Your dust-capture hoods aren’t capturing dust. Ductwork is plugging with settled dust. Exhaust fans are going out of balance and failing. Fan flexible connectors are tearing apart. Balancing dampers are constantly shifting inside the ductwork. Filters elements need replacement weekly. The system is collecting combustible dust without meeting the required safety measures for handling it.

Why is this happening to your dust collection system? Many poorly performing dust collection systems were designed using the guidelines for heating, ventilating, and air conditioning (HVAC) systems, not industrial dust collection systems. This happens more often than you may think. Dust collection systems designed according to HVAC guidelines don’t work, aren’t safe if they’re handling combustible dust, and, typically, can’t be easily fixed. The designers of these poorly performing systems need to become more knowledgeable about the standards set by such publications as Industrial Ventilation: A Manual of Recommended Practice, published by The American Conference of Governmental Industrial Hygienists (ACGIH).1

Let’s compare some of the important components of an exhaust system, showing the design differences between a commercial building’s HVAC ventilation system for comfort conditioning and an industrial ventilation system for dust collection.

Dust transport velocities
Exhaust ducts for HVAC systems are typically sized to provide dust transport velocities of around 1,500 fpm. The reason for this is to reduce noise — low velocities are acceptably quiet. However, in an industrial ventilation dust collection system, low velocities will result in collected dust settling inside the ductwork. The ducts will eventually plug, resulting in even lower velocities. If the settled dust is combustible, it can provide fuel for a fire or dust explosion. In general, a dust collection system needs to transport dust at velocities around 4,000 fpm.

Dust-capture hoods
HVAC system designers typically don’t need to design dust-capture hoods or involve users because supply-air diffusers and exhaust grills are usually on the ceiling and out of the way. But most dust collection systems do need dust-capture hoods at the dust sources. Unfortunately, many dust collection systems designed according to HVAC guidelines end up with no hoods. Instead, open-ended ducts may be positioned near the dust sources. But to reduce the dust concentration in the air by up to 90 percent, an open-ended duct won’t make it.

What happened to the dust-capture hoods? If there were any hoods to begin with, the hood designs were possibly left up to the contractor and didn’t work. Or perhaps the designed hoods were installed in a way that they interfered with production and maintenance or captured valuable product along with the dust and so were removed. A dust collection system designer needs to realize that ignoring the way capture hoods affect the user won’t lead to success in a manufacturing environment. By making sure the dust-capture hoods meet the needs of production and maintenance as well as the system itself, the designer helps ensure that the hoods will stay in use.

Ductwork
HVAC ductwork doesn’t normally see the tough operating conditions that industrial dust collection systems do. The higher operating static pressures that dust collection systems demand require heavier-gauge sheet metal ducts and tighter seams to minimize air leakage. Spiral-wound lock-seam duct (machine-fabricated with an interlocking helical seam that runs the full length of the duct) is often used in both HVAC and dust collection systems. If manufactured within tolerance, this duct can perform well with dust collection system demands. While manufacturers claim the spiral duct’s air leakage is 1 percent of full airflow when properly installed and sealed at the duct connections, the spiral duct isn’t normally tested for air leakage at the factory. If the spiral duct machine is out of adjustment when the duct is fabricated, the seams may look good but air leakage can be up to 20 percent. Welded-seam ductwork can be a less leak-prone alternative for the higher pressures of an effective dust collection system.

Airflow balancing dampers
The round butterfly dampers found in HVAC ductwork are built to operate in maximum air velocities of 2,000 fpm. Balancing dampers installed in dust collection system ductwork will usually see velocities around 4,000 fpm. Butterfly dampers won’t last long and will fall apart at dust collection system velocities, upsetting the system air balance. The correct industrial dampers may be a bit more expensive, but they’ll last.

Access doors
Access doors for HVAC ductwork typically see less than 10 inches water gauge vacuum pressure. Industrial dust collection system vacuum pressures can sometimes reach up to 20
Dust collection system unwisely designed using HVAC commercial ventilation standards

The HEPA filters noted on this design drawing were specified and installed as the sole filtration system for this dust collection system. The HEPA filters collapsed after 4 weeks of operation because of the quantity of collected dust. With the fan installed on the HEPA filters’ dirty-air side, the exhaust fan went out of balance because of dust abrasion. This fan should have been protected by an industrial dust collector.

To reduce the load on the HEPA filters in this system, the company installed commercial HVAC prefilters at the fan inlet. This, too, was unsuccessful because the prefilters didn’t last long. The turbulent air coming out of the 30-inch-diameter elbows at the prefilter housing inlet ripped the prefilters apart. The frequent replacement of the HEPA and prefilters has cost this plant major downtime and lost production.

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inches water gauge and higher, requiring stronger, leak-tight construction. If the access door manufacturer can’t tell you at what vacuum pressure the door will begin to leak, you need to find another supplier. Don’t accept a statement like “We never had a problem with leakage.”

Filtration

HEPA filters and their associated lower-efficiency prefilters are standard fare for HVAC systems. You’ll frequently find HEPA filters together with these prefilters on dust collection systems, too. But because of their high dust loadings (typically around 1 grain per standard cubic foot), most duct collection systems require an automatic self-cleaning dust collector instead of low-efficiency HVAC prefilters to protect the downstream HEPA filters. An industrial-rated dust collector will filter up to 99.9 percent of dust down to 0.5 microns and operate many months without plugging. With this level of “prefiltering,” the HEPA filter can last more than a year before needing replacement.

How do you know that the engineering firm you contract will successfully engineer and design your dust collection system for your process? Ask the firm for a list of its previous projects with references you can contact. Ask to see samples of design drawings for the system that show hood details, ductwork, and filtration systems. Ask to speak to the engineer assigned to your project. If the engineering firm can’t produce what you ask for, you may well need to go to a firm that has more experience.

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Reference

1. Available from The American Conference of Governmental Industrial Hygienists (ACGIH), 1330 Kemper Meadow Drive, Cincinnati, OH 45240; 513-742-2020, fax 513-742-3355 (mail@acgih.org, www.acgih.org).

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