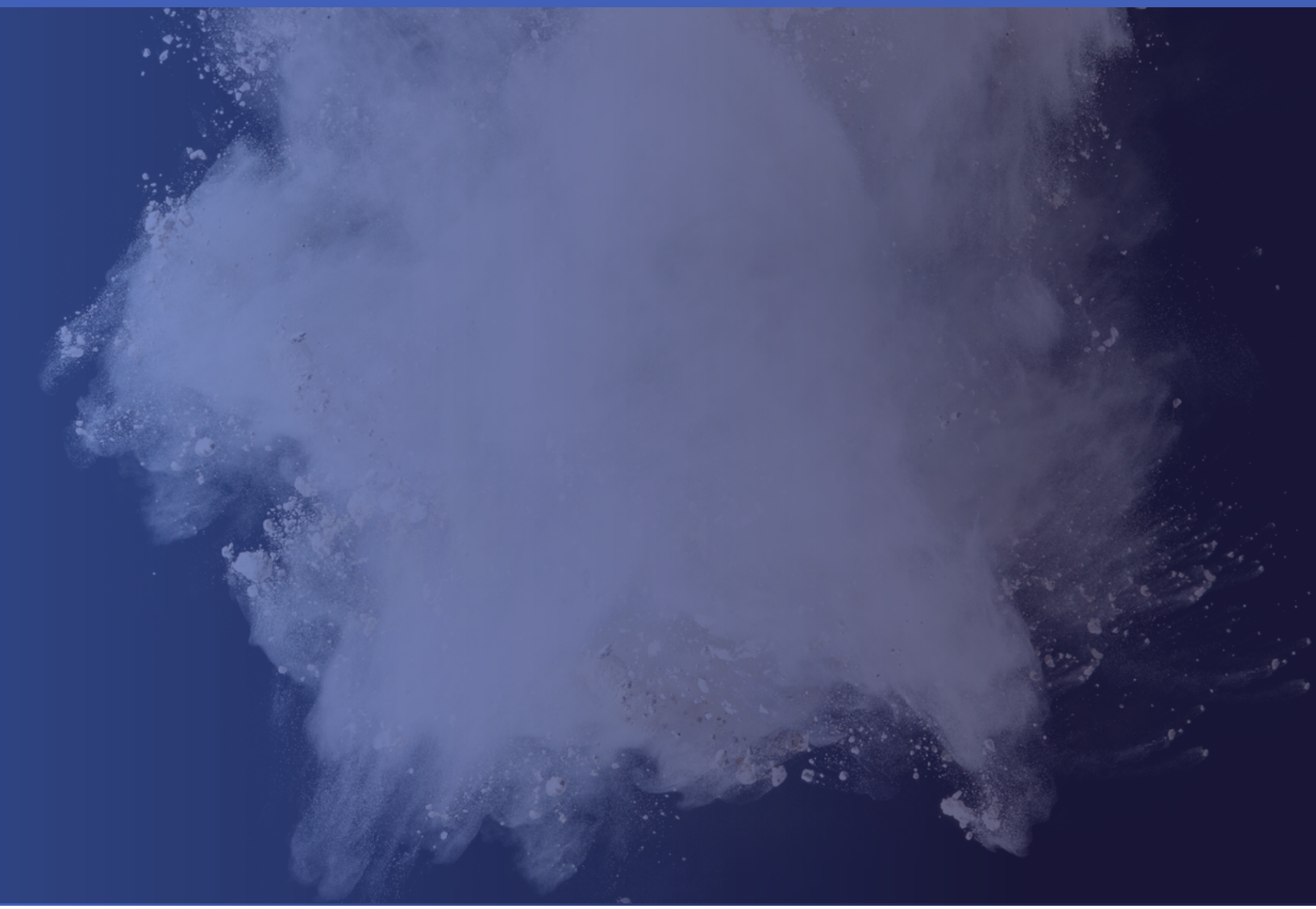
UNDERSTANDING & MANAGING COMBUSTIBLE DUST

Your Guide to Maintaining Safe and Compliant Systems



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WHAT YOU NEED TO KNOW ABOUT COMBUSTIBLE DUST

Combustible dust is far more prevalent in the workplace than most people realize. Almost all organic dust is considered combustible.

Unfortunately, combustible dust presents a risk that is often seriously underestimated. Systems that lack the proper safeguards for combustible dust ignition can result in consequences ranging from fines for noncompliance to devastating explosions and loss of life.

Combustible Dust Explosions Demonstrate Dangers

In September of 2018, a combustible dust explosion occurred at Metal-Matic in Minneapolis, MN, resulting in two employees being badly injured. The Minneapolis Fire Department confirmed that the explosion occurred when a pipe welding torch ignited a mixture of aluminum dust and water.

Ten years earlier, the Sugar Refinery Disaster of 2008, involved a series of sugar dust explosions that left fourteen workers fatally burned at a sugar plant near Savannah, Georgia. As a result, rigorous and demanding regulatory standards for managing combustible dust increased, raising awareness in the field.

Dependable Combustible Dust Safety Solutions are Available

Manufacturers of dust collection equipment have responded to the need for solutions with innovative devices and systems for preventing and isolating combustible dust explosions. Facility managers need to be proactive with implementing combustible dust management systems to assure the safety and compliance of their organization.

Understanding the Threats and Choosing the Right Solutions

Choosing the right combustible dust equipment for your facility and processes can be complicated. Knowledgeable and experienced guidance in implementing your system can mean the difference between success and failure. The purpose of this guide is to get you started with understanding combustible dust and the options you have.

DO YOU HAVE COMBUSTIBLE DUST IN YOUR FACILITY?

When in the form of a dust cloud, certain types of dust will explode if exposed to an ignition source. These are considered combustible dusts. The best way to know for certain if your dust is combustible is to have dust testing done to verify its material properties.

Combustible Dust Testing

Sometimes documentation may also be available to help you determine if the dust from your materials is explosive. In the event that documentation for your materials is not available, dust testing of your materials should be done at a facility using ASTM (American Society for Testing and Materials) and ISO (International Standard Organization) procedures.

Dust testing will reveal if dust or powder produced by process applications is potentially combustible. The test results will determine if a material is classified as Type A — Explosible — or Type B — Non-Explosible.

Four Steps to a Combustible Dust Solution

1. Determining if dust is combustible is the first step toward developing a combustible dust solution. If any of the particles produced in your process can burn, chances are it is a combustible dust.
2. Dust Hazard Analysis (DHA) should be done once dust is determined to be combustible. DHA of the dust provides a Kst value, the measurement used to indicate how likely a dust is to explode. This value helps determine your dust collector needs.
3. Determine best equipment placement. Depending on your facility and process, your dust collector can be installed inside or outside of the building.
4. Select accessories. A variety of explosion and fire mitigation accessories are available to optimize the safety of your system.

Hazardous Dust Analysis Terminology

The following factors are evaluated during dust testing and will help determine the appropriate dust collector and explosion isolation equipment selections.

Kst - the rate of combustion and dust deflagration index, which measures the relative explosion severity compared to other dusts. The larger the value for Kst, the more severe the explosion. Kst provides the best “single number” estimate of the anticipated behavior of a dust deflagration.

Pmax - the maximum explosion overpressure generated in the test chamber.

Mean Particulate Distribution Size - the smaller the particle, the more combustible the dust is, unless the particle is too small for combustion to occur.Used to determine appropriate filter selections.

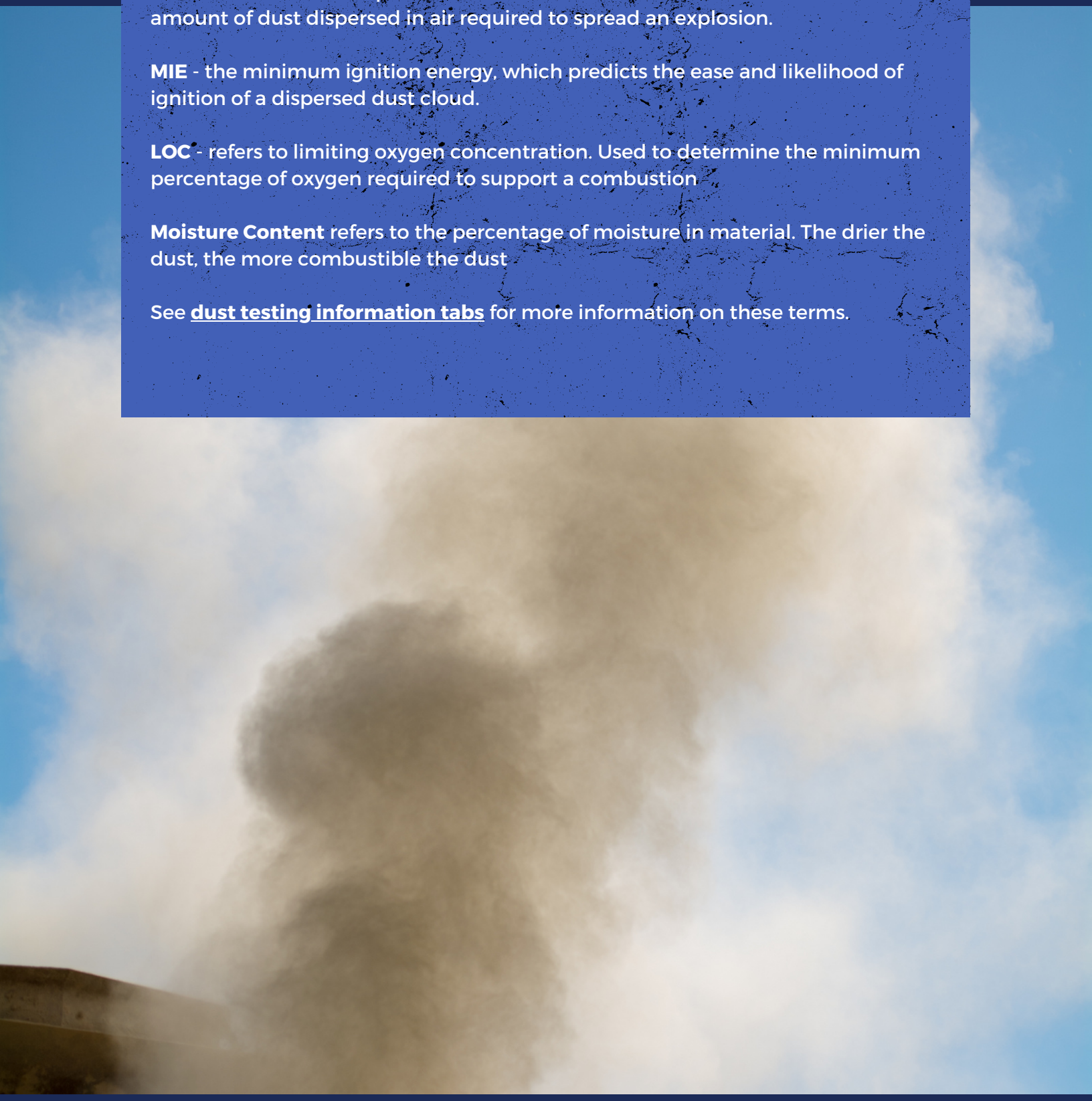
MEC - the minimum explosible concentration, which measures the minimum amount of dust dispersed in air required to spread an explosion.

MIE - the minimum ignition energy, which predicts the ease and likelihood of ignition of a dispersed dust cloud.

LOC - refers to limiting oxygen concentration. Used to determine the minimum percentage of oxygen required to support a combustion

Moisture Content refers to the percentage of moisture in material. The drier the dust, the more combustible the dust

See **dust testing information tabs** for more information on these terms.



EXPLOSIVE DUST ROADMAP

HAS YOUR DUST BEEN TESTED?

- **NO** → **GET IT TESTED!**
- **YES** → **IS IT COMBUSTIBLE**
  - **NO** → Additional testing and dust explosion protection may not be required.
  - **YES** → DEPENDING ON WHAT THE KST VALUE IS, WILL DETERMINE WHAT YOU NEED IN ORDER TO BE SAFE.

KST 185 or Below pmax 10	ST-1 Class KST Less Than 200 pmax 10	ST-2 Hazard Class KST 201-300 pmax 10	ST-3 Hazard Class KST 300 and Above pmax 12
CONDUCT A DUST HAZARD ANALYSIS (DHA)			
INLET Explosion Isolation Valve or Chemical Explosion Isolation or Fast Acting Slide Gate	**INLET** Explosion Isolation Valve or Chemical Explosion Isolation or Fast Acting Slide Gate	**INLET** Explosion Isolation Valve or Chemical Explosion Isolation or Fast Acting Slide Gate	**INLET** Chemical Explosion Isolation or Fast Acting Slide Gate
COLLECTOR Explosion Venting (outside installation) or Explosion Venting (ducted outside) or Chemical Explosion Suppression or Flameless Vent	**COLLECTOR** Explosion Venting (outside installation) or Explosion Venting (ducted outside) or Chemical Explosion Suppression or Flameless Vent	**COLLECTOR** Explosion Venting (outside installation) or Explosion Venting (ducted outside) or Chemical Explosion Suppression or Flameless Vent	**COLLECTOR** Explosion Venting (outside installation) or Explosion Venting (ducted outside) or Chemical Explosion Suppression
OUTLET Air NOT Returning to the Building or Imperial Systems IDA (In-line Deflagration Arrestor) or Chemical explosion Isolation and/or Fast acting slide gate	**OUTLET** Air NOT Returning to the Building or Chemical explosion Isolation and/or Fast acting slide gate	**OUTLET** Air NOT Returning to the Building or Chemical explosion Isolation and/or Fast acting slide gate	**OUTLET** Air NOT Returning to the Building or Chemical explosion Isolation and/or Fast acting slide gate

Contact Imperial Systems for a Dust Collector Quote

The above explosive dust roadmap is intended to guide a process owner on the proper items to consider when using a dust or fume collector on combustible dust. The final decisions should be made to protect life and property based on a Dust Hazard Analysis / Process Hazard Analysis performed by the business owner. We can help guide you through which products or features may be needed, but the business owner should consult an independent expert before selecting their final strategy. The expert can help the owner with the applicable laws, regulations and standards, including NFPA guidelines. This guide may not identify all the possible options and can help mitigate but not eliminate the risk of fire and explosion.

UNDERSTANDING NFPA REGULATIONS

The National Fire Protection Association (NFPA) sets standards and codes to protect buildings against fire and explosion risks, and OSHA is enforcing these standards with increasing vigilance.

The following is a summary of NFPA relating to combustible dust and explosive materials:

NFPA 654

- Standard for Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids.
- Most general document on how to design a safe dust collection system.
- Defines requirements for a Process Hazard Analysis and Risk Assessment.
- Directs readers to many other relevant documents and more specific NFPA standards.

NFPA 68

- Standard for Explosion Protection by Deflagration Venting.
- Contains design requirements and calculations for devices that vent pressures resulting from a deflagration in a dust collector.
- Intended to minimize structural and mechanical damage to equipment if a deflagration even should happen.

NFPA 69

- Standard on Explosion Prevention Systems.
- Prescribes the design of prevention controls for dust collection systems.
- Prevention Controls include Isolation and Suppression devices.

NFPA 664

- Standard for Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.
- Prescribes specific controls relating to wood dust, because of the tendency of wood processing equipment to create sparks and start fires.

NFPA 61

- Standard for Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities.
- Prescribes specific controls relating to the food industry, due to the large variety of combustible dusts and bulk material in food processing facilities. Such as grains, sugar, flour, feeds, and spices.

NFPA 484

- Standard for Combustible Metals.
- Outlines the procedures to determine whether a metal is in combustible form or not.
- Prescribes specific controls relating to metal dust due to the severity of explosions and the relative ease of ignition.
- Aluminum and Magnesium have specific requirements for dry dust collection.

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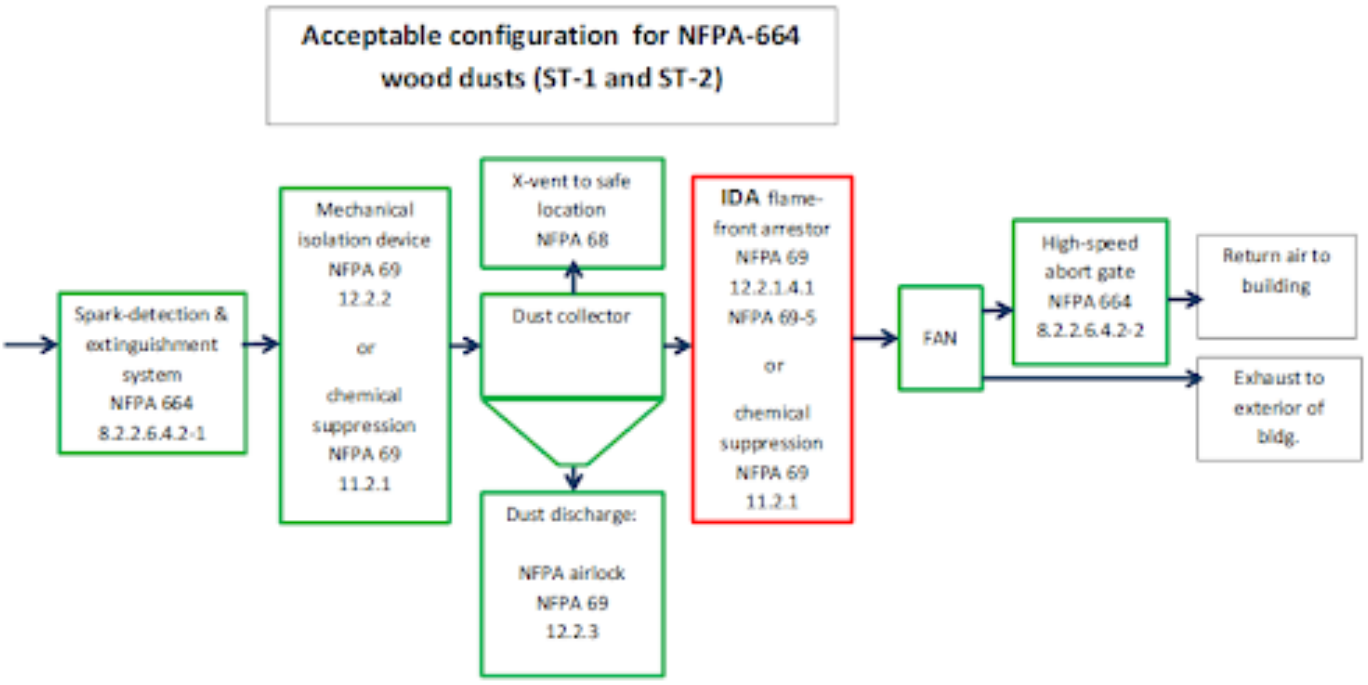
Compliance



The NFPA (National Fire Protection Association) has set numerous codes and standards relating to prevention of fire and dust explosions from the manufacturing, processing, and handling of dusts.

OSHA enforces the standards published by NFPA under their General Duty Clause. Two of the most common violations are 1) accumulation of combustible dust in workplaces and 2) failure to perform a Process Hazard Analysis and Risk Assessment.

Failure to have proper documentation on how hazardous a dust may be is one of the most common oversights.

PASSIVE & ACTIVE COMBUSTIBLE DUST SOLUTIONS

There are two basic categories of equipment used to comply with NFPA standards for the explosion protection of dust collection systems:

1. Passive or reactive systems react to a deflagration event by containing or minimize the damage it can inflict upon people, equipment, and other property.
2. Active or proactive systems are designed to prevent an explosion from occurring. An active system involves expensive technology and typically requires recertification every three months.

Passive Systems

Explosion venting: An explosion vent opens when predetermined pressures are reached inside the collector, allowing the excess pressure and flame front to exit to a safe area. It's role is to minimize damage to the collector and prevent it from blowing up in the event of a deflagration.

Flameless venting: A flameless vent is installed over a standard vent and extinguishes the flame front exiting the vented area, not allowing it to escape. This allows conventional venting to be achieved indoors where a deflagration could otherwise endanger personnel and/or ignite secondary explosions.

Passive float valve: This device is designed to be installed in the outlet ducting of a dust collection system. The passive float valve utilizes a mechanical barrier to isolate pressure and flame fronts caused by the explosion and prevent them from further propagating through the ducting. The barrier reacts within milliseconds and is closed by the pressure of the explosion.

B*ack draft damper:* A mechanical back draft damper is installed in the inlet ducting. It utilizes a mechanical barrier that is held open by the process air and is slammed shut by the pressure of the explosion. When closed, this barrier isolates pressure and flame fronts keeping them from being able to propagate further up the process stream.

Flame front diverters: These devices divert the flame front to the atmosphere, away from the downstream piping. Typically, these devices are used between two different vessels equipped with their own explosion protection systems. The flame front diverter is used to eliminate "flame jet ignition" between the two vessels that could overpower the protection systems installed.

Active Systems

Chemical isolation: Chemical suppression systems are designed to react within milliseconds of detecting an explosion and can be installed in either inlet or outlet ducting. Components commonly include explosion pressure detector(s), flame detector, and a control panel. This system creates a chemical barrier that suppresses the explosion within the ducting, reduces the propagation of flame through the ducting, minimizing pressure increase within connected process equipment.

Chemical suppression: While chemical isolation is used to detect and suppress explosions within the ducting, chemical suppression protects the dust collector itself. It is often used with isolation when it is not possible to safely vent an explosion or when the dust is harmful or toxic. It detects an explosion hazard within milliseconds and releases a chemical agent to extinguish the flame before an explosion can occur.

Fast acting valve: This device is designed to close within milliseconds of detecting an explosion. It is installed in either inlet or outlet ducting. It creates a mechanical barrier within the ducting that effectively isolates pressure and flame fronts from either direction, preventing them from propagating further through the process.

High-speed abort gate: The high-speed abort gate is designed to divert process air in the event of a deflagration. They are often tied into a spark detection system to trigger when an ignition source is detected. They do not react quickly enough to be NFPA compliant as an outlet isolation device. Its primary purpose is to divert burning debris and smoke from entering the building.

ILLUSTRATED COMBUSTIBLE DUST SYSTEM

The illustration below shows a complete combustible dust system with all of the components labeled.

1. SPARK TRAP
2. EXPLOSION ISOLATION VALVE
3. FAST ACTING SLIDE GATE
4. FIKE FIRE SUPPRESSION
5. FIRE TRACE
6. SMOKE DETECTOR
7. CHEMICAL EXPLOSION ISOLATION
8. HEAVY DUTY ABORT GATE
9. HEAVY DUTY CONSTRUCTION
10. EXPLOSION VENT
11. CAST IRON AIRLOCK
12. DELTAMAXX FILTERS
13. FLAMELESS EXPLOSION VENTING

DON'T TAKE CHANCES - PARTNER WITH AN EXPERIENCED EXPERT

Glacier Technology can guide you with the right questions to ask. We can also help examine current dust collection systems to help determine if they are in compliance with the most recent NFPA standards. When we do facility evaluations, we also discuss dust control measures, explosion prevention measures, and explosion protection measures. And we can put you in contact with testing facilities capable of analyzing your dust.

Your Source For Trusted Combustible Dust Solutions
Glacier Technology has extensive experience and expert knowledge in not only industrial dust collection system design and development, but also experience in successfully navigating OSHA and NFPA requirements.

Our team also has developed great relationships with the industry's leading suppliers of explosion and fire mitigation equipment. We work with thee suppliers to bring you the most dependable and cost-effective field-tested solutions including:

- CMAXX and IDA (In-Line Deflagration Arrester) DeltaMAXX filters
- Rhino Drum Explosion Tested Drum Kit (ETDK)
- Spark Detection and Extinguishing Systems
- Abort Gates
- EIV Backdraft
- Spark Arrestors

Ready to Get Started on Your System?

Don't operate another day with uncertainty about your facility's safety and compliance.

Contact the Glacier Technology team to schedule a consultation.