INTRODUCTION TO COMBUSTIBLE DUST

For decades Donaldson Torit has been providing quality dust collectors that have become an integral part of many plant’s combustible dust management strategies. As standards are updated or new requirements enacted, Donaldson continues to supply dust collectors to support your combustible dust control strategy. By interfacing with you and your experts on fire and explosion protection equipment and strategies, we can offer a selection of products to fit your application.

UNDERSTANDING THE BASICS

The U.S. Occupational Safety and Health Administration (OSHA) issued a National Emphasis Program and continues to communicate with most industries on the hazards of combustible dust. The agency’s focused effort is targeted at reducing combustible dust risks in industrial plant settings.

Many manufacturing processes create very small particles of dust which may become airborne, where they settle on surfaces and in crevices throughout the plant. Eventually these particles not only create a housekeeping issue, but they can also create a potentially explosive dust cloud when disturbed.

It is essential for plant leaders to understand the risks of combustible dust and ensure they manage combustible dusts in their facilities. Combustible dusts generally present both fire and explosion risks. It may help to consider the management of these risks separately.

This document is intended to increase your understanding of typical combustible dust management strategies and some of the components involved.

FIRE TRIANGLE

Fire mitigation strategies traditionally focus on the control or elimination of one of the three key elements necessary for a fire — often represented by the “fire triangle.” Controlling one or more of the elements in the triangle can decrease the fire risk.

EXPLOSION PENTAGON

Explosion risk mitigation strategies consider a slightly expanded set of control elements often represented as an “explosion pentagon.” In addition to the key elements from the fire triangle — fuel, heat, and oxygen, the explosion pentagon includes two additional elements: “Dispersion of Dust” and “Confinement of Dust.” As with fire mitigation strategies, the control or removal of one or more of the elements in the explosion pentagon can reduce the explosion risk. Controlling the same elements in the fire triangle, will also mitigate the explosion risk. Any mitigation strategies that focus on the dispersion of dust, or the containment of dust alone, may require a separate strategy to address any remaining fire risks.
To be compliant with OSHA regulations, you must meet other requirements and all applicable standards or codes. Visit [www.osha.gov](http://www.osha.gov) to find OSHA regulations.
WHERE TO START?

The first step is to review any dust(s) generated at the facility and determine if a risk is present. A qualified lab can work with you to determine dust characteristics. Next perform a dust and process hazard analysis.

A Donaldson representative can then review your operational challenges to help you better understand how to integrate dust collection into your combustible dust management strategy. These considerations are designed to help you decide how you want Donaldson to support your combustible dust management strategy. To see a detailed Combustible Dust Roadmap and to learn more, visit: donaldsonitorit.com/combustibledust

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**Dust Hazard Analysis [DHA]:**
Completed and Maintained by the Process Owner

- **Dust Combustible? Data and/or Tests**
  - Yes or Unknown
  - Dust is Not Combustible
  - Combustible Screening
    - Determines if dust can burn in a pile (Dust is Combustible)
  - Go/No-Go Screening
    - Determines if dust is explosible in a cloud
  - Explosibility Testing
    - Since the dust is explosible: Consider the following tests:
      - Explosibility Severity (Kg)
        - Used for explosion prevention
      - Minimum Explosible Concentration (MEC)
        - Used for explosion avoidance
      - Minimum Ignition Energy (MIE)
        - Used for ignition avoidance
      - Minimum Autoignition Temperature (MIT)
        - Resistance of hot surfaces or fire reverberations
  - Ensuring samples used for testing are representative. Samples may require special handling to ensure they stay representative (e.g. avoid oxidation during transmission and storage).
  - If Dust is confirmed as Not Combustible, additional testing and mitigation may not be required.

**Dust and Process Hazard Analysis [DHA & PHA]:**
Completed and Maintained by the Process Owner

- Yes – Fire Mitigation May Be Needed
  - No – Fire Mitigation May Not Be Needed
  - Consider Fire Prevention
    - Spark Mitigation – Passive (Spark Catcher™) or Active (Detect & Extinguish)
    - Collector Choice – Dry Media, Cyclone, or Wet Collectors - primarily with Metal Dusts
    - Dust Additives to “Inert” Combustible Dust – such as Limestone
  - Consider Fire Protection
    - Sprinklers & Water Drain Valve or CO₂ Extinguishing System
    - Collector Location – place collector outdoors
    - Damper is not needed
  - No Fire Mitigation
  - Consider Explosion Prevention
    - Spark Mitigation – Passive (Spark Catcher™) or Active (Detect & Extinguish)
    - Collector Choice – Dry Media, Cyclone, or Wet Collectors - primarily with Metal Dusts
    - Dust Additives to “Inert” Combustible Dust – such as Limestone
    - Explosion Isolation from other Degraders
  - Consider Explosion Protection
    - Active Explosion Suppression Systems
    - Explosion Venting with Ducts or Flammless Vents
    - Explosion Isolation – Air Inlet/Outlet, Hopper Discharge

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**Important Information:** It is the process owner’s responsibility to understand the risks in their process and to mitigate those risks in accordance with all applicable laws, regulations and standards, including consideration of those published by the NFPA. Note this Roadmap may not identify all potential mitigation steps and does not cover the commissioning and on-going testing and maintenance required for various mitigation strategies. This Roadmap is a high-level summary of steps for a process owner to consider and is not intended as a replacement for careful review of all applicable laws, regulations, and standards. Donaldson Company can assist a process owner in understanding what products are available to help mitigate their risks but they are not regulatory experts. If you need assistance finding an expert in the field, please contact us and we will assist you in finding resource options. Please note that various strategies can help mitigate, but not eliminate the risks of fire and explosion.
### PREVENTION AND PROTECTION COMPONENTS

#### PREVENTION

**In-Line Spark Abatement.** Located within the intake ducting, this device create turbulence in the airstream that cools and extinguishes sparks without water or chemicals.

**Spark Detection & Extinguishing System.** Highly sensitive spark sensors located on the ductwork automatically trigger an extinguishing device and a spark alarm. The extinguishing assembly reacts within 300 milliseconds of an alarm releasing a water spray curtain to extinguish sparks.

#### FIRE PROTECTION

**Fire Suppression System.** Delivers clean, dependable CO₂-based fire suppression to deep-seated fires in seconds.

**Sprinkler Couplings.** Allow ease of installation of sprinkler systems to extinguish fires quickly.

**Inlet/Outlet Damper.** Inlet and outlet dampers work with a CO₂-based fire suppression system to isolate the CO₂ in the dust collector.

**Automatic Fast Acting Abort Gate.** Fast-acting abort gates used in conjunction with spark detection systems can divert sparks, flames, smoke and other dangerous material to a safe location.

#### EXPLOSION PROTECTION

**Explosion Relief Panels.** Designed to rupture at specific pressure, these vents help minimize damage and direct the fireball and pressure into a safe area in the case of an explosion.

**Chemical Suppressant.** These suppression systems can detect and react to explosion pressures in less than one millisecond to chemically suppress explosions before they become catastrophic.

**Chemical Isolation – Inlet/Outlet.** These systems detect explosive pressure and quickly inject a chemical suppressive to prevent the flames from an explosion from propagating through the inlet or outlet duct.

**Actuated Knife Gate – Inlet/Outlet.** Knife gates actuate within milliseconds of an explosion event to prevent the explosion from propagating back into the building from either the inlet or outlet duct.

**Flow Actuated Isolation Valve – Inlet.** Flow actuated isolation valves on the inlet duct prevent the flames from explosions from propagating back into the building from the dust collector.

**Rotary Valve/Airlock.** Rotary valves can help prevent explosions from propagating through the dust collector hopper outlet.
As a process owner, you are responsible for the selection of your combustible material management strategy and to assure compliance with all applicable federal, state, and local codes and standards.

**STANDARDS, CODES, AND GUIDELINES THAT IMPACT DUST COLLECTOR DECISIONS**

Many standards and codes may influence your decisions on dust control, including local, state, and federal regulations. Knowing the codes that apply to your facility is critical, and you should always research the code requirements in your area. A few commonly referenced standards for combustible dust risk management strategies include those issued by: National Fire Protection Association (NFPA), the International Mechanical Code, the International Fire Code, Factory Mutual Property Loss Data Sheets, and OSHA (federal).

Since each Authority Having Jurisdiction may have a specific set of codes or standards it references, you may need to have knowledge of more than one standard or code. Some of the most commonly referenced standards are published by NFPA, including both design and operational standards focused on combustible dust.

Since these standards are often referenced by OSHA, and have been adopted as code in many areas of the country, they may be a good starting point for consideration in developing your combustible dust management strategy.

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<th>Standard</th>
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<td>NFPA 652</td>
<td>Standard on the Fundamentals of Combustible Dust</td>
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<td>NFPA 654</td>
<td>Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids</td>
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<td>NFPA 68</td>
<td>Standard for Explosion Protection by Deflagration Venting</td>
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<td>Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids</td>
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<td>Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities</td>
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<td>NFPA 33</td>
<td>Standard for Spray Applications Using Flammable or Combustible Materials</td>
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Visit [www nfpa org](http://www.nfpa.org) for more information.
COMBUSTIBLE DUST EQUIPMENT INSTALLATIONS

Explosion Vent  Flow Actuated Isolation Valve  Rotary Valve
Flameless Explosion Vent  Chemical Suppressant  Fire Suppression

COMBUSTIBLE DUST STATEMENT

As a manufacturer and supplier of Industrial Filtration Products, Donaldson can assist process owners/operators in the selection of filtration technologies. Donaldson cannot, however, select fire and/or explosion mitigation strategies for process owners.

Compliance with applicable codes and standards remains the responsibility of the process owner/operator. Among other considerations, the current NFPA standards require owners/operators whose processes involve potentially combustible materials to have a current Hazard Analysis, which can serve as the foundation for the process owner/operators hazard mitigation strategies.

Upon request, Donaldson can assist owners/operators to incorporate Donaldson filtration products into their comprehensive fire and/or explosion mitigation strategy. To provide this support, Donaldson needs complete and accurate information on all potentially combustible contaminants and the fire and/or explosion mitigation strategies that a process owner/operator intends to pursue.
Industry-Leading Technology
• Advanced filtration technology for optimal performance
• Reduced energy consumption and cost of ownership

The Most Filters and Parts
• For every brand and style of collector
• Wide range of filtration media for any application
• 90,000 filters and parts in stock and ready to ship

Unparalleled Support
• Live technical specialists
• Comprehensive pre- and post-sale support
• 40 manufacturing plants and 14 distribution centers worldwide

Significantly improve the performance of your collector with genuine Donaldson Torit replacement filters and parts. Call Donaldson Torit at 800-365-1331.

Important Notice
Many factors beyond the control of Donaldson can affect the use and performance of Donaldson products in a particular application, including the conditions under which the product is used. Since these factors are uniquely within the user’s knowledge and control, it is essential the user evaluate the products to determine whether the product is fit for the particular purpose and suitable for the user’s application. All products, product specifications, availability and data are subject to change without notice, and may vary by region or country.