

DYNACOM

Designing Clean Air Solutions

The 5 C's of Dust Collection

A well-engineered dust collection system considers what we refer to as the 5 “C’s” of dust collection. Each is equally important and must be given adequate consideration. They are:

- Capture (type of hoods and capture devices)
- Convey (size and type of duct)
- Collect (dust collection or air filtration technology)
- Clean (maintenance of the system)
- Combustibility (explosiveness and/or flammability of the material)

Capture

The goal of a source capture system is to contain the dust/smoke prior to entering the ambient air. To do so, there are a variety of approaches for most applications. However, in all instances, the same basic principle applies in that a hood placed closer to the source will result in a lower air volume requirement.

- Refer to Industrial Ventilation Manual (IVM) table 6-3 to reference a variety of different hood designs and sizing parameters.
- Refer to the IVM. There are numerous drawings showing common applications and outlining sizing parameters.
- Refer to IVM table 6-2 which shows you recommended “capture velocities” (not to be confused with “conveying velocities”). Capture velocities are based upon what is required to either contain or redirect airborne particulate into an enclosure or hood.

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Convey

Often, the duct system on a dust collector/air filtration system is overlooked. The duct system is the arteries of the system which carry the dust from the source to the collector. If not sized properly, dust/mist/smoke will settle resulting in duct blockage, fire hazards, and in combustible applications, explosion hazards. The duct design (branch entries and elbows) needs to be carefully considered and engineered to minimize resistance to the air stream. How this system is designed will have a direct effect on the horsepower of the fan.

Duct sizing and construction follow specific guidelines as set forth by the Industrial Ventilation Manual for sizing and the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) for the construction.

- Refer to IVM table 5-1 to reference recommended conveying velocities. This table gives you a generic description of dusts as well as examples of a few specific dusts for each category.
- Use the “SYSWRKUP” template saved in Forms (blank)/Engineering to help size the duct and determine the static pressure of the system.

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Collect

There are many dust collection and air filtration technologies available today including baghouses, reverse pulse cartridge style, cyclones, ESP's, media systems, centrifugal mist collectors, and wet collectors to name a few. When selecting a technology, we consider the type of contaminants (and all the characteristics such as particle size), the loading (how much of the contaminant is generated), and the desired/necessary filtration requirements. With each collector there are various options such as silencers, cleaning controls, dust disposal, and many more that must be considered.

- For dust collectors reference the UAS air-to-cloth chart. Air-to-cloth ratio is the relationship of the air volume relative to the amount of filter media in square feet.
- Experience plays a large role in determining which technology is best suited for a given application. This is experience is available to you through our manufacturers and our personnel at Dynacom, Inc.
- Parameters that go into determining which technology is best (questions to ask):
 - Loading: how much is generated in a given time (cubic feet in a day)?
 - Hours of operation: how many shifts are they operating?
 - Characteristics of the dust: What is the dust? Is it abrasive? Is it sticky? Is it granular or fibrous? Etc.
 - The process: What is their process/operation (i.e., dry grinding, welding, plasma cutting, wet grinding, machining, etc. etc. etc.)
 - Temperature of the airstream: Most often, the temperature will be close to ambient temperatures and is not an issue.

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Clean

How the collector is maintained is critical to any system. There is no such thing as a maintenance free air filtration or dust collection system. However, there are ways to automate the cleaning which are considered based upon the requirements of the end user.

- Maintenance of any system is a key factor. If the system is not maintained, it will not function properly.
- Find out if monthly (i.e., for Smog-Hog applications) is a possibility. If compressed air for a cartridge collector is needed, find out if they have it available. And/or discuss the possibility of replacement filters for disposable media systems.

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Combustibility

For a wide variety of reasons, but largely for the sake of safety and the protection of property, it is required that the generator of any dust determine whether or not it is combustible and/or the flammability of such materials. In many instances, this may require that the producer of the dust or contaminants will have to have the material tested to determine the Kst value (how combustible the dust is). Per the OSHA standards as set by the NFPA, anything over a Kst value of zero (0) should have proper explosion venting and all other applicable controls.

It is the sole responsibility of the end user to determine whether or not these controls are necessary.

- When discussing “dust collection systems” ALWAYS ask if the dust is combustible.
- If the dust is combustible this can have a significant impact on the design and cost of the system. Controls and limitations for dust collection systems collecting explosive (different than flammable) dusts can include, but are NOT limited to the following:
 - Explosion venting on the dust collector
 - Explosion suppression systems
 - Isolation gates (on the inlet and possibly on the outlet duct)
 - Fire suppression systems
 - Location of the collector (may need to be located outside and may need to follow certain parameters relative to personnel traffic such as parking lots, exit doors, etc.)
 - Duct design and velocities (i.e. duct systems collecting explosive dusts technically should NOT have slide gates at branches and typically have minimum duct velocities they must maintain.
 - The ability to return the exhaust air back within the building.

As you can see, there are a lot of steps involved in designing a dust collection system. Obviously, you are not expected to be able to design such a system overnight. However, what is important to remember is that there is a “cookbook” with the recipe(s) available to walk you through the design of such a system. This relatively short synopsis is intended to help you break down the system design into segments and simplify the process.

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