Dust capture hoods, ductwork, and the dust collector rightfully get much of the attention during a dust collection system’s engineering and design phase, while the system’s exhaust fan is often taken for granted. Engineering calculations include data such as exhaust system total airflow, system static pressures at the fan inlet and outlet, and operating temperature and elevation, which the exhaust fan supplier uses to select the proper fan for your system. This column will address some additional, often overlooked factors that you should consider and discuss with your exhaust fan supplier to ensure that you receive the best fan for your dust collection system.

Dust collection fans

Dust collection systems typically use either axial or centrifugal exhaust fans. An axial fan moves air parallel to the fan’s axis, while a centrifugal fan moves air perpendicular to the fan’s axis. An axial fan is limited in its ability to generate sufficient static pressure for a dust collection system but is sometimes used as a booster fan on the clean-air side of an existing dust collection system if the system’s primary centrifugal exhaust fan can’t generate sufficient static pressure. Centrifugal fans can have various fan blade types with differing levels of efficiency and abilities to handle light dust loads. Your fan supplier can advise you on which fan type is best for your application.

Exhaust fan volume

A dust collection system’s total exhaust fan volume is typically based on the sum of the dust capture volumes at all the dust capture hoods, measured in cubic feet per minute (cfm). This calculated volume must be increased, however, by the expected ductwork leakage and the possible need for system reserve capacity.

All types of industrial ductwork will leak some amount of air. At one extreme, inexpensive ductwork available at the local home improvement center can leak about 40 percent of its airflow capacity unless the seams and joints are fully sealed with tape and sealant after installation. Industrial sheet metal shops can provide fully welded ductwork installed with gasketed angle iron bolted flanges, but measurements of such installations can still show leakage of about 20 percent of the total exhaust airflow volume. Even clamp-on ductwork has been found to leak at duct connections when improperly installed. Leaks through the continuous seam on spiral ductwork can exceed the claimed 1 percent of total air volume when the equipment used to manufacture the duct is out of adjustment. To minimize ductwork leakage, specify that the installing contractor test all ductwork for leaks during construction and seal any leaks identified. Alternatively, you can compensate for expected ductwork leakage by increasing the exhaust fan’s specified capacity.

Exhaust fan reserve capacity

Ensure that the fan you select won’t pulsate when operating in the range you choose. Be sure to let the fan supplier know about your plans for reserve capacity. Also, be sure that the fan will maintain the necessary dust conveying velocities in the ductwork for both the current operating conditions and after future system expansion.

Exhaust fan accessories

The following is a list of centrifugal exhaust fan accessories that you should consider:

1. A shaft seal to limit air leakage and noise.
2. A housing access door to allow inspection and cleaning of the fan housing interior.
3. A drain connection on the fan housing to ease washing the housing interior.
4. A fan damper for air volume control. Fan dampers come in three types:
   a. A fan outlet damper moves the fan operating point up the fan curve by adding additional system resistance. This is the least expensive damper type but isn’t energy efficient.
   b. Variable inlet vanes at the fan inlet efficiently throttle the fan and control the fan’s capacity. Only use variable inlet vanes on clean-air applications, however.
   c. Inlet box dampers made by the fan manufacturer are similar to variable inlet vanes in their effectiveness but provide less horsepower savings. High-temperature applications...
typically use inlet box dampers because the damper bearings can be removed from the hot airstream.

5. A **variable-frequency drive (VFD)** to control fan capacity while maintaining the same fan efficiency throughout the complete range of fan curves. While dampers require lower upfront capital costs than a VFD, installing a VFD may be less expensive over the long-term because of reduced energy costs.


7. Spark-resistant construction to prevent explosions in applications where combustible dust or ignitable vapors may pass through the fan.

8. Special metals and coatings for applications handling corrosive gases or operating at elevated temperatures.

9. A fan inlet box for applications where the inlet duct to the fan can’t be perpendicular to the fan outlet. Air entering the fan at an angle other than 90 degrees to the fan outlet can cause unpredictable fan performance. Having the fan manufacturer design and install a fan inlet box will minimize this problem.

**Exhaust fan ratings**

The Air Movement and Control Association (AMCA), an international nonprofit organization of fan manufacturers, has created a standard — AMCA Standard 210-16, “Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.” The purpose of the standard is to provide end users with accurate and reliable performance ratings to compare when purchasing a fan. These ratings include airflow, pressure, power, and efficiency. The standard also assures fan manufacturers that competitive ratings are based on standard test methods and procedures and are subject to review by AMCA International as an impartial authority. (Learn more at www.amca.org.)

When ordering a fan, specify that it must have an AMCA label affixed to the fan housing, certifying its performance. If no label is available because the fan hasn’t been tested, require that the fan is tested and certified before shipment. This testing and AMCA certification may add an extra cost, but your dust collection system’s performance is critical to your manufacturing process, and certification will ensure that the exhaust fan will meet your system’s needs.

---

**John A. Constance, PE** (jac@engcollab.com), a consulting engineer at The Engineers Collaborative, has more than 30 years of experience designing, engineering, and troubleshooting dust control and industrial air systems for bulk solids processing and handling industries.

The Engineers Collaborative
Canandaigua, NY
215-300-9563
www.engcollab.com