm(Class H, EN 1822)

Nevertheless, the EFX filters can be compared to "mechanic" filters (F or H classes) if we consider their performance towards the size of the particles .
The EFX filter itself performs an increasing filtration efficiency at decreasing airstream velocity.
At a speed of 4 m / s, an EFX filter will be comparable to a "mechanic" filter class F7, while at 1.5 m / s its filtration efficiency will make it comparable to a filter class of H12.
Therefore, in a plant with variable airflow using an active electrostatic filter, the minimal efficiency class will be the one obtained at maximum airflow capacity and will increase by lower airflow ranges.
This peculiarity is not valid for mechanic filters which retain the same class of efficiency at different airflow rates while operating, although the efficiency degree is at its minimum when the filter is brand new.

Conclusions about technology and performance
A consumer should always evaluate a suitable air filter for each appliance, with the choice based on both its filtration efficiency and air flow capabilities.
Employing an unsuitable filter for the air handling unit will make the plant perform poorly since most of the ultrafine powders suspended in the air pass through the system and enter the bloodstream. This results in the long run in the fouling of the battery, the fan duct and a high concentration of ultrafine powders which are difficult to eliminate once inside air treated areas.

The choice of a high efficiency filter considerably reduces the effects mentioned above. The performance of active electrostatic filters from AP towards fine (PM 2.5), ultrafine (PM 1) and nanoparticles (PM 0.4) makes them the ideal choice for those who want to get a ventilation system with a high degree of air hygiene, markedly reduced maintenance costs, considerably lower energy costs, large storage capacity (600g) and, last but not least, air flow rates and constant efficiencies over the operating life time.
Having a high efficiency over the whole spectrum of dusts is similar to very high IAQ air quality, especially from a point of view of hygiene (bacteria, spores, molds, viruses, etc..), as well as the preservation of the plant (batteries exchange, ducts, etc.). with important economic advantages in maintenance costs.

Return on investments
The active electrostatic filter is a high precision filter, composed of precious materials and not to be referred to as "throwaway" items.

The higher initial cost will be paid back in 2.5 - 3.5 years thanks to :
a. lower maintenance costs
b. reduced power consumption and a much better IAQ

It is therefore clear that taking all parameters into consideration the active electrostatic filters give a better return on investment than conventional filters.