DUST COLLECTOR MONITORING...

IS THERE A COST EFFECTIVE SOLUTION?

The retention of particulates, no matter if they are carried in an exhaust gas stream or are a valuable product in a drying process, is covered by modern filtration technology. Beside more exotic principles like electrostatic precipitators or wet scrubbers, a vast range of applications where particulates are carried by a dry gas stream are retained by so called 'dust collectors' these days. (Pic 1)
These dust collectors, which are also called 'bag houses' or dust filters, have gone through an impressive evolution over the past decades and have reached incredibly effective retention rates and thus very low particle emission levels downstream.

Pic 1. Medium Size Bag Hoses Filter *Source: Rippert*

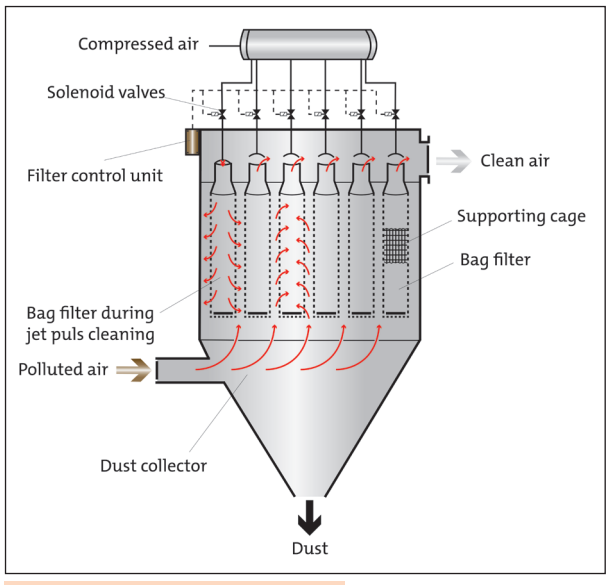
The dust collecting elements inside the filter houses are designed in different ways and tend to prioritise manufacturer preferences over technical necessities. Whether the filter element has the form of a hose, a bag or a pleated cartridge, the basic material is usually made of organic or synthetic fabric, woven or as a fleece. Depending on the basic principle, the filter cloth is internally supported by a metallic frame, cage, grid or tube on the downstream side.

Most of the dust collectors are designed for continuous operation and feature a blow back system of various designs to clean the collected dust load off the filter elements periodically. According to local governmental regulations the complete filter installation may need an approval for certain applications and/ or is subject to regular inspections by official bodies. In some industries the filter houses may reach enormous dimensions to be able to handle the individual exhaust gas stream and provide adequate operational conditions and dirt holding capacity.

Even more dust collectors can be found in less extreme environments, having 'normal' sizes but never the less must provide very low and stable emissions. There is a danger that operators of such units will damage their local reputation and credibility in their neighbourhoods if their production process covers the whole area with dust because his dust filter failed. In other words, there are a number of very good reasons why such dust collectors should be continuously monitored apart from any regulatory or other official requirements.

The filter elements however, need to perform a challenging task. During operation they collect the dust particles on the surface of the upstream side and quickly build up a so called filter cake. This filter cake improves the retention rate to the better because the surface structure gets even finer. On the other hand, the filter cake will increase the pressure loss across the filter element and consequently steadily reduces the exit flow. Modern dust collector installations provide delta p controller which trigger the blow back sequence. The blow back system basically consists of a capacitive vessel of sufficient volume for the storage of pressurized air as well as a number of valves and pipe work to direct an air shot into the downstream side of the filter elements in order to brake the filter cake on the upstream side loose and to force the collected dust to fall towards the bunker room at the bottom of the house. The blow back takes place while the complete filter remains operable which consequently explains why the dust is falling towards the bunker in sequences. (Pic 2)

Considering the mechanical forces to which the filter cloth is exposed to during this blow back process, it is easy to imagine that the life time of the filter elements is limited. Even worse, the elements degrade over an unpredictable period of time just like a pair of socks which get frayed over time before the formation of real holes. This wear is caused primarily by the relative movements of the filter material on the support cage, the impact of the blow back and sometimes even through abrasive dust particles. If the material gets slightly worn it does not necessarily mean that the filter element will not function any more. The filter cake will build up again even on a thinner structure, but for a short while a higher amount of residual dust will slip through. This process will go on until the fabric structure fails completely, a hole breaks and the dust will flow freely causing all the hassle no one really wants.



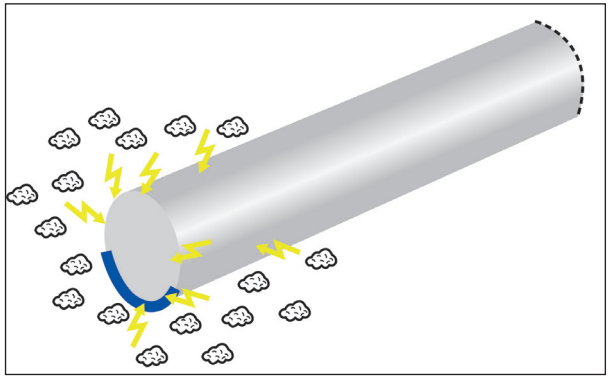
Pic 2. Function Principle Back Puls Air Purge

The problem:

A major obstacle for a broadly acceptable method of monitoring non regulatory or small dust filters was the availability of affordable control devices. The usual downsizing of sophisticated optical equipment widely spread in the regulated applications could not meet an acceptable ratio adequate for the investment in the dust collector itself. Therefore common practice is to change the filter elements on a time schedule regardless of their condition. The way out of this dilemma could be the adoption of a very well established technology available as monitoring equipment for a low budget but with great potential to increase the operational efficiency of the dust collectors.

The answer:

Bühler Technologies, one of the leading global suppliers of



Pic 3. Triboelectric Measuring Principle

advanced solutions for Gas Analysis and Fluid Control, took up the challenge. Based on the comprehensive experience gained in over 45 years in the field of cartridge filter technology, the target for the development of dust filter monitors was set for a unit which is affordable even for owners of small dust filters, based on reliable technology, easy to install and providing just enough information for the operator to run his unit efficiently and cost effectively while the investment for purchase and implementation should be moderate.

The Technology:

Every particle carried in a gas stream is electrically charged simply by its motion within the stream. If the particle collides with a conductive metal rod, its charge will be discharged to the rod and led to zero. This also happens if the particles come very close to the rod. The charge transferred is almost proportional to the number of contacts i.e. to the mass of particles in the stream. Of course, the intensity of the transfer is influenced by the velocity with which the particles pass by and also by the size of the particles. (Pic 3)

In the case of dust filter monitoring, the latter parameters become less important. This is because, firstly, particles passing through a filter matrix are fairly uniform and small (even in the event of filter failure) and secondly the flow through a filter installation does not normally fluctuate, and last but not least: it is absolutely sufficient to detect deviations from pre-set levels and their development over time rather than measuring a certain mass of dust particulates downstream from the filter element.

The electrical charge discharged is transferred via the rod to an electronic transducer which consequently forms the relevant signals.

The Product:

Bühler Technologies has launched the BDA 02 series, a monitor specifically designed to detect the residual dust particles down stream of dust filter elements. (Pic 4)

Placed into exhaust pipes with flow rates around and above 3 m/s the BDA will detect and display small leakages and short dust slips. A 2,5" graphic screen displays continuously the residual dust level present in the exhaust air. Appropriate alarms can be set with enough reserve to keep the emissions under a desired or recommended level. The BDA 02 can even sort out the filter row in which a faulty element may be found if the signal peak is correlated with the blow back sequencer. If necessary, the unit

Pic 4. Real-time Filtermonitor BDA 02

can be calibrated in mg/ Nm (cubic metres) if respective isokinetic samples have been drawn.

The standard version of the BDA 02 comes with the 1" Easyjust installation set and cable glances. TriClamp or flange mounting is optional. The power supply is also optional 115/ 230V AC or 24V DC. The units are self- checking and provide respective alarm out puts.

The BDA 02 Ex version is available with 24V DC supply only and is suitable for applications in hazardous areas zone 2/ 22. ATEX classification: EX II 1/3 D Ex ia/tc T7°C Da/ Dc and Ex II 3G Ex ic nA II T4 Gc.

The BDA instruments are dedicated to cater for applications where the operators are focussed on a cost effective, reliable and trouble free operation of fabric dust collectors.

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