Five Questions to Ask When Considering a Cyclone Dust Collector

Designing a dust collection system can be quite a daunting task. With so many collector options and so many application variables to consider, it is difficult to know where to begin. Cyclones are among the oldest and still most reliable methods of dust collection available. Because they require little maintenance, have low up-front cost, and offer versatility, cyclone collectors remain a viable solution to many air-handling challenges. Although heightened environmental regulations and collection efficiency needs have shifted industry toward the use of filter-media collectors, cyclonic dust collection still plays a vital role in many air-handling systems. These five questions will help determine if a cyclone dust collector is right for your application.

1. How big is my dust?

Cyclonic dust collection relies on inertial forces to separate dust particles from an air stream. The larger and denser the particulate is, the greater its inertia. This is the reason cyclones have such high collection efficiencies when handling relatively large dust particles. The forces generated in typical cyclonic dust collectors are not high enough to achieve effective separation of extremely fine particulate. However, some alternative design cyclones use a powerful secondary air stream to create a “counter-cyclonic” action in the collector and raise efficiencies of fine particulate collection. Another benefit of the secondary air stream is the ability to use it as a cooler or dryer by drawing the secondary air stream from an appropriate source.

2. How much dust is too much?

Grain loading or dust loading refers to the amount of dust particulate that is suspended in a gas stream. This is typically measured in the number of grains per cubic foot of gas. This is an important number to consider when designing a pollution control system. Not only will this factor into the size requirement of a dust collector, but it will also determine the appropriate type of dust collector. The strict air pollution control standards in the U.S. often necessitate a “filter-media” dust collector, such as a bag house, for the final collection stage. Unfortunately, extremely high grain loading conditions can hinder the proper operation of these collectors, often requiring them to be oversized to accommodate the large dust volume.

High grain loading can blind filter media, considerably affecting collection efficiencies. As dust builds up on the filter media, the initial dust cake aids in separation efficiency. However, extremely high dust loads can block airflow through the filter media. Another problem high grain loading creates for filter-type collectors is the fast wear of the filter media due to frequent cleaning.

Installing a cyclone as a pre-filter to a filter bag house or cartridge collector is an effective way to reduce the load put on the filter media. Placed in-line before a bag

house, a cyclonic dust collector can remove a majority of the larger particulates, thereby reducing the amount of dust sent to final stage filters.

3. Can I reuse the dust I am collecting?

Dust generated by handling dry bulk materials can be hazardous but also valuable. Unfortunately, most filter-type dust collection systems are designed for disposal rather than product reclamation. Filter media collectors such as cartridge filters and bag houses often do not allow collected particulates to be recovered for reuse due to contamination or particulate size issues. In many cases, contaminated dust filters in food-grade applications make product recovery cost-prohibitive. Also, filter collectors receiving a variety of materials do not lend themselves to product recovery because the materials mix within the collector. By placing a mechanical collector such as a cyclone in process before a final filter collector, valuable material can be reclaimed without the threat of contamination and a cyclone can be placed on the lines handling the most valuable materials to capture a majority of the particulate.

Unusable fine particulate is another concern involved with reclaiming particulates from a filter-type dust collector. It is often the case that particulate large enough to be reused is mixed with very fine, unusable dust. The nature of mechanical separation allows cyclones sometimes to act as classifiers, collecting the larger particles and sending the fines to a final filter. A particle size distribution test of the material being collected and a reliable efficiency curve for a specified cyclone can help to determine if it can be used as a classifier for a given application.

4. Do I have heat or humidity concerns?

Air handling in manufacturing processes is often a delicate balance with a number of variables to contend with. Process heat and humidity in the air stream create a difficult challenge when it comes to dust collection. Collection of red-hot dust particulate is simply not possible with many bag houses because cotton filters are flammable and flame retardant filters can be costly. High humidity levels that result in condensation or steam also pose a problem for these collectors as successful filter cleaning can be inhibited. In some cases, a cyclonic dust collector can be the solution to these problems. Installed before a bag house on high heat processes, a cyclone can act as a spark arrestor, collecting the larger particulates that can retain enough heat to ignite a filter bag. Humid conditions generally pose less of a problem to cyclones than to filter-type collectors. Although humidity interferes with the filter cleaning process or completely damages filters, it can actually improve collection in cyclones. Humidity can saturate dust particulates, which increases their mass and the inertial force acting on them during cyclonic separation.

5. How much should I spend?

Perhaps the most important and most difficult question asked when designing a dust collection system is how much to spend. The simple answer is, it depends. It depends on what the overall goal of the system should achieve. The best dust collection systems

are those that were designed with several functions in mind: capacity, operation costs, maintenance costs, and product/material value.

The volume of dust-laden air needing to be moved will dictate the size of collector required. Simply put, larger collectors cost more to operate.

A cyclonic dust collector placed before a bag house can allow for the use of a smaller bag house by reducing the amount of dust the bag house receives. Reducing the size of the bag house not only reduces the operational costs but greatly reduces the maintenance costs. Fewer bags, cages, cartridges, and retainers mean fewer dollars spent on replacements.

The value of the product being collected should be considered when it comes to designing a dust collection system. When dealing with highly valuable material, ease of product reclamation is extremely important. The cost savings realized by recovering valuable product should be factored into the cost of a dust collector. If the material being collected is valuable enough to be reused or repurposed, it may warrant the inclusion of a cyclone separator in the system. When handling extremely valuable material, the addition of a cyclonic dust collector can pay for itself in a very short timeframe.