



***Combustible Dust Hazards
in Dust Collection***

Combustible Dust: What You Need to Know

Combustible dust explosions can cause employee injuries, deaths and destruction of entire buildings. Metalworking plants are at high risk for such explosions. They contain high-energy ignition sources such as welding torches, metal dust and fines, confined spaces, and dust containment systems — a recipe for potential disaster if the correct risk mitigation steps are not taken.

What Is Combustible Dust?

The National Fire Protection Agency (NFPA) defines combustible dust as “any finely divided solid material that is 420 microns or smaller in diameter and presents a fire or explosion hazard when dispersed and ignited in air.”

Any combustible material can burn rapidly when in a finely divided form. If such a dust is suspended in air in the right concentration, under certain conditions, it can become explosible. Left uncontrolled, dusts may migrate from the point of production/release, increasing the portion of the facility subjected to combustible dust fire and explosion hazards.

Even materials that do not burn in larger pieces, given the proper conditions, can be explosible in dust form. Typical metalworking materials that can form combustible dusts include titanium, aluminum, magnesium and iron. The amount of dust required to produce a dangerous dust cloud can be surprisingly small — a dust layer as little as 1/32 inch thick can be of concern in some situations.



How Combustible Dust Explosions Happen

Combustible dust explosions are relatively rare, but when they happen, they can be catastrophic.

According to the Occupational Safety & Health Administration (OSHA), five elements are needed for a combustible dust explosion:

- Combustible dust (fuel)
- Ignition source (heat)
- Oxygen in the air (oxidizer)
- Dispersion of dust particles in sufficient quantity and concentration
- Confinement of the dust cloud



Source: OSHA

If the quantity of dust in suspension in the air that is moving through a dust collection system is above what is called the minimum explosive concentration (MEC), then the suspension can potentially explode in the presence of an ignition source (e.g., a welding gun).

Unlike most gas or vapor explosions, the major damage of a dust explosion often results from the secondary event, which happens when a primary explosion within a piece of equipment or local to an ignition source spreads to remote areas due to involvement of dust accumulations outside of the equipment. The initial explosion can dislodge more accumulated dust into the air or damage a dust containment system, again releasing more dust.

What Combustible Dust Regulations You Should Follow

Excellent information about combustible dust is available from OSHA, which offers a Safety and Health Information Bulletin titled, “**Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions.**” The Bulletin is not a standard or regulation, and it creates no legal obligations. Instead, it is intended to assist employers in providing a safe and healthful workplace. Highlights include:

- Hazards associated with combustible dusts
- Work practices and guidelines that reduce the potential for a combustible dust explosion, or that reduce the danger to employees if such an explosion occurs
- Training to protect employees from these hazards

The National Fire Protection Association (NFPA) issues a standard, NFPA 654, the *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particle Solids*. This standard discusses how to design a safe dust collection system and directs you to other resources and standards for explosion venting and/or explosion prevention.

Other NFPA standards include:

NFPA 68	<i>Standard on Explosion Protection by Deflagration Venting</i>
NFPA 69	<i>Standard on Explosion Prevention Systems</i>
NFPA 91	<i>Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids</i>
NFPA 484	<i>Standard for Combustible Metals</i>
NFPA 33	<i>Standard for Spray Applications Using Flammable or Combustible Materials</i>

NFPA also offers companion guidance in the “*NFPA Guide to Combustible Dusts*.” In it, the NFPA provides information on the fire and explosion hazards of combustible dusts and the protective and preventive strategies presented in the various NFPA standards.

IMPORTANT REGULATION REGARDING ALUMINUM DUST:

As stated in regulation NFPA 484, special consideration must be taken in operations involving the creation or transfer of combustible aluminum dusts or powders.

12.7.2.1 Any equipment used for the machining, fabrication, or finishing of aluminum shall be dedicated only and marked with a placard that reads as follows:

WARNING: Aluminum Metal Only — Fire or Explosion Can Result with Other Metals.

12.7.2.2 Equipment producing aluminum in a combustible form shall be permitted to be used for other materials only when the system is thoroughly cleaned of all incompatible materials prior and after its use.

Safety Regulations Quick Links:

-  [Combustible Dust in Industry: Preventing and Mitigating the Effects of Fire and Explosions](#)
-  [NFPA 652 : Standard on Fundamentals of Combustible Dust](#)
-  [NFPA 654 : Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particle Solids](#)
-  [NFPA 68: Standard on Explosion Protection by Deflagration Venting](#)
-  [NFPA 69: Standard on Explosion Prevention Systems](#)
-  [NFPA 91: Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids](#)
-  [NFPA 484: Standard for Combustible Metals](#)
-  [NFPA 33: Standard for Spray Applications Using Flammable or Combustible Materials](#)
-  [US Chemical Safety Board: Keyword Search: Explosions](#)

This brochure is an information guide intended to assist you in evaluating the possibility of dust combustion issues in your facilities. It is not legal advice, and should not be substituted for consultation with an attorney.

Combustible Dust: What It Means for Your Business

Metalworking shops have an obligation to confirm, via sample testing, the explosive index (K_{st}) and the maximum pressure rise (P_{max}) values of their dust via ASTM E1226-10, *Standard Test Method for Explosibility of Dust Clouds*. Identifying all of the ignition sources in your processes is an essential requirement here.

If OSHA determines that even a very low K_{st} dust is present in a facility with no explosion protection in place, a citation may result. These values also are crucial for your dust collection equipment supplier to correctly size explosion venting or suppression systems. Incorrect values, such as those obtained via tabular data, could result in ineffective protection.



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Table 2: MEC, P_{max} and K_{st} for Metal Dusts

Material	Mass Median Diameter (um)	Minimum Flammable Concentration (g/m ³)	P_{max} (bar)	K_{st} (bar-m/sec)	Dust Hazard Class
Aluminum	29	30	12.4	415	3
Bronze	18	750	4.1	31	1
Iron carbonyl	<10	125	6.1	111	1
Magnesium	28	30	17.5	508	3
Phenolic resin	55	—	7.9	269	2
Zinc	10	250	6.7	125	1
Zinc	<10	125	7.3	176	1

Source: NFPA 68, 2007 ed., Table F.1(d).

In addition to determining whether your dust is explosive, plant professionals might:

- Commission a hazard analysis of their dust collection system.
- Maintain extensive documentation.
- Schedule an annual inspection of the dust collection system's explosion venting equipment.

These safety measures are critical for the well-being of your businesses staff and facility!

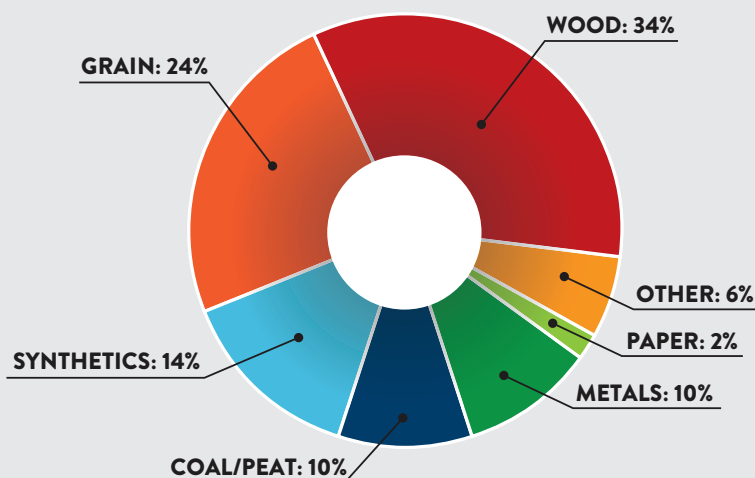
RoboVent: Safety First!

With any combustible dust solution, RoboVent's engineering team takes into careful consideration all aspects needed for NFPA combustible dust compliance. From isolation valves to explosion relief panels; spark arrestance to fire prevention systems—we engineer it with your safety in mind.

Combustible Dust Engineering Process:

1. Most dusts generated by industrial processes, under certain conditions, may be combustible.
2. Determine if your dust is explosive. Undergoing explosibility testing in accordance with ASTM test methods will determine if the dust is explosive.

Types of Dusts Involved in Explosions



Source: OSHA Combustible Dust Training Program

3. PHA (Process Hazard Analysis), sometimes known as risk assessment, is recommended for all combustible processes.
4. RoboVent requires a PHA for any dust with a K_{st} value of greater than 200 bar-m/sec.
5. RoboVent's engineering team incorporates explosion relief panels and other devices into our dust control systems to help you comply with the latest NFPA standards.

RoboVent is your partner to solve your dust problem and will help you take the necessary precautions to mitigate the risk associated with combustible dust explosions. However, a Process Hazard Analysis is imperative to determining all the aspects of an explosion risk in your manufacturing process, and the measures that should be taken in order to avert potential explosions.



How RoboVent Can Help

You can count on RoboVent to help you integrate dust control and NFPA combustible dust compliance into your ventilation system. To provide support, RoboVent must have current, complete and accurate information on all potentially combustible contaminants and the fire and/or explosion mitigation strategies you intend to pursue. Using that information, RoboVent will work with you to suggest and design a ventilation system that captures and contains fugitive dust with appropriate explosion protection features.

Remember:

The plant owner, and not RoboVent or any supplier of dust collection/management or ventilation systems, is responsible for the selection of a combustible dust management strategy and must assure compliance with all applicable federal, state and local codes and standards.

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