Using Continuous Dust Emission Monitors to Anticipate and Locate Ruptured Bags in Multi-Compartment Baghouses

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Introduction

Over the past five years, significant progress has been made in the monitoring of emissions from fabric filter dust collectors with the development of new monitoring technologies. As a result it is now widely accepted that dust collector emissions can be continuously monitored with a high level of reliability and accuracy.

In order to obtain a picture of how the baghouse is performing and, therefore, the state of the fabric filters, a continuous dust emission monitor with the necessary response characteristics is required. In addition specialised analysis software can be used to more easily understand the current state of the baghouse performance.

Requirements for Operation

When choosing a monitoring system to observe the workings of the baghouse the following considerations should be observed;

Sensitivity – It must have the necessary sensitivity to meet the low levels of emissions of modern fabric filters, from < 0.1 to 10 mg.

Reliability – Both in terms of being able to run continuously with virtually no maintenance and in terms of being able to run despite influences such as vibration, build up on the probe or changes in velocity.

Response Time – The monitor must be able to respond quickly enough to the pulses which are characteristic to baghouse emissions and functionality – See Figure 1. This is only normally achieved by particulate monitors with automatic gain control and large dynamic range. (typically better than 50,000:1)

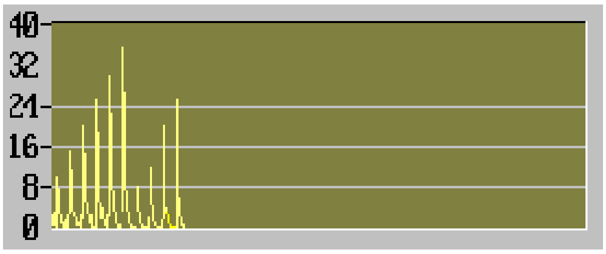

Figure 1- Typical response from a baghouse cleaning cycle

A system that meets these testing standards is one using the Dynatrack and based on the Electrodynamic principle. (automatic gain control & dynamic range of 100,000:1)

The basic principle of operation for the Electrodynamic monitoring system is;

A rod is placed into the airstream of the emission stack. When particulate interact with the rod an induced frequency response charge transfer occurs between the particulate and the rod. This induced frequency response has been empirically shown to be repeatable. This signal is proportional to dust concentration since more particles interacting with the probe will result in a proportionally larger signal*.
* See TUV & MCERTS test reports

Methodology

A method of analysing the status of the fabric filters is to use an emissions monitor that has the capability of displaying the pulses generated on-line as and when a bag row is being cleaned. By observing the height of the individual pulses the state of each row can be assessed. The row that is displaying higher than normal is likely to contain one or more suspect fabric filters.

In order to identify the actual row that is being cleaned a number of methods are available, some being more practical and user friendly than others. For example;

1. A person stands next to the appropriate bank of bags that are being cleaned and watches the display of the monitor. They are then able to identify the status of that row by the height of the pulse. This is not very user friendly and can be impractical depending on location of the baghouse in relation to the monitor.

2. A marker pulse is operated which allows the person observing the display to identify a particular row. For example an audio visual aid can be connected to relay contacts actuated by the solenoid that starts the shake down of the row.

3. An alternative to this is to have the marker pulse show up directly on the monitor display.

Once the row has been identified and the suspect fabric filters changed, the same method can now be used to confirm;

- Correct problem area identified and repaired.
- New fabric filters are not / have not been damaged.
- New fabric filters are fitted correctly ie Seal integrity is good.

Points 2 and 3 are available as standard on some of the PCME products and optional on others.

Taking this to the next logical stage, a software package has been developed to help with the analysis which clearly shows the status of the baghouse at a glance and enables records to be generated*. This information can also be down loaded directly into a spreadsheet so that the data can be manipulated accordingly.
*This is displayed on a remote PC.

Analysis Software and the Suitability of the Fabric Filter Dust Collector

The software package is suitable for monitoring the performance of fabric filter arrestment systems that operate in a pre-set sequential cleaning cycle. It is not important how the cleaning cycle is initiated, it can be by any method such as timed or pressure drop, as the analysis is started via a marker pulse identifying a specific row.

If the arrestment system operates in a non-sequential manner, such as on demand by pressure drop, then a manual over-ride system to cycle through the rows is required. Alternatively, to automatically cycle through the rows a test routine can be programmed into a PLC (Programmable Logic Controller).

Initial Set Up Considerations

In order to maximise the analysis of the pulses generated by the cleaning cycle, a number of considerations need to be taken into account. For the purposes of this report the fabric filter dust collector (baghouse) will consist of 6 rows cleaned in order starting with row 1.

Regular Cleaning

If the cleaning is regular the program sets up a time window and looks for the next pulse inside that window. Any pulse which falls outside it's detection window will be ignored.

Irregular Cleaning

If the cleaning is irregular then the pulses need to be identified. In order to recognise a pulse, a 'Pulse Detection Threshold' is set. Any signal of a higher level than the Pulse Detection Threshold will be identified as a pulse. For example, if the background signal level is around 0.3 units, and the pulses vary between say 10 units and 100 units, then a value between 0.3 and 10 for the Pulse Detection Threshold is entered e.g. a value of 3.0.

Analysis Possible By Monitoring Emissions From Filter Collector Using Specialist Software

Having completed a cleaning cycle a bar graph is generated indicating the peak emission level from each row. The bar graph has a dual colour display. When the warning level is exceeded the bar graph changes colour from blue to red. This is used to highlight that row at a glance showing the emission level for that row is higher than normal. This could mean either a broken bag or a fault is developing in that row. The bar graph is updated at the end of each complete cleaning cycle. The order of the bar graph can be switched between firing order and dust level order. This again helps quickly identify the rows which need or will shortly need attention. Now instead of having to change all the bags in the baghouse only the rows which indicate high emission levels need be changed.

Another benefit is that once the bags have been changed the installation can be double checked. If the bag is faulty or the seal has not been fitted correctly or is faulty then this is quickly checked by observing the bar graph.

The data received during the analysis period can be stored in its own file. Within this file the information is stored in two parts, the Main pulse file and the Pulse information file.

After running this analysis for some time a picture of how the baghouse is working can be built. The time for deterioration of filters can be assessed such that maintenance can be scheduled for natural shutdowns or when the process is least affected.

Summary

Legislation is beginning to concentrate on the performance and control of arrestment plants and not just on the overall emission. Continuous particulate monitors need not only be used to just meet legislation. Valuable information can be gained for process control and baghouse maintenance. The functionality of the fabric filter dust collector can be controlled and maintained to operate at its optimum level. By being able to identify the row in which the suspect fabric filter is fitted, down time and costs for replacing non faulty fabric filters is reduced such that large savings are possible. In addition, prediction of faulty fabric filters can mean few or no excursions over the emission levels set by legislation.