

3. Coal pneumatic cleaning plants (No. 653)
4. Plastics industry (No. 654)
5. Flour and feed mills (No. 61C)
6. Pulverized-fuel systems (No. 60)
7. Confectionery plants (No. 657)
8. Spice-grinding plants (No. 656)
9. Starch factories (No. 61A)
10. Sugar- and cocoa-pulverizing systems (No. 62)
11. Sulfur dust (No. 655)
12. Terminal grain elevators (No. 61B)
13. Suggested good practices for the application of suction and venting for the control of dust in grain elevators and storage units (No. 661)
14. Country grain elevators (No. 64)
15. Wood-flour manufacturing establishments (No. 662)
16. Woodworking plants (No. 663)
17. Aluminum processing and finishing (No. 65)

Other pertinent NFPA standards and pamphlets are:

1. Standard for fire and explosion prevention by inerting (No. 69)
2. Pamphlets on combustible metals
3. Guide for explosion venting (No. 68)
4. Pamphlet on static electricity
5. National electrical code

Important recommendations in these codes include:

1. All possible ignition sources should be eliminated from equipment containing flammable dust and from areas surrounding such equipment. This means prohibiting open flames or lights and smoking; avoiding the use of electric or gas cutting or welding equipment for repair work, unless dust-producing machinery in that part of the plant is shut down and the vicinity is entirely dust-free; grounding all machinery capable of producing static electrical sparks; providing conduits for electric wiring and locating switches and motors outside, or using dustproof types; adhering strictly, in installing wiring and electrical equipment to the rules of the National Electrical Code pertaining to hazardous locations; using magnetic separators to prevent entrance of hazardous materials to dust-grinding mills; using nonferrous blades in fans through which dust passes; and avoiding the use of high-speed shafting and belts wherever possible.

2. Buildings should be constructed to avoid the collection of dust on beams, ledges, and other surfaces, particularly overhead. Good housekeeping is a prime essential in preventing dust accumulation and dissemination. In removal of dust from exposed surfaces, vacuum cleaning is preferable, although soft push brooms may be used without serious hazard; for highly flammable dusts industrial vacuum cleaners of approved design are recommended. Use of compressed air for dust removal is highly dangerous. Buildings in which flammable dusts are produced or stored should be detached units of incombustible construction, including inside partitions; and hazardous areas within buildings should be separated by substantial fire walls.

3. Equipment wherein dust clouds may be produced, such as grinders, conveyors, elevators, or collectors, should be as dust-tight as possible; it should have

the smallest practical interior volume; and it should be constructed strong enough to withstand explosion pressures from dust.

4. Properly designed and proportioned and properly distributed vents, in the form of unrestricted openings if possible; hinged windows, panels, or light wall construction in rooms; and the use of release diaphragms or other vent closures in equipment will release explosion pressures without damage.

In recent years much work on venting has been performed by the Bureau of Mines¹⁸⁻²⁰ in explosion galleries of several sizes. The pressure-release requirements of various dusts have been determined with unrestricted vents (Figure 8), and the relative effectiveness of numerous diaphragms was studied.¹⁹ Many of the data

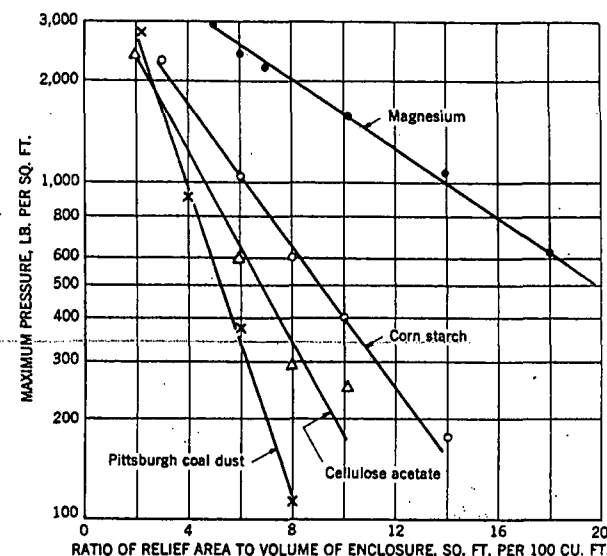


Figure 8. Effect of unrestricted relief vents on pressures developed by dust explosions in 1 cubic foot test gallery. (Courtesy Bureau of Mines, U. S. Department of the Interior.)

on venting through ducts of various shapes and sizes, effects of bends in ducts, secondary vents in ducts, flame speeds in ducts, quenching of explosions in ducts, and quenching during the incipient stages of ignitions have not been published yet, and the research is in fact still being continued.

¹⁸ I. Hartmann and J. Nagy, *U. S. Bur. Mines Rept. Invest. No. 3924*, 1946.

¹⁹ I. Hartmann, Pressure release for dust explosions, *Natl. Fire Protect. Assoc. Quart.*, **40**, 47-53 (July, 1946).

²⁰ J. Nagy, J. E. Zeilinger, and I. Hartmann, *U. S. Bur. Mines Rept. Invest. No. 4636*, 1950. See also I. Hartmann, *Chem. Eng. Progr.*, **53**, 107M (1957); I. Hartmann and J. Nagy, *Ind. Eng. Chem.*, **49**, 1734 (1957).