# 25 Point Combustible Dust Inspection Guide

**Application |** These guidelines apply to woodworking operations with a potential risk of explosion. There is no restriction on the size of the work area.

## Codes and Regulations

- **National Fire Protection Association (NFPA)**

  Wood dust is broken into two categories: deflagrable wood dust and dry nondeflagrable wood dust.

| Deflagrable | Dry Nondeflagrable |
|---|---|
| **Deflagrable wood dust** is defined as wood particulate that will propagate a flame front, thus presenting a fire or explosion hazard, when suspended in air, or the process-specific oxidizing medium over a range of concentrations, regardless of particle size or shape; wood particulate with a mass median particle size of 500 microns or smaller (material that will pass through a U.S. No. 35 Standard Sieve), having a moisture content of less than 25 percent (wet basis). | **Dry Nondeflagrable wood dust** is defined as wood particulate with a mass median particle size greater than 500 microns (material that will not pass through a U.S. No. 35 Standard Sieve), having a moisture content of less than 25 percent (wet basis). |
| **Wood-derived materials** include but are not limited to sawdust, planer shavings, hoggings, wood flour, and moulder waste. | |

- ***Fire Prevention Act***
  **CHAPTER F-13**

  "building" means a structure used or intended to be used for supporting or sheltering any use or occupancy;

  *30(1)The Lieutenant-Governor in Council may make regulations*
  *(d) prescribing building standards and fire prevention standards,*

  New Brunswick Regulation 82-20, Fire Prevention and Inspection (under the *Fire Prevention Act* of New Brunswick*)*

  *(2) The building standards and fire prevention standards contained in the documents referred to in paragraphs (a) to (e) are the building standards and fire prevention standards prescribed for the purposes of the Act and shall be incorporated in and form a part of this Regulation:*
  *(a) National Fire Code of Canada 2010*

- ***National Building Code of Canada 2010* - Group F**

**High-hazard industrial occupancy (Group F, Division 1)** means an industrial occupancy containing sufficient quantities of highly combustible and flammable or explosive materials which, because of their inherent characteristics, constitute a special fire hazard.

- ***2010 National Fire Code* (NFC)**

S. 1.2.1.1 Compliance with this Code shall be achieved by

a) complying with the applicable acceptable solutions in Division B (see Appendix A), or

b) using alternative solutions that will achieve at least the minimum level of performance required by Division Bin the areas defined by the objectives and functional statements attributed to the applicable acceptable solutions (see Appendix A).

Group F mentioned in NFC:

S.2.1.2.2 **Hazardous Activities**

**1)** Activities that create a hazard and that are not allowed for in the original design shall not be carried out in a *building* unless provisions are made to control the hazard in conformance with *this* Code. (See Appendix A)

**2)** No *major occupancy* of Group F, Division 1 shall be contained within a *building* with any *occupancy* classified as an *assembly, care, treatment, detention* or *residential occupancy.*

**Legend for the 25 point guide**

- NFPA 68
- NFPA 69
- NFPA 77
- NFPA 91
- NFPA 654
- NFPA 664

# 25 Point Combustible Dust System Guide

| Item # | | NFPA Section Reference | NFC Section Reference |
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| 1 | **Dust Collector Information and Drawings** | NFPA 69 S. 1.2.3<br>**1.2.3*** To meet a minimum level of reliability, explosion prevention and control systems provided in accordance with the requirements of this standard shall include, but not be limited to, the following:<br>(1) Design system verification through testing<br>(2) Design documentation<br>(3) System acceptance<br>(4) Management of change<br>(5) Regular testing and maintenance<br><br>**A.1.2.3** Some jurisdictions, industries, and companies require system reliability to meet a target measure of failure on demand for hardware. These targets can be stated as a level of safety integrity. Establishing safety integrity levels is covered by ISA and other organizations. The requirements of this standard and the review and approval processes stated are intended to establish an acceptable level of reliability. Nothing in this standard is intended to prevent the use of safety integrity levels used by other organizations. *(See also A.15.5.5.1.)*<br><br>**A.15.5.5.1** Safety instrumented system (SIS) design focuses increasingly on the concept of safety integrity level (SIL).A process that is to be protected is assigned an SIL level based upon risk analysis. An SIL level of between 1 and 3 is assigned (between 1 and 4 under IEC 61511, *Functional Safety — Safety Instrumented Systems for the Process Industry Sector*), with 1 being the lowest level. Layers of protection are typically combined to achieve the SIL requirement for a process with individual safety systems often having a lower level than the process. This edition of NFPA 69 does not require the use of SIL levels for explosion prevention systems but recognizes their use. The guidelines for isolating a Safety Instrumented System from the basic process control system are included in ANSI/ISA-84.00.01, *Functional Safety: Safety Instrumented Systems for the Process Industry Sector*, current edition.<br><br>IEC 61511 is also appropriate. | |

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| 2 | **Documentation for Transport Velocity** | NFPA 654<br>**7.3.2.6.6*** All ductwork shall be sized to provide the air volume and air velocity necessary to keep the duct interior clean and free of residual material.<br><br>**A.7.3.2.6.6** Dust collection systems and centralized vacuum cleaning systems handling combustible dusts usually use branched duct networks with multiple pickup points and variable material loading. In contrast, dilute phase and dense phase pneumatic conveying systems are typically linear systems with controlled infeed and consistent material loading. Dust collection systems for combustible dusts represent a significant increase in deflagration risk compared with most pneumatic conveying systems. A properly designed system is critical to minimizing that risk. For guidance on determining proper dust collection system design, refer to ACGIH Industrial Ventilation: A Manual of Recommended Practice for Design. | NFPA 654<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include: NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids; "NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 3 | **Explosion Protection (# and Type)** | | For NFPA 68:<br><br>**4 .9.4.2. Explosion Protection**<br>**1)** Processing equipment where an explosion hazard is present shall be<br>a) designed to withstand the explosion pressure without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1.6. Explosion Venting**<br>**1)** Except as provided in Article 5.3.1.7., an activity that creates an atmosphere containing significant concentrations of *combustible dusts* shall be located only in a *building* provided with explosion venting to the outdoors.<br>**2)** When explosion venting is required in this Section, it shall be designed to prevent critical structural and mechanical damage to |

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| | | | the *building* in conformance with good engineering practice such as that described in NFPA 68, "Explosion Protection by Deflagration Venting." (See A-3.2.8.2. (1)(d) in Appendix A.)<br><br>**5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be provided.<br>**2)** When an explosion prevention system is required in this Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems."<br><br>**A-3.2.8.2.(1 )(d)** When a flammable mixture of air and vapour/gas/dust is ignited and causes an explosion, the exothermic reaction results in the rapid expansion of heated gases and the corresponding pressure waves travel through the mixture at sonic or supersonic velocities. The pressures developed by an explosion very rapidly reach levels that most buildings and equipment cannot withstand unless specifically designed to do so. Explosion venting consists of devices designed to open at a predetermined pressure to relieve internal pressure build-up inside a room or enclosure, hence limiting the structural and mechanical damage.<br><br>The major parameters to be considered in designing an explosion venting system for a building are:<br>• the physical and chemical properties of the flammable air mixture, such as the particle size or the droplet diameter, the moisture content, the minimum ignition temperature and explosive concentration, the burning velocity or explosibility classification, the maximum explosion pressure and the rate of pressurerise,<br>• the concentration and dispersion of the flammable mixture in the room,<br>• the turbulence and physical obstructions in the room,<br>• the size and shape of the room, the type of construction and its ability to withstand internal pressures, and |

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| | | | • the type, size and location of relief panels, which should also be designed to reduce the possibility of injury to people in the immediate vicinity of the panels.<br><br>For NFPA 69:<br>**4.9.4.2. Explosion Protection**<br>**1)** Processing equipment where an Explosion hazard is present shall be<br>a) designed to withstand the explosion pressure, without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be provided.<br>**2)** When an explosion prevention system is required in this Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems."<br><br>For NFPA 654:<br>NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br><br>For NFPA 664:<br>**5.3.1.3. Dust-Collecting Systems**<br>**1)** Dust-collecting systems shall be provided to prevent the accumulation of dust and keep suspended dusts at a safe concentration inside a *building.*<br>**2)** A dust-collecting system required in Sentence (1) shall be designed in conformance with good engineering practice such as |

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| | | | that described in NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities," and the NFPA standards on dust explosion hazards, and shall<br>a) be made of noncombustible materials, and<br>b) not create sparks upon physical contact in the fan assembly.<br>(See Append ix A.)<br><br>**5.3 .2.1. Exhaust Systems**<br>**1)** Every machine that produce wood dust, particles or shavings shall *be* provided with a blower and exhaust system installed in conformance with NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br>**2)** Operations or machines that generate sparks or combustible vapours shall not be served by exhaust systems connected to woodworking machines referred to in Sentence (1). |
| 4 | **Explosion Vents Labeled** | NFPA 68<br>**11.3.4*** Vent closures shall be clearly marked as follows:<br>**WARNING:** Explosion relief device.<br><br>**A.11.3.4** For symbols, placement, and layout, refer to ANSI Z535, *Product Safety Signs and Labels*. | For NFPA 68:<br>**4 .9.4.2. Explosion Protection**<br>**1)** Processing equipment where an explosion hazard is present shall be<br>a) designed to withstand the explosion pressure without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1.6. Explosion Venting**<br>**1)** Except as provided in Article 5.3.1.7., an activity that creates an atmosphere containing significant concentrations of *combustible dusts* shall be located only in a *building* provided with explosion venting to the outdoors.<br>**2)** When explosion venting is required in this Section, it shall be designed to prevent critical structural and mechanical damage to the *building* in conformance with good engineering practice such as that described in NFPA 68, "Explosion Protection by Deflagration Venting." (See A-3.2.8.2.(1)(d) in Appendix A.) |

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| | | | **5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be provided.<br>**2)** When an explosion prevention system is required in this Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems."<br><br>**A-3.2.8.2.(1 )(d)** When a flammable mixture of air and vapour/gas/dust is ignited and causes an explosion, the exothermic reaction results in the rapid expansion of heated gases and the corresponding pressure waves travel through the mixture at sonic or supersonic velocities. The pressures developed by an explosion very rapidly reach levels that most buildings and equipment cannot withstand unless specifically designed to do so. Explosion venting consists of devices designed to open at a redetermined pressure to relieve internal pressure build-up inside a room or enclosure, hence limiting the structural and mechanical damage.<br><br>The major parameters to be considered in designing an explosion venting system for a building are:<br>• the physical and chemical properties of the flammable air mixture, such as the particle size or the droplet diameter, the moisture content, the minimum ignition temperature and explosive concentration, the burning velocity or explosibility classification, the maximum explosion pressure and the rate of pressure rise,<br>• the concentration and dispersion of the flammable mixture in the room,<br>• the turbulence and physical obstructions in the room,<br>• the size and shape of the room, the type of construction and its ability to withstand internal pressures, and<br>• the type, size and location of relief panels, which should also be designed to reduce the possibility of injury to people in the immediate vicinity of the panels. |

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| 5 | **Safe Blast Zone** | NFPA 68<br>**7.4.4** The vented material discharged from an enclosure during a deflagration shall be directed to a safe outside location to avoid injury to personnel and to minimize property damage.<br>*(See Section 6.8.)*<br><br>**6.8 Effects of Vent Discharge Ducts.** | For NFPA 68:<br>**4 .9.4.2. Explosion Protection**<br>**1)** Processing equipment where an explosion hazard is present shall be<br>a) designed to withstand the explosion pressure without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1.6. Explosion Venting**<br>**1)** Except as provided in Article 5.3.1.7., an activity that creates an atmosphere containing significant concentrations of *combustible dusts* shall be located only in a *building* provided with explosion venting to the outdoors.<br>**2)** When explosion venting is required in this Section, it shall be designed to prevent critical structural and mechanical damage to the *building* in conformance with good engineering practice such as that described in NFPA 68, "Explosion Protection by Deflagration Venting." (See A-3.2.8.2.(1)(d) in Appendix A.)<br><br>**5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be provided.<br>**2)** When an explosion prevention system is required in this Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems."<br><br>**A-3.2.8.2.(1 )(d)** When a flammable mixture of air and vapour/gas/dust is ignited and causes an explosion, the exothermic reaction results in the rapid expansion of heated gases and the corresponding pressure waves travel through the mixture at sonic or supersonic velocities. The pressures developed by an explosion very rapidly reach levels that most |

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| | | | buildings and equipment cannot withstand unless specifically designed to do so. Explosion venting consists of devices designed to open at a redetermined pressure to relieve internal pressure build-up inside a room or enclosure, hence limiting the structural and mechanical damage.<br><br>The major parameters to be considered in designing an explosion venting system for a building are:<br>• the physical and chemical properties of the flammable air mixture, such as the particle size or the droplet diameter, the moisture content, the minimum ignition temperature and explosive concentration, the burning velocity or explosibility classification, the maximum explosion pressure and the rate of pressure rise,<br>• the concentration and dispersion of the flammable mixture in the room,<br>• the turbulence and physical obstructions in the room,<br>• the size and shape of the room, the type of construction and its ability to withstand internal pressures, and<br>• the type, size and location of relief panels, which should also be designed to reduce the possibility of injury to people in the immediate vicinity of the panels. |
| 6 | **Inlet Explosion Isolation(s) (Type)** | NFPA 654<br>**7.1.6*** Isolation of Equipment and Work Areas.<br><br>**A.7.1.6** Methods of explosion protection that use containment, venting, and suppression protect the specific process equipment on which they are installed. For details on deflagration propagation, see Annex E.<br><br>**7.1.7*** Systems for the pre-deflagration detection and control of ignition sources, installed in accordance with NFPA 69 shall be permitted to be used to reduce the probability of occurrence of a deflagration in the following:<br>(1) In ductwork supplying AMS<br>(2) In recycled air from AMS to a building<br>(3) In ductwork between process equipment | For NFPA 69<br>**4.9.4.2. Explosion Protection**<br>**1)** Processing equipment where an Explosion hazard is present shall be<br>a) designed to withstand the explosion pressure, without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be |

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| | | **A.7.1.7** These devices reduce the frequency or likelihood that the sparks will cause a deflagration but do not eliminate the need for deflagration isolation devices. The abort gate cannot be relied on to serve as a deflagration isolation device because the response time is relatively slow and construction is usually unsuitable for withstanding explosion pressures. Additional information on spark extinguishing systems can be found in Annex C. | provided.<br>**2)** When an explosion prevention system is required in this Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems."<br><br>For NFPA 654<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include: NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 7 | **Discharge Isolation (Type)** | NFPA 654<br>**7.1.6*** Isolation of Equipment and Work Areas.<br><br>**A.7.1.6** Methods of explosion protection that use containment, venting, and suppression protect the specific process equipment on which they are installed. For details on deflagration propagation, see Annex E.<br><br>**7.1.7*** Systems for the pre-deflagration detection and control of ignition sources, installed in accordance with NFPA 69 shall be permitted to be used to reduce the probability of occurrence of a deflagration in the following:<br>(1) In ductwork supplying AMS<br>(2) In recycled air from AMS to a building<br>(3) In ductwork between process equipment<br><br>**A.7.1.7** These devices reduce the frequency or likelihood that the sparks will cause a deflagration but do not eliminate the need for deflagration isolation devices. The abort gate cannot be relied on to serve as a deflagration isolation device because the response time is relatively slow and construction is usually unsuitable for withstanding explosion pressures. Additional information on spark extinguishing systems can be found in Annex C. | NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 8 | **Fan Interlocked to Fire** | NFPA 69 | For NFPA 69: |

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| | **Detection** | **12.2.4.3.8** An independent explosion detection device or interlock from another installed explosion prevention or control system on the same protected enclosure shall be interlocked to automatically stop the rotary valve upon a deflagration event. | **4.9.4.2. Explosion Protection**<br>**1)** Processing equipment where an Explosion hazard is present shall be<br>a) designed to withstand the explosion pressure, without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be provided.<br>**2)** When an explosion prevention system is required in this Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems." |
| 9 | **Discharge Isolation Interlocked to Fire Detection** | NFPA 69<br>**12.2.4.3.8** An independent explosion detection device or interlock from another installed explosion prevention or control system on the same protected enclosure shall be interlocked to automatically stop the rotary valve upon a deflagration event. | For NFPA 69:<br>**4.9.4.2. Explosion Protection**<br>**1)** Processing equipment where an Explosion hazard is present shall be<br>a) designed to withstand the explosion pressure, without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be provided.<br>**2)** When an explosion prevention system is required in this |

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| | | | Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems." |
| 10 | **Air Recycled** | NFPA 654<br>**7.13.1.6 Exhaust Air.**<br><br>**7.13.1.6.1** Exhaust air from the final AMS shall be discharged outside to a restricted area and away from air intakes.<br><br>**7.13.1.6.3*** Recycling of AMS exhaust to buildings or rooms shall be permitted when all of the following requirements are met:<br>(1) Combustible or flammable gases or vapors are not present either in the intake or the recycled air in concentrations above applicable industrial hygiene exposure limits or 1 percent of the LFL, whichever is lower.<br>(2)* Combustible particulate solids are not present in the recycled air in concentrations above applicable industrial hygiene exposure limits or 1 percent of the MEC, whichever is lower.<br>(3)* The oxygen concentration of the recycled air stream is between 19.5 percent and 23.5 percent by volume.<br>(4) Provisions are incorporated to prevent transmission of flame and pressure effects from a deflagration in an AMS back to the facility unless a DHA indicates that those effects do not pose a threat to the facility or the occupants.<br>(5) Provisions are incorporated to prevent transmission of smoke and flame from a fire in an AMS back to the facility unless a DHA indicates that those effects do not pose a threat to the facility or the occupants.<br>(6) The system includes a method for detecting AMS malfunctions that would reduce collection efficiency and allow increases in the amount of combustible particulate solids returned to the building.<br>(7) The building or room to which the recycled air is returned meets the fugitive dust control and housekeeping requirements of this standard (Chapter 8).<br>(8) Recycled-air ducts are inspected and cleaned at least annually.<br><br>**A.7.13.1.6.3** Recommended design, maintenance, and operating guidelines for recirculation of industrial exhaust systems, as | For NFPA 654<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include:<br>NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"<br>NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |

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| | | described in Chapter 7 of ACGIH, *Industrial Ventilation: A Manual of Recommended Practice*, should be followed.<br><br>**A.7.13.1.6.3(2)** The system should be designed, maintained, and operated according to accepted engineering practice, and the AMS efficiency should be sufficient to prevent dust in the recycled air from causing hazardous accumulations of combustible dust in any area of the building.<br><br>**A.7.13.1.6.3(3)** OSHA has established limits on oxygen concentration in the workplace. Permissible limits range from no lower than 19.5 percent by volume to no higher than 23.5 percent by volume in air. See 29 CFR 1910.146. | |
| 11 | **Spark Detection** | NFPA 664(2012)<br>**8.2.2.6.4.2*** For dust collection systems of capacity greater than 2.4 m3/sec (5000 cfm), the following shall apply:<br>(1) The system shall be equipped with a listed spark detection system, designed and installed in conformance with the relevant sections of *NFPA 72, National Fire Alarm and Signaling Code*, located on the duct upstream from the dust collector and downstream from the last material entry point, or on the exhaust side of the dust collector, to detect fire entering or occurring within the dust collector, respectively, and<br>(2) The exhaust air duct conveying the recycled air back to the building shall be equipped with a high-speed abort gate activated by the spark detector in 8.2.2.6.4.2(1), and the abort gate shall be sufficiently fast to intercept and divert any burning material to atmosphere before it can enter the plant.<br>(3)*The abort gate is provided with a manual reset so that, after it has aborted, it can be reset to the normal position only by manual interaction at the damper; automatic or remote reset shall not be allowed. A powered reset is acceptable if it can be activated only by manual interaction at the damper location.<br><br>**A.8.2.2.6.4.2** Dust collection systems greater than 2.4 m3/sec (5000 cfm) in capacity represent a greater inherent hazard and risk and were deemed to require the inherently greater reliability of an abort gate as opposed to extinguishing systems. Where | For NFPA 664<br>**5.3.1.3. Dust-Collecting Systems**<br>**1)** Dust-collecting systems shall be provided to prevent the accumulation of dust and keep suspended dusts at a safe concentration inside a *building.*<br>**2)** A dust-collecting system required in Sentence (1) shall be designed in conformance with good engineering practice such as that described in NFPA 664,<br>"Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities,"<br>and the NFPA standards on dust explosion hazards, and shall<br>a) be made of noncombustible materials, and<br>b) not create sparks upon physical contact in the fan assembly.<br>(See Append ix A.)<br><br>**5.3.2.1. Exhaust Systems**<br>**1)** Every machine that produces wood dust, particles or shavings shall *be* provided with a blower and exhaust system installed in conformance with NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br>**2)** Operations or machines that generate sparks or combustible vapours shall not be served by exhaust systems connected to woodworking machines referred to in Sentence (1). |

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| | | extinguishing systems can be shown to be equally reliable to the abort gate, it can be used as a performance equivalent alternative design pursuant to Chapter 5.<br><br>**A.8.2.2.6.4.2(3)** Manual interaction at the abort gate is required so that the damper can be examined for any damage that could render it unsuitable for continued use. | |
| 12 | **Abort Gate** | NFPA 664(2012)<br>**8.2.2.6.4.2*** For dust collection systems of capacity greater than 2.4 m3/sec (5000 cfm), the following shall apply:<br>(1) The system shall be equipped with a listed spark detection system, designed and installed in conformance with the relevant sections of *NFPA 72, National Fire Alarm and Signaling Code*, located on the duct upstream from the dust collector and downstream from the last material entry point, or on the exhaust side of the dust collector, to detect fire entering or occurring within the dust collector, respectively, and<br>(2) The exhaust air duct conveying the recycled air back to the building shall be equipped with a high-speed abort gate activated by the spark detector in 8.2.2.6.4.2(1), and the abort gate shall be sufficiently fast to intercept and divert any burning material to atmosphere before it can enter the plant.<br>(3)*The abort gate is provided with a manual reset so that, after it has aborted, it can be reset to the normal position only by manual interaction at the damper; automatic or remote reset shall not be allowed. A powered reset is acceptable if it can be activated only by manual interaction at the damper location.<br><br>**A.8.2.2.6.4.2** Dust collection systems greater than 2.4 $m^3$/sec (5000 cfm) in capacity represent a greater inherent hazard and risk and were deemed to require the inherently greater reliability of an abort gate as opposed to extinguishing systems. Where extinguishing systems can be shown to be equally reliable to the abort gate, it can be used as a performance equivalent alternative design pursuant to Chapter 5.<br><br>**A.8.2.2.6.4.2(3)** Manual interaction at the abort gate is required so that the damper can be examined for any damage that could | For NFPA 664<br>**5.3.1.3. Dust-Collecting Systems**<br>**1)** Dust-collecting systems shall be provided to prevent the accumulation of dust and keep suspended dusts at a safe concentration inside a *building*.<br>**2)** A dust-collecting system required in Sentence (1) shall be designed in conformance with good engineering practice such as that described in NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities," and the NFPA standards on dust explosion hazards, and shall<br>a) be made of noncombustible materials, and<br>b) not create sparks upon physical contact in the fan assembly.<br>(See Append ix A.)<br><br>**5.3 .2.1. Exhaust Systems**<br>**1)** Every machine that produces wood dust, particles or shavings shall *be* provided with a blower and exhaust system installed in conformance with NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br>**2)** Operations or machines that generate sparks or combustible vapours shall not be served by exhaust systems connected to woodworking machines referred to in Sentence (1). |

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| | | render it unsuitable for continued use. | |
| 13 | **Sprinklers Inside Dust Collector** | NFPA 91<br>**7.1.7.1** Where both an explosion hazard and a fire hazard exist in an air–material separator, provisions for protection for each type of hazard shall be provided. | For NFPA 91<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include: NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 14 | **Sprinklers Inside Ducting** | NFPA 91<br>**9.1* General.** Any portion of an exhaust system utilizing combustible components or having the potential for combustible residue buildup on the inside, where the duct cross-sectional area is greater than or equal to 75 in.$^2$ (480 cm$^2$), shall be provided with an automatic extinguishing system within the duct and at the duct intake, hood, enclosure, or canopy.<br><br>**A.9.1** For additional information on these topics, please see the following NFPA standards:<br>(1) NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*<br>(2) NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*<br>(3) NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*<br>(4) NFPA 13, *Standard for the Installation of Sprinkler Systems*<br>(5) NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*<br>(6) NFPA 17, *Standard for Dry Chemical Extinguishing Systems*<br>(7) NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*<br>(8) NFPA 750, *Standard on Water Mist Fire Protection Systems*<br>(9) NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*<br><br>**9.2 Drainage.** When a sprinkler system is installed, means shall be provided to prevent water accumulation in the duct or flow of water back to a process subject that could be damaged by water. | For NFPA 91:<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include: NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 15 | **Dust Collector Filters/Cages Bonded** | NFPA 77<br>**15.9.2** Where combustible dusts are handled, the end-to-end resistance of boots and socks should be less than $10^6$ ohms, as measured using a megohmmeter. | Not mentioned in NFC |

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| | | **15.10.3** Filters and cages should be engineered so that a positive ground connection is always ensured during maintenance, even if personnel are inexperienced or inattentive. One way of ensuring this connection is by sewing two metal braids into the cuffs of the filters, 180 degrees apart. Each braid is continuous and is sewn up the inside of the cuff, across the top, and down the outside of the cuff. This method ensures that the braids always make a positive contact with the cage, the venturi, and the clamp and that such an arrangement withstands the rigors of the operation. In any case, the resistance between the cage and ground should be less than 10 ohms. | |
| 16 | **Ducting and Equipment Bonded** | NFPA 77<br>**15.7.2** Pipes and ducts should be metal and should be grounded. | |
| 17 | **Dust Collector Grounded** | *NOTE: This was an item brought forth by the Office of the Fire Marshall in Nova Scotia* | Not mentioned in NFC |
| 18 | **Level Sensor** | NFPA 68<br>**6.5.1*** The vent opening shall be free and clear.<br><br>**A.6.5.1** If the vent discharges into a congested area, the pressure inside the vented enclosure increases. A major blast pressure can be caused by the ignition of unburned gases or dusts outside the enclosure. If vents are fitted with closure devices that do not remain open after activation (i.e., self-closing), it should be recognized that a vacuum can be created where gases within the enclosure cool. Vacuum within the enclosure could result in equipment damage. | For NFPA 68:<br>**4 .9.4.2. Explosion Protection**<br>**1)** Processing equipment where an explosion hazard is present shall be<br>a) designed to withstand the explosion pressure without damage to the equipment,<br>b) provided with explosion venting in conformance with NFPA 68, "Explosion Protection by Deflagration Venting," or<br>c) provided with an explosion prevention system in conformance with NFPA 69, "Explosion Prevention Systems."<br><br>**5.3.1.6. Explosion Venting**<br>**1)** Except as provided in Article 5.3.1.7., an activity that creates an atmosphere containing significant concentrations of *combustible dusts* shall be located only in a *building* provided with explosion venting to the outdoors.<br>**2)** When explosion venting is required in this Section, it shall be designed to prevent critical structural and mechanical damage to the *building* in conformance with good engineering practice such as that described in NFPA 68, "Explosion Protection by |

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| | | | Deflagration Venting." (See A-3.2.8.2.(1)(d) in Appendix A.)<br><br>**5.3.1. 7. Explosion Prevention Systems**<br>**1)** In processes where an explosion hazard is present and conditions exist that prevent adequate explosion venting as required in this Section, an explosion prevention system shall be provided.<br>**2)** When an explosion prevention system is required in this Section, it shall be designed in conformance with good engineering practice such as that described in NFPA 69, "Explosion Prevention Systems."<br><br>**A-3.2.8.2.(1 )(d)** When a flammable mixture of air and vapour/gas/dust is ignited and causes an explosion, the exothermic reaction results in the rapid expansion of heated gases and the corresponding pressure waves travel through the mixture at sonic or supersonic velocities. The pressures developed by an explosion very rapidly reach levels that most buildings and equipment cannot withstand unless specifically designed to do so. Explosion venting consists of devices designed to open at a redetermined pressure to relieve internal pressure build-up inside a room or enclosure, hence limiting the structural and mechanical damage.<br><br>The major parameters to be considered in designing an explosion venting system for a building are:<br>• the physical and chemical properties of the flammable air mixture, such as the particle size or the droplet diameter, the moisture content, the minimum ignition temperature and explosive concentration, the burning velocity or explosibility classification, the maximum explosion pressure and the rate of pressure rise,<br>• the concentration and dispersion of the flammable mixture in the room,<br>• the turbulence and physical obstructions in the room,<br>• the size and shape of the room, the type of construction and its ability to withstand internal pressures, and<br>• the type, size and location of relief panels, which should also be designed to reduce the possibility of injury to |

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| | | | people in the immediate vicinity of the panels. |
| 19 | **Broken Bag Detector** | NFPA 654<br>**7.12.2 Combustible Particulate Solids.**<br><br>**7.12.2.1*** Where an explosion hazard exists, systems shall be designed in such a manner that combustible particulate solids do not pass through an AMD.<br><br>**A.7.12.2.1** The Committee is aware of installations of AMDs (electrical motor and impeller) inside the clean-air plenum of AMSs. Standard duty AMDs are not suitable for such service. Because of the potential for failure of the filter medium or other malfunction, the clean-air side of air-material separators should be considered as at least a Class II, Division 2, location with regard to proper installation of electrical equipment. NFPA 91 also addresses AMD materials of construction and clearances, including specific requirements where combustible materials could be present. | For NFPA 654<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include: NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 20 | **Dust Collector Condition**<br><br>*NOTE: This is not stated in NFPA as a set requirement, but the vessel must be able to withstand a set system pressure. If the vessel is in poor condition with holes and what not then chances are it will not be able to withstand the required pressure. Nothing can be determined for sure unless a finite element analysis is completed on the vessel, unless the vessel Pred is provided by the manufacturer.* | **Chapter 11 Inspection and Maintenance**<br>**11.1.2** Sections 11.4 through 11.11 shall be applied retroactively.<br><br>**11.2* Design Parameters and Documentation.** Data sheets, installation details, and design calculations shall be developed and maintained for each vent closure application, suitable for review by an **authority having jurisdiction** that verifies the vent area is sufficient to prevent deflagration pressure from exceeding the enclosure strength and identifies areas exposed to potential overpressure, event propagation, and fireball effects during venting.<br>Documentation shall include all of the following:<br>(1) Manufacturer's data sheets and instruction manuals<br>(2) Design calculations<br>(3) General specifications<br>(4) Vent closure specifications<br>(5) End user inspection/maintenance forms<br>(6) User documentation of conformity with applicable standards<br>(7) Vent closure identification | |

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| | *Note: this is covered under NFPA 68 S.11 – inspection and maintenance section* | (8) Combustible material properties test report<br>(9) Copy of vent identification label<br>(10) Process plan view<br>(11) Process elevation view<br>(12) Vent relief (pressure and fireball) path<br>(13) Proximity of personnel to vent relief path<br>(14) Mechanical installation details<br>(15) Electrical supervision (if provided) installation details<br>(16) Vent restraint installation and design documentation (if required)<br>(17) Process interlocks (if provided)<br>(18) Event deflagration isolation requirements (if required)<br>(19) Employee training requirements<br><br>**A.11.2** A sample vent closure information form is shown in Figure A.11.2.<br><br>**11.3 Installation.**<br>**11.3.1** Mounting frames shall be fabricated and mounted so that the vent closure is not stressed in any way that will contribute to fatiguing the vent closure.<br>**11.3.2** Vent closures shall be installed in accordance with the manufacturer's requirements.<br>**11.3.3** The final installation shall be inspected to verify its conformance to the design.<br>**11.3.4*** Vent closures shall be clearly marked as follows:<br>**WARNING:** Explosion relief device.<br><br>**A.11.3.4** For symbols, placement, and layout, refer to ANSI Z535, *Product Safety Signs and Labels*. | |
| 21 | **Ducting to SMACNA Standards**<br><br>*NOTE: unless otherwise classified with the approval of the AHJ, ducting transporting wood particulates shall be* | NFPA 654<br>**7.6 Duct Systems.**<br><br>**7.6.1** Ducts that handle combustible particulate solids shall conform to the requirements of NFPA 91 except as amended by the requirements of this chapter.<br><br>NFPA 91 | For NFPA 654:<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include: NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br><br>For NFPA 91: |

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| | *SMACNA Class III, spiral ducting prohibited.* | **4.3.2** The duct construction shall conform to the following applicable Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) standards:<br>(1) *Accepted Industry Practice for Industrial Duct Construction*<br>(2) *Rectangular Industrial Duct Construction Standard*<br>(3) *Round Industrial Duct Construction Standard*<br>(4) *Thermoplastic Duct (PVC) Construction Manual*<br>(5) *Thermoset FRP Duct Construction Manual*<br><br>**4.3.5** Laps in duct construction shall be in the direction of airflow. | **A-5.3.1.3.(2)** NFPA standards on dust explosions include:<br><br>NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 22 | **Hangers to SMACNA Standards** | NFPA 91(2015)<br>**4.6.1** Duct supports shall be designed to carry the weight of the duct half filled with material.<br><br>**4.6.2** Where sprinkler protection is provided or cleaning of the duct will be performed, the hanger's design shall include the weight of any expected liquid accumulation. | For NFPA 91:<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include:<br>NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities." |
| 23 | **Ducting Inspection Doors**<br><br>*NOTE: Only B applies to the actually installation of inspection doors. The other sections apply as well but for different items (such as bonding/grounding, venting etc)* | NFPA 91<br>**4.4.1*** A means shall be provided to inspect the system in accordance with Section 10.3.<br><br>**A.4.4.1** Access into ducts is required to perform intended inspection, to clean interior surfaces, and to service or replace devices located inside the duct.<br><br>NFPA 664<br>**8.2.2.2.1.9* Hazard Determination.** The dust accumulation hazard associated with the duct system shall be determined by means of a hazard analysis.<br>**(B)** Access doors, openings, or removable sections of ductwork shall be provided to allow inspection, cleaning, maintenance, and fire department access.<br><br>**A.8.2.2.2.1.9** Resinous woods such as southern yellow pine, spruce, and fir tend to yield wood dust that is tacky and can adhere to duct interiors. This is especially true on ducts serving abrasive planers and sanders, which also introduce heat input to the dust. Hardwoods such as maple, oak, hickory, and cherry lack | For NFPA 91:<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include:<br><br>NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids,"; NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br><br>For NFPA 664:<br>**5.3.1.3. Dust-Collecting Systems**<br>**1)** Dust-collecting systems shall be provided to prevent the accumulation of dust and keep suspended dusts at a safe concentration inside a *building*.<br>**2)** A dust-collecting system required in Sentence (1) shall be designed in conformance with good engineering practice such as that described in NFPA 664,"Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities," and the NFPA standards on dust explosion hazards, and shall<br>a) be made of noncombustible materials, and<br>b) not create sparks upon physical contact in the fan assembly. |

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| | | the resins of the soft woods and are much less likely to coat duct interiors with accumulated dust. | (See Append ix A.)<br><br>**5.3 .2.1. Exhaust Systems**<br>**1)** Every machine that produces wood dust, particles or shavings shall be provided with a blower and exhaust system installed in conformance with NFPA 664., "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br>**2)** Operations or machines that generate sparks or combustible vapours shall not be served by exhaust systems connected to woodworking machines referred to in Sentence (1). |
| 24 | **Additional Sensors**<br><br>*NOTE: Acceptable Engineering Practice:*<br><br>*According to the American Institute of Chemical Engineers (AIChE) states: "Recognized and generally accepted" good engineering practice (RAGAGEP) normally involves the application of engineering, operating or maintenance activities derived from engineering knowledge and industry experience based upon the evaluation and analyses of appropriate internal and external standards, applicable codes, technical reports, guidance, or recommended practices or documents of a similar nature. RAGAGEP can be derived from singular or multiple sources and will* | There is no section that states that additional sensors maybe required. However sometimes during audits there are light sensors or heat sensors and we like to note them to ensure the client is aware they are there and that they are being maintained.<br><br>NFPA refers to acceptable engineering practice which would require additional sensors such as level or flow sensors which may be required to verify the reliability and protection of explosion protection devices. An example would be a level sensor in the hopper of a dust collector to ensure that the dust level does not block the explosion vents or suppression sensors. | |

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| | *vary based upon individual facility processes, materials, service, and other engineering considerations.* | | |
| 25 | **Dust Accumulations** | NFPA 654<br>**6.1.1.1** Those portions of the process and facility interior where dust accumulations exist external to equipment in sufficient depth to prevent discerning the underlying contrasting surface color shall be evaluated to determine if a dust explosion hazard or flash-fire hazard exists.<br><br>**6.1.1.3*** Dust flash-fire or dust explosion hazard areas shall additionally be determined in accordance with any one of the following four methods:<br>(1) Layer depth criterion method in 6.1.3<br>(2) Mass method A in 6.1.4<br>(3) Mass method B in 6.1.5<br>(4) Risk assessment method in 6.1.6<br><br>**6.1.3* Layer Depth Criterion Method.** A dust flash-fire or dust explosion hazard area exists where the dust layer thickness measured external to process equipment exceeds the quantity determined in 6.1.3.1 and 6.1.3.2.<br><br>**6.1.4* Mass Method A.** A dust flash-fire or dust explosion hazard area exists when the total accumulated dust external to process equipment exceeds the quantities determined from the equations in 6.1.4.1 and 6.1.4.2.<br><br>**6.1.5* Mass Method B.** A dust flash-fire or dust explosion hazard area exists when the total accumulated dust external to process equipment exceeds the quantities determined from the equations in 6.1.5.1 and 6.1.5.2.<br><br>**6.1.6* Risk Assessment Method.** A documented risk assessment acceptable to the AHJ shall be permitted to be conducted to determine whether or where a dust explosion hazard or dust flash-fire hazard area exists. | For NFPA 654:<br>**A-5.3.1.3.(2)** NFPA standards on dust explosions include: NFPA 654, "Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids," NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br><br>For NFPA 664:<br>**5.3.1.3. Dust-Collecting Systems**<br>**1)** Dust-collecting systems shall be provided to prevent the accumulation of dust and keep suspended dusts at a safe concentration inside a *building.*<br>**2)** A dust-collecting system required in Sentence (1) shall be designed in conformance with good engineering practice such as that described in NFPA 664, "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities," and the NFPA standards on dust explosion hazards, and shall<br>a) be made of noncombustible materials, and<br>b) not create sparks upon physical contact in the fan assembly.<br>(See Append ix A.)<br><br>**5.3 .2.1. Exhaust Systems**<br>**1)** Every machine that produces wood dust, particles or shavings shall *be* provided with a blower and exhaust system installed in conformance with NFPA 664. "Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities."<br>**2)** Operations or machines that generate sparks or combustible vapours shall not be served by exhaust systems connected to woodworking machines referred to in Sentence (1). |

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| | | **A.6.1.1.3** For many situations, the layer depth method is the easiest and can be used for any application or ceiling height. Either of the mass methods can be used for any ceiling height. Mass method A does not require specific material properties or building strength data. Using mass method A for buildings with greater than 12 m ceiling height does not allow the user increased dust accumulation, compared to mass method B. Mass method B allows the owner/operator the greatest flexibility in addressing dust accumulations and takes into account specific building and material properties. However, this requires more detailed information about the building construction that might not be available for some buildings. When calculating dust loads by either method, include dust on mezzanines. When calculating the allowable volume or mass of dust, the area of the mezzanine is not added to the footprint of the building or room.<br><br>**8.1 Fugitive Dust Control.**<br><br>**8.1.1** Continuous suction to minimize the escape of dust shall be provided for processes where combustible dust is liberated in normal operation.<br><br>**8.2 Housekeeping.** All requirements of 8.2.1 through 8.2.3 shall be applied retroactively.<br><br>**8.2.1 Cleaning Frequency.**<br>**8.2.1.1*** Where the facility is intended to be operated with less than the dust accumulation defined by the owner/operator's chosen criterion in Section 6.1, the housekeeping frequency shall be established to ensure that the accumulated dust levels on walls, floors, and horizontal surfaces such as equipment,<br><br>**8.2.3 Portable Vacuum Cleaners.**<br>**8.2.3.1*** Portable vacuum cleaners that meet the following minimum requirements shall be permitted to be used to collect combustible particulate solids in unclassified (general purpose) areas:<br>(1) Materials of construction shall comply with 7.13.2 and 9.3.2. | |

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| | | (2) Hoses shall be conductive or static dissipative.<br>(3) All conductive components, including wands and attachments, shall be bonded and grounded.<br>(4) Dust-laden air shall not pass through the fan or blower.<br>(5) Electrical motors shall not be in the dust-laden air stream unless listed for Class II, Division 1, locations.<br>(6)* When liquids or wet material are picked up by the vacuum cleaner, paper filter elements shall not be used.<br>(7) Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484.<br><br>**8.2.3.2*** In Class II electrically classified (hazardous) locations, vacuum cleaners shall be listed for the purpose and location or shall be a fixed-pipe suction system with remotely located exhauster and AMS installed in conformance with Section 7.13 and shall be suitable for the dust being collected.<br><br>**8.2.3.3** Where flammable vapors or gases are present, vacuum cleaners shall be listed for Class I and Class II hazardous locations.<br><br>**Chapter 9 Ign 8.2.3 Portable Vacuum Cleaners.**<br>**8.2.3.1*** Portable vacuum cleaners that meet the following minimum requirements shall be permitted to be used to collect combustible particulate solids in unclassified (general purpose) areas:<br>(1) Materials of construction shall comply with 7.13.2 and 9.3.2.<br>(2) Hoses shall be conductive or static dissipative.<br>(3) All conductive components, including wands and attachments, shall be bonded and grounded.<br>(4) Dust-laden air shall not pass through the fan or blower.<br>(5) Electrical motors shall not be in the dust-laden air stream unless listed for Class II, Division 1, locations.<br>(6)* When liquids or wet material are picked up by the vacuum cleaner, paper filter elements shall not be used.<br>(7) Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484.<br>**8.2.3.2*** In Class II electrically classified (hazardous) locations, vacuum cleaners shall be listed for the purpose and location or shall be a fixed-pipe suction system with remotely located | |

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| | | exhauster and AMS installed in conformance with Section 7.13 and shall be suitable for the dust being collected.<br>**8.2.3.3** Where flammable vapors or gases are present, vacuum cleaners shall be listed for Class I and Class II hazardous locations.<br><br>NFPA 664<br>**11.2 Cleanup Methods.**<br><br>**11.2.1 Removal of Dust.**<br>**11.2.1.1*** Surfaces shall be cleaned in a manner that minimizes the generation of dust clouds. Blowing down with steam or compressed air or even vigorous sweeping shall be permitted only if the following requirements are met:<br>(1) The floor area and equipment shall be vacuumed prior to blowdown.<br>(2) Electrical power and other sources of ignition shall be shut down, removed from the area, or classified for use in dusty areas per *NFPA 70, National Electrical Code*.<br>(3) Only a low gauge pressure of 103 kPa (15 psi) steam or compressed air shall be used.<br>(4) No open flames, sparks from spark-producing equipment, or hot surfaces capable of igniting a dust cloud or layer shall exist.<br>(5) All fire protection equipment shall be in service.<br><br>**A.11.2.1.1** Sweeping and/or vacuuming are the preferred methods to be utilized. Blowing down with steam or compressed air, or even vigorous sweeping, produces dust clouds. Facilities should not be operating during blowdown. Blowdown should be done in individual sections of the building, starting near the center and working out, in order to prevent filling the entire building with dust-laden air. Blowdown should be frequent enough that large amounts of dust are not blown into suspension. In some cases, the use of spark-resistant tools might be advisable.<br><br>**11.2.1.2*** Unless the conditions stipulated in 11.2.1.3 are met, portable vacuum cleaners shall be listed for use in Class II hazardous locations or shall be a fixed-pipe suction system with remotely located exhauster and air-material separator dust collector installed in conformance with Chapter 11. | |

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| | | **A.11.2.1.2** Unapproved portable vacuum cleaning equipment can be used if the powered suction source is located in a remote, unclassified area. | |

## Additional Information

**NFPA 664-12**

**1.1.2*** The requirements contained in Chapters 4, 5, 6, 7, 8, and 9 shall not apply to woodworking operations that occupy areas smaller than 465 $m^2$ (5000 $ft^2$), and where dust-producing
equipment requires an aggregate dust collection flow rate less than 2549 $m^3$/hr (1500 $ft^3$/min).

**A.1.1.2** Specific criteria in this standard are advisable for facilities that fall outside this document's scope. A hazard and risk analysis should be performed to identify areas where specific criteria are appropriate.

**3.3.26 Wood-Derived Materials.** These materials include but are not limited to sawdust, sanderdust, planer shavings, hoggings, wood flour, and moulder waste.

**3.3.27 Wood Dust**.

**3.3.27.1* Deflagrable Wood Dust**. Wood particulate that will propagate a flame front, thus presenting a fire or explosion hazard, when suspended in air, or the process-specific oxidizing medium over a range of concentrations, regardless of particle size or shape; wood particulate with a mass median particle size of 500 µm or smaller, having a moisture content of less than 25 percent (wet basis).

**A.3.3.27.1 Deflagrable Wood Dust.** Dusts traditionally have been defined as a material 420 µm or smaller. More recent data on wood particulates suggests that particulates with a major dimension as large as 5 mm (0.2 in.) could pose a deflagration hazard. Particulate surface area-to-volume ratio is a key factor in determining the rate of combustion. For consistency, with more recent test data and other standards, 500 µm is now considered an appropriate size criterion. The particle surface area-to-volume ratio is a key factor in determining the rate of combustion. Combustible particulate solids with a minimum dimension more than 500 µm generally have a surface-to volume ratio that is too small to pose a deflagration hazard. Flat platelet-shaped particles, flakes, or fibers with lengths that are large compared to their diameter usually do not pass through a 500 µm sieve, yet could still pose a deflagration hazard. Many particulates accumulate electrostatic charge in handling, causing them to attract each other, forming agglomerates. Often agglomerates behave as if they were larger particles, yet when they are dispersed they present a significant hazard. Therefore, it can be inferred that any particle that has a major dimension as large as 5 mm (0.2 in.) could behave as a deflagrable wood dust if suspended in air. It is critical to keep in mind that as particulate is processed, handled, or transported, the particle size generally decreases due to particle attrition. The determination of whether a sample of material is a combustible (explosible) dust should be based on a screening test methodology such as provided in the draft ASTM E1226, Standard Test Method for Explosibility of Dust Clouds. Alternatively, a standardized test method such as ASTM E1515, Standard Test Method for Minimum Explosible Concentration of Combustible Dusts, can be used to determine dust explosibility. There is some possibility that a sample will result in a false positive in the 20 L sphere when tested by the ASTM E1226 screening test or ASTM E1515 test. This is due to the high energy ignition source over-driving the test. When the lowest ignition energy allowed by either method still results in a positive result, the owner/operator can elect to determine whether the sample is a combustible dust with screening tests performed in a larger scale (1 $m^3$) enclosure, which is less susceptible to over-driving and thus will provide more realistic results. This possibility for false positives has

been known for quite some time and is attributed to over-driven conditions that exist in the 20 L chamber due to the use of strong pyrotechnic igniters. For that reason, the reference method for explosibility testing is based on a 1 $m^3$ chamber, and the 20 L chamber test method is calibrated to produce results comparable to those from a 1 $m^3$ chamber for most dusts. In fact, the U.S. standard for 20 L testing (ASTM E1226) states: "The objective of this test method is to develop data that can be correlated to those from the 1 $m^3$ chamber (described in ISO-6184/1 and VDI 3673)…." ASTM E1226 further states: "Because a number of factors (concentration, uniformity of dispersion, turbulence of ignition, sample age, etc.) can affect the test results, the test vessel to be used for routine work must be standardized using dust samples whose $K_{St}$ and $P_{max}$ parameters are known in the 1 $m^3$ chamber." NFPA 68 also recognizes this problem and addresses it, stating: "The 20 L test apparatus is designed to simulate results of the 1 $m^3$ chamber; however, the igniter discharge makes it problematic to determine $K_{St}$ values less than 50 bar-m/sec. Where the material is expected to yield $K_{St}$ values less than 50 bar-m/sec, testing in a 1 $m^3$ chamber might yield lower values." Any time a combustible dust is processed or handled, a potential for deflagration exists. The degree of deflagration hazard varies depending on the type of combustible dust and the processing methods used. A dust deflagration has the following 4 requirements:

(1) Combustible dust
(2) Dust dispersion in air or other oxidant
(3) Sufficient concentration at or exceeding the minimum explosible concentration (MEC)
(4) Sufficiently powerful ignition source, such as an electrostatic discharge, an electric current arc, a glowing ember, a hot surface, welding slag, frictional heat, or a flame

If the deflagration is confined and produces a pressure sufficient to rupture the confining enclosure, the event is, by definition, an "explosion." Evaluation of the hazard of a combustible dust should be determined by the means of actual test data. Each situation should be evaluated and applicable tests selected. The following list represents the factors that are sometimes used in determining the deflagration hazard of a dust:

(1) Minimum explosible concentration (MEC)
(2) Minimum ignition energy (MIE)
(3) Particle size distribution
(4) Moisture content as received and as tested
(5) Maximum explosion pressure at optimum concentration
(6) Maximum rate of pressure rise at optimum concentration
(7) $K_{St}$ (normalized rate of pressure rise) as defined in ASTM E1226
(8) Layer ignition temperature
(9) Dust cloud ignition temperature
(10) Limiting oxidant concentration (LOC) to prevent ignition
(11) Electrical volume resistivity
(12) Charge relaxation time
(13) Chargeability

Consequently, it is often necessary to evaluate the explosibility of the particulate at multiple points along the process. Where process conditions dictate the use of oxidizing media other than air (nominally taken as 21 percent oxygen and 79 percent nitrogen), certain of the above tests should be conducted in the appropriate process specific medium.

**3.3.27.2 Dry Nondeflagrable Wood Dust.** Wood particulate with a mass median particle size greater than 500 µm, having a moisture content of less than 25 percent (wet basis).