Effective particle control

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Today, the cement industry has better media and better testing methods to certify efficiency results. In Europe, the ETU test protocol and in the USA the ETV protocols have proven their value in helping customers to be confident in reaching collection efficiencies touted by the media manufacturer. These testing methodologies provide results in both imperial and metric standards. The following are the test results for a 275ºF pleatable polyester with a high-efficiency ePTFE membrane often used in finish mills (Air Pollution Control Technology Center, 2007).

Pristyne® filter media from Midwesco® Filter Resources (ETV Certified Media)

Having the information for two medias, allows you to compare PM 2.5 and total mass efficiency using line 1 (see Table 1). Line 2, average residual pressure drop, can be an indicator of energy usage. The higher the delta P, the lower the flow/throughput and the higher the energy requirement. Line 6, mass gain of test sample, tells you what you might expect for material retention. Line 7, number of cleaning cycles, will tell which media requires the least cleaning air to maintain the delta P listed on line 2. This information can also be turned into energy cost for compressed air.

Currently there are six media ETV certified and this information can be found on the EPA's website, www.epa.gov/etv/vt-apc.html#bfp. The line items discussed are on *page 4* of the statement PDF file for each of the media. The details of the testing protocol are also listed on the website. As more media are tested under either of these protocols, ETV or ETU, the easier our jobs will be to ensure we are using a media that will meet the PM 2.5 standard.

Having the right media is a major step. The rest of compliance is collector operation, maintenance and instrumentation. The following are key components in ensuring that you maximise the effectiveness of your filter elements.

- Set up the pulse system at 90 to 100 psi with a pulse duration/on time of 150 milliseconds and vary the pulse frequency to maintain a delta P at 4-6in. (This applies to almost all pulse jet collectors with pleated bags and felted filter bags. The exception is fibreglass media and a few other media, which are exceptions by the manufacturing specifications.) While some would argue that 60psi is adequate and talk about compressed air savings, we find that we can generate more compressed air savings and gain element life by a complete cleaning of the elements' permeability using 90 to 100psi and reducing the cleaning frequency.
- The pulse cleaning sequence needs to be staggered so that we are not cleaning/contaminating the row next to the row we just completed cleaning.
- The reservoir should be large enough to supply the full demand of the valve. It is seldom possible to fire multiple valves off of the same reservoir at the same time without reducing the effectiveness of valves firing.
- The presence of a psi gauge on the reservoir enables you to immediately

Table 1: parameters for comparison of two filter medias

Verification parameter	*At verification test conditions*
1. Outlet particle concentration at standard conditionsa	
PM 2.5, g/dscm	0.0000078
(gr/dscf)	(0.0000034)
Total mass, g/dscm	0.0000078
(gr/dscf)	(0.0000034)
2. Average residual pressure drop, cm wg (in wg)	3.97 (1.56)
3. Initial residual pressure drop, cm wg (in wg)	3.90 (1.54)
4. Residual pressure drop increase, cm wg (in wg)	0.13 (0.05)
5. Filtration cycle time, s	134
6. Mass gain of test sample filter, g (gr)	0.13 (2.0)
7. Number of cleaning cycles	162

NA = Not applicable – values shown are for three tests.
a. Standard conditions: 101, 3kPa (14.7 psia) and 20 °C (68 °F). One or more of the impactor substrate weight changes for these results were near the reproducibility of the balance.
b. Total mass includes the mass of PM 2.5 and larger particles that passed through the fabric

evaluate whether the cleaning system is receiving adequate air.

• The supply line to the reservoir should be the same size as the blowpipe diameter and should be unrestricted, ie, if we have an 1-1/2in supply line and then bell down for a 0.75in regulator, we will reduce volumetric flow from the regulator to the pulse valve, which may result in not meeting the pulse valve's air demand.

• The cleaning air needs to be clean and dry. While air dryers are nice, a good in-line trap/separator is also effective when properly maintained.

• There should be no hopper accumulation. Material collected in the hopper is picked up by the inlet air and recycled to the filtration zone, causing the filter to process the same dust multiple times. The hopper discharge system needs to be operated at a speed which keeps the hopper empty. Any changes in the components or operational procedure of the baghouse can change hopper acceleration and should be addressed at the same time as the other changes. While this sounds like a lot of work, this initial setup will save maintenance time and collector down-time.

Maintaining the collector is a matter of watching/recording data trends and then initiating correcting action expeditiously. To accomplish this, the following tools, instrumentation and inspection protocols are helpful in identifying possible problems:

• Total flow ACFM at the collector outlet needs to be monitored.

• During an outage the collector needs to be inspected to ensure baffles, target plates, turning vanes, etc, are all in good repair. This will ensure that the inlet air distribution is equally distributed throughout the collector.

• During the inspection, look for leaks and shiny spots. Leaks are sometimes easier to find at night by illuminating the inside of the collector and then look for light holes from the outside of the collector. Shiny spots are an indication of abrasion. When you find abrasion it is usually caused by something out of place or missing from the inlet diffuser and should be repaired during the outage.

• Mapping any failure by date, location and type of failure is an invaluable tool in helping you find failure causes. Often you will discover misaligned blowpipes, malfunctioning valves or solenoids and/or misdirected air that are adversely affecting the elements.


Membrane fabric texture is closely knitted

• Magnahelics on all modules are key in helping you identify problems before they shut the process down if they are functioning. One of the biggest problems we see is that the magnahelic, photohelic or pulse-on demand system pressure device are plugged, which can cause premature element failure from under pulsing or over pulsing. There are tube line cleaners that can be installed to automatically clean the line so you always have accurate delta Ps. If there isn't an automated tube cleaning system, then preventative maintenance procedures should have a protocol which ensures the accuracy of the delta P readings.

• Collectors that clean modules off-line are only effective when the module is totally isolated, zero flow, zero reading on the delta P instrument. The sole way that this can happen is for the poppet valve/damper to be completely closed (without leaks). The cleaning pressure and settings for off-line cleaning should be the same as the on-line requirements previously stated. Additionally, the modules need to be off-line long enough that the evacuation system can completely empty the hopper.

• A temperature probe needs to be located in the inlet duct at a point where it measures the hottest air being delivered to the baghouse.

• Consider the purchase of a control board or smart controller with an automatic off-line, pulse-down feature for those times when the collector's delta P is above your desired level so the cleaning system can be activated while the fan is off.

• The best instrumentation system is one that has all of the readings in a centralised control room where operators can monitor/record current operating conditions as part of their daily routine. Having said that, there needs to be someone walking by the collector daily or weekly and listening/looking at their operation. Bad valves or solenoids make a noticeably different sound than good valves and solenoids.

We have touched on a multitude of different facets of operating a dust collector effectively and capturing particulate matter 2.5microns and larger. This barely scratches the surface of all the details that will keep company's in compliance. Using the above criteria is a starting point that will provide effective collection, reduced emissions and lower maintenance costs.

Reference:

Air Pollution Control Technology Center. (2007, December 17). Retrieved January 15, 2008, from Environmental Technology Verification Program: http://www.epa.gov/etv/vt-apc.html#bfp