ASKING THE RIGHT QUESTIONS ABOUT CARTRIDGE DUST COLLECTION

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Over the past decade, cartridge-style dust collectors have overtaken baghouses as the preferred technology for dust collection in the chemical processing industry. Combining high efficiency filtration with compact size and reduced pressure drop, a high efficiency cartridge dust collector will in most cases be the system of choice.

Choosing the best cartridge collection system for a given application, however, involves research and attention to detail. This article will review four key areas of investigation. By reviewing these topics with a knowledgeable equipment supplier and knowing the right questions to ask, chemical manufacturing professionals will be better equipped to make informed dust collection decisions.

1. Will the dust collector ensure compliance?

Production, maintenance and engineering departments today must deal with an increasingly complex alphabet soup of regulations as the EPA, OSHA and other organizations continue to tighten air quality and safety requirements. Meeting these requirements should be first and foremost in any dust collection game plan. Failure to comply may result in fines, production shutdowns or costly litigation.

Dust collector installation on a plastic powder mixing application.

OSHA has established permissible exposure limits (PEL) for hundreds of dusts ranging from nonspecific or “nuisance” dust to more toxic dusts that may be generated during the manufacturing of pesticides, insecticides and some agricultural dry chemicals. The limits are based on 8-hour time weighted average (TWA) exposure. Further information on PELs can be found at http://www.osha.gov/SLTC/pel/. When handling toxic dusts, a dust collector will need to be equipped with high efficiency filtration media to meet requirements.

How do you know if your dust collector will comply with emission thresholds? The equipment supplier should provide a written guarantee stating the maximum emissions rate for the equipment over an 8-hour TWA. Filter efficiency stated as a percentage is not an acceptable substitute, even if the supplier promises 99.9 percent efficiency. OSHA only cares that the quantified amount of dust in the air is below established limits.

While OSHA guidelines must be met, it is also good practice to follow the guidelines published by the American Conference of Governmental Industrial Hygienists (ACGIH). The guidelines in this manual are sometimes a little tighter than those OSHA has adopted.

You should also become familiar with the National Fire Protection Association's "NFPA 68 Standard on Explosion Protection by Deflagration Venting", which provides stringent and mandatory requirements for dust collection applications involving explosive dusts. The change from a guideline to a standard is enforced by OSHA, which in 2008 reissued a National Emphasis Program focusing on the safe handling of combustible dusts. More recently, in an Advance Notice of Proposed Rulemaking (ANPR) published in the October 21, 2009, Federal Register, OSHA announced its intent to develop a comprehensive federal safety standard on combustible dust – further evidence that compliance in this area will continue to be a top priority.

The explosive power of a dust is denoted as "Kst", the rate of pressure rise. Figure 1 compares the Kst values of a number of common chemical dusts. For a much more comprehensive compendium, go to http://www.dguv.de/ifa/en/gestis/expl/index.jsp. This web site contains a European database known as "GESTIS-DUST-EX" that lists the combustion and explosion characteristics of more than 4,000 dusts. The database provides a useful reference point, although it is not a substitute for the required dust testing. To determine whether your particular dust is combustible, it must undergo explosibility testing in accordance with ASTM test methods. Under the new directives, any dust with a Kst value >0 is considered to be potentially explosive. This is significant because, to ensure compliance, many chemical plants now have to install updated dust collection/explosion venting equipment that is manufactured in accordance with the latest NFPA standards.

Kst Values of Various Dusts

Dust	Micron	Kst Value
Acryinitrate Butadiene Styrene Copolymer	200	147
Epoxy Resin	55	147
Polyester Resin with glass	14	182
Melamin Resin	18	110
Phenol Resin	10	129
Polyamid Resin	15	105
Plymethacrylate	33	199
Polystyrene (Copolymer)	155	110
Polyurethane	3	156
Polyvinylalcohol	26	128
Polyvinylchloride	125	68
Dimethylaminophenazone	10	337
2-Ethoxybenzamide	100	214
Paracetamole	100	156
Anthrachinon	10	364
Azodicarbonamia	10	176
Diphenol Ketylene	15	270
Dicyandiamide	10	9
Pentaerythrite	10	120

Figure 1. Kst values of common chemical dusts

2. Will it fix the problem?

Though compliance is a major issue, it is not the only issue. What else is the dust collector expected to do? Perhaps it must reclaim valuable product, maintain a higher level of cleanliness in manufacturing areas, accommodate changes or expansions in the plant, or solve a performance problem experienced with an older dust collection system.

This dust collector explosion vent is manufactured in accordance with the latest NFPA standards to protect against combustible dust hazards.

A good way to pinpoint objectives is by using a site survey form available from most equipment suppliers. This form typically calls for information on the process and the material to be collected, operating hours and conditions, electrical requirements, airflow and pressure ratings, and other specifics of the application. The survey will also call for detailed information on the physical properties of the dust.

Even if the dust is a common type, something in the process may cause it to behave differently. Therefore, dust should always be tested, preferably using a sample collected from used filters. What are the median size and particle distribution of the dust? Is it in the shape of long fibers, uniform spheres or jagged crystals? Is it combustible? Is it sticky or hygroscopic? These are just some of the characteristics that can be determined through a series of bench tests available from independent laboratories and many equipment suppliers.

A site survey coupled with lab testing is the best approach for determining the dust collector's required filtration efficiency and pressure drop across the filter media and, from this, what type of collector design and media will be most effective for the application.

3. Will it perform reliably?

Dust collection equipment can often be a maintenance headache, but this need not be the case. Reliability problems typically stem from neglecting or misunderstanding details about the unit's performance during the initial selection process or when changes are made in the plant. By following the steps above, you can help to ensure more reliable performance from your dust collector.

Although the site survey and lab analysis typically provide enough data, in some cases you may opt to commission full-scale dust collection testing. Full-scale testing typically requires a large (55-gallon) dust sample that is run through a full-size dust collector on a test rig in a simulation of real-life operating conditions. Dust particle size, pressure drop and other parameters can be precisely monitored and real-time emissions monitoring can be performed. Full-scale testing is usually limited to analysis of difficult or hard-to-handle dusts, or applications where emissions control requirements are particularly stringent.

When selecting equipment, it also helps to be aware of design and technological improvements that can enhance reliability and performance. Examples include:

Horizontal vs. vertical cartridge mounting: Some pleated filter cartridges are mounted on their sides. The biggest problem with horizontal mounting is that the dust does not get cleaned off the top of the filter, causing the dust to blind at least one third of the filter.

Also, because the incoming dust is dumped on top of the filters, there is no pre-separation of heavy or abrasive particles from the air stream. This situation can shorten filter life or, in spark-generating applications, pose a fire hazard because any spark entering the collector will come into direct contact with filter cartridges.

An antidote to this problem is a system using vertically mounted cartridges. The best designs incorporate a high, side entry inlet with a series of staggered baffles that distribute the air and also separate out larger particles, dropping them straight into the hopper. This reduces the load on the filters and helps eliminate problems encountered with horizontal mounting.

Advances in pleat spacing: Most dust collection cartridges use tightly packed media configurations. Though they offer high efficiency, much of the media surface area is unavailable for filtering, allowing dust to remain trapped within the filter even after pulse cleaning.

A recently introduced pleating technology makes use of hot melt separators that open up the full length of the pleat, allowing the entire depth of the pleat to be utilized. This design thereby allows significantly higher air flows per sq. foot of media than what has been achieved in the past.

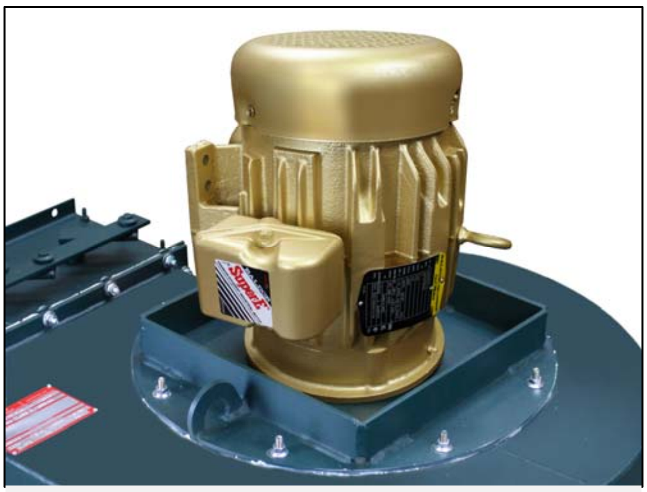
The open-pleated design of this filter results in significantly lower pressure drop as well as improved dust release characteristics during pulse cleaning.

Because virtually all the media surface is exposed to the air stream, the filter holds more dust between cleaning pulses. The open, breathable design also results in significantly lower pressure drop as well as improved dust release characteristics during pulse cleaning, using fewer pulses, and therefore less energy.

4. Will it provide the best possible return on investment (ROI)?

Where feasible, the best way to maximize ROI is to recirculate air downstream of a dust collector. By recirculating heated or cooled air back through the plant, the cost to replace that conditioned air is eliminated. Many plants report five- to six-figure annual energy savings. Also, dust collectors in shops with high ceilings can often improve the efficiency of a heating system by taking hot air off the ceiling and delivering it at ground level.

Another advantage of recirculating systems is the reduction in regulatory paperwork. By containing the air indoors, the engineer can deal with OSHA and avoid the time-consuming EPA permitting involved when contaminated air is exhausted outside. Recirculating systems have special safety and performance concerns that must be addressed, but the payback can still be substantial.



Special features such as this premium efficiency fan motor can reduce energy costs and save on total cost of dust collector ownership.

Finally, it is not initial cost but total cost of ownership that counts. What will it cost to operate and maintain the unit and replace the filters? How much compressed air will the collector use? Does the system incorporate "green" features such as premium efficiency fan motors that can reduce energy costs and sometimes be eligible for utility rebates or incentives? Can it save on maintenance of electrical components such as motors and control panels that are exposed to the dust? A reputable equipment supplier can project these costs mathematically and help analyze the best ways to improve ROI and get the most out of dust collector performance.

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