

NFPA No.

664

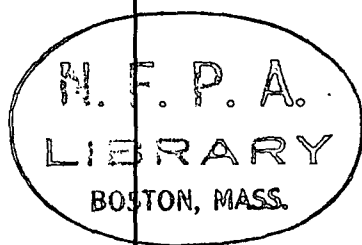
ANSI Z12.20
(R1969)

DUST EXPLOSION PREVENTION

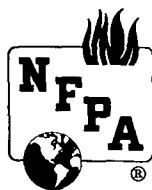
WOODWORKING WOOD FLOUR PLANTS 1971

An American National Standard

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Official NFPA Definitions

Adopted Jan. 23, 1964; Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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SHOULD is intended to indicate recommendations or that which is advised but not required.

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**Standard for the Prevention of Dust Explosions in
Woodworking and Wood Flour
Manufacturing Plants**

NFPA No. 664 — 1971

1971 Edition of No. 664

This edition, which is the same as the 1962 edition, was reaffirmed by the Dust Explosion Hazards Committee in 1969, and was adopted at the 1971 Annual Meeting.

Origin and Development of No. 664

NFPA activity in the field of wood dust explosion hazards dates from 1930, when work on a Code on Wood Flour Manufacturing (No. 662) was initiated. The first edition was adopted in 1931, and subsequent editions were issued in 1940, 1942, 1946, and 1949. A separate Code on Woodworking Plants (No. 663) was added in 1934, and reissued in 1952 and 1959. In 1960 these two codes were combined in a new Code for the Prevention of Dust Explosions in Woodworking and Wood Flour Manufacturing Plants (No. 664), and a revised edition was adopted in 1962.

The 1971 edition of this standard was approved by the American National Standards Institute as an ANSI Standard Z12.20 on Nov. 14, 1969.

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SCOPE: The prevention of dust explosions in connection with processes and industries producing combustible or explosive dusts, including measures for the prevention of ignition, restriction of potential damage by proper construction and arrangement of buildings, restriction of the production and escape of dust through the control of dust-producing processes and equipment, extinguishing methods, and related features. Fire prevention and extinguishing are included, since dust explosions may result from fire.

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**Standard for the Prevention of Dust Explosions in
Woodworking and Wood Flour
Manufacturing Plants**

NFPA No. 664 — 1971

Introduction

1. Object.

This standard has two principal objects—first, to prevent dust explosions and minimize the resulting damage should an explosion occur; and second, to provide standards for minimizing fire hazards.

2. Application.

This standard is intended to apply to new construction and to plants to be rebuilt or remodeled. It is recommended that wherever possible, existing installations be modified to conform to these standards.

3. Scope.

This standard is intended to cover the hazards involved in the production of finely divided wood particles in the course of woodworking operations, the removal of these particles from the point of operation, and their subsequent disposal. It has been expanded to include wood flour manufacturing hazards.

It should serve as a supplement to the present Safety Code for Woodworking Machinery (ANSI O1.1-1954* (R1961)), which covers primarily "point of operation" hazards. In the case of exhaust systems and collecting equipment, NFPA No. 91, Standard for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying, shall apply together with this standard.

*Available from the American National Standards Institute, 1430 Broadway, New York, N. Y. 10017.

4. Good Housekeeping.

Good housekeeping and clean premises are the first essentials in the elimination of the dust explosion hazard, consequently this standard is not intended to lessen in any way the responsibility of the owner or operator in this respect.

5. Definitions.

In this standard the following words are used as defined below:

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction in the enforcement of standards.

PULVERIZING DEPARTMENT refers to that portion of the plant in which the pulverizing processes are carried on. The equipment usually consists of mills or pulverizers, in conjunction with which may be used bolters or screens, separators or dust collectors, spouts and conveying apparatus.

PART A—WOODWORKING PLANTS

Chapter 10. Location and Structural Features

101. Location.

1011. As great a space as is practicable should be provided between the various buildings of the plant to prevent spread of fire. Where this cannot be accomplished, adequate segregation shall be provided to prevent spread of fire (see Articles 102 and 103).

102. Construction.

1021. In view of the combustible nature of the contents of woodworking plants, the buildings should be of fire-resistive construction, heavy timber construction, or non-combustible construction.

1022. Where structural steel is used in the building construction, and where work in progress, material in storage, wood waste or other combustible material is present in quantity sufficient to produce a serious fire and such material is not protected by automatic sprinklers, all such structural steel should be protected by approved fireproofing.

1023. Adequate precautions shall be taken to prevent the spread of fire from one section of the plant to another. This shall include the erection of adequate fire walls, the elimination of all unnecessary openings between sections or floors, and the proper protection of all necessary horizontal or vertical openings to prevent spread of fire.

103. Communications.

1031. Where it is necessary for separate buildings of the plant to adjoin, they shall be separated by an approved fire wall.

1032. Communicating openings in masonry fire walls shall be equipped with approved fire doors in accord with NFPA No. 80, Standard for Fire Doors and Windows. All fire doors shall have self-closing devices.

1033. All other openings in fire walls, e.g., openings for material handling equipment, should be protected by approved fire doors or shutters in accordance with NFPA No. 80.

104. Stairways, Elevators and Fire Escapes.

1041. In buildings all stairways and elevators shall be enclosed as recommended in NFPA No. 220, Standard Types of Building Construction.

1042. Doors of the self-closing type, or closed from within by the elevator operator, shall be provided at each landing.

1043. An exterior fire escape of the stair type with landings at each floor level or enclosed stairway or smokeproof tower shall be provided from the roof of the building to the ground.

1044. All fire escape doors and exit doors shall swing in the direction of exit travel.

1045. All exits shall comply with NFPA No. 101, the Life Safety Code.

Chapter 11. Dusty Areas

111. Explosion Venting.

1111. In sections of the plant where excessive dust is generated, accumulated or present in suspension in the air, explosion venting shall be provided in a portion of the exterior wall (or walls) or roof. See NFPA No. 68, Guide for Explosion Venting.

112. Surfaces and Ledges.

1121. Interior surfaces shall be as smooth as practicable.

1122. Horizontal surfaces and all pockets and ledges shall be minimized.

1123. Inaccessible surfaces which must necessarily exist shall be inclined as steeply as possible to minimize dust accumulation, preferably not less than 45 degrees from the horizontal.

113. Housekeeping.

1131. Good housekeeping is a must in the prevention of dust explosions. See Chapter 17.

Chapter 12. Wood Waste Exhaust System and Collecting Equipment

121. Exhaust System.

1211. One or more exhaust systems shall be provided. Each exhaust system shall consist of branch pipes connected to hoods or enclosures, one or more headers, air flow producing equipment and discharge stack to the out-of-doors, and means for separating the entrained wood particles from the air flowing in the system. For detailed information as to proper installation of exhaust systems, see NFPA No. 91, Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying.

122. Hoods and Enclosures.

1221. LOCATION. All cutting, shaping, planing, sanding, or other machines which produce finely divided wood particles or shavings shall be provided with adequate exhaust hoods or enclosures.

1222. DESIGN. Exhaust hoods or enclosures shall be so designed, located and placed that the finely divided wood particles or shavings generated will fall or be projected or drawn into the hood or enclosures in the direction of the air flow and so as to provide the greatest possible enclosure in the zone of wood particle generation without interfering with the safe and satisfactory operation of the machine.

1223. MATERIAL. All hoods and enclosures shall be constructed of metal. If the exhaust hood or enclosure also must act as a safety guard, the construction, strength and material specifications must be such as also to guard the machine adequately.

1224. AIR FLOW. The rate of air flow into every hood and enclosure shall be sufficient to control the wood particles or shavings and cause them to be carried into the exhaust outlet.

123. Exhaust Piping System.

1231. PIPING. The entire exhaust system shall be properly designed for minimum resistance to air flow. Each exhaust outlet of the hoods or enclosures and every branch pipe and every section of header pipe shall be sized for not less than the minimum air velocity and volume required to pick up the wood particles and transport them through the exhaust piping and to the air cleaning equipment.

1232. CAPACITY OF SYSTEM. For proper performance and efficiency the capacity of the exhaust system shall be calculated on the basis of all hoods and floor sweeps connected to the system being open.

1233. DAMPERS AND GATES. The use of dampers or gates or orifice plates shall not be permitted in the exhaust system unless provided for the specific purpose of balancing the air flow in the system and then they shall be riveted or permanently fastened to prevent any further manipulation.

1234. FLOOR SWEEPS. In addition to the exhaust intakes at the individual machines, connections to the exhaust system shall be provided at the floor level in convenient locations to provide for the removal of such fine material as may accumulate around the machines and be swept up. Floor sweeps shall be open at all times.

1235. MATERIAL. Exhaust piping shall be of proper gage galvanized sheet steel or black sheet steel protected against corrosion, or of other noncombustible materials of equal strength, corrosion and abrasion resisting properties. Piping shall be properly supported.

124. Air Cleaning Equipment (Separators).

1241. REQUIREMENTS. The exhaust system shall be provided with air cleaning equipment (separator or collector) of sufficient size and capacity to separate the wood particles from the air before the air is vented to out-of-doors. The air cleaning equipment shall be of all-metal construction and the capacity and operating characteristics and collection efficiency shall be such as to insure its continuous operation without loss of efficiency of the exhaust system.

125. Air Flow Producing Equipment.

1251. SIZE AND CAPACITY. The exhaust system shall be connected to an exhaust fan or air flow producing equipment that will maintain the required rate of air flow in all parts of the exhaust system and shall be of a type and size suitable for handling the wood particles or shavings being exhausted. Where conditions permit, the exhaust fan shall be located beyond the air cleaning equipment so as to handle the cleaned air.

126. Exhausting Dissimilar Matter.

1261. Woodworking exhaust systems shall be restricted to handling wood wastes and under no circumstances shall an operation generating sparks, such as from grinding wheels, be connected to a woodworking exhaust system.

Chapter 13. Wood Waste Disposal

131. Refuse.

1311. Refuse from collectors shall discharge into storage vaults through means that will minimize the raising of dust clouds. The discharge arrangement shall be through a dust-tight metal enclosure and shall be provided with an effective choke to prevent flashback in case of dust explosion or fire. A combination of dust-tight chute and screw conveyor with a choke section in the conveyor makes a preferable arrangement.

132. Wood Scrap.

1321. Wood scrap, blocks, ends, etc., may be collected in vaults, portable trucks or, where the quantity justifies, by belt conveyors and transferred to a central storage. If the wood is disposed of as collected without further breaking up, no special precautions are required.

133. Storage Vaults for Wood Waste.

1331. Vaults used for the collection and storage of sawdust, shavings, or hogwood should, wherever possible, be isolated from the plant proper.

1332. When the plant arrangement prevents the isolation of such vaults, they shall be so designed and constructed as to provide a complete fire and explosion cut-off between them and adjacent plant areas and the vault structure shall be protected by adequate means for pressure release as specified in Section 1335 to prevent its destruction in the event of an explosion.

1333. If the vault is so located that at least one wall is flush with an outside wall of the building, then this wall shall be of light construction, and provided with vents as specified in Section 1335. The remaining walls of the vault shall be strong fire- and explosion-resistant construction.

1334. Where plant conditions make it more suitable, the vault may be built with all four walls of strong fire- and explosion-resistant construction and the vault top of light construction and provided with vents as specified in Section 1335.

1335. All vaults shall be provided with explosion relief to conform with NFPA No. 68, Guide for Explosion Venting.

134. Hogs for Scrap Wood.

1341. If the scrap wood is to be processed by hogs delivering small chips and shredded product for use as fuel or for other purposes, the material shall be transferred to storage vaults, conforming to Article 133. This material should preferably be transferred through a closed chokefeed conveyor to a separate storage vault used only for this material.

1342. If an air transfer system is used for the hog wood, each hog shall discharge through a separate fan to a separate collector. Each collector shall discharge to the hog wood storage vault.

1343. If the scrap wood is to be processed by mills delivering a pulverized product, the requirements of Part B—Wood Flour Manufacturing shall be observed.

135. Disposal from Storage Vaults.

1351. REMOVAL FROM PREMISES. If the finely divided wood particles in the vaults, either the hog wood vault or the vaults used for the wood dust from the plant, are to be disposed of by removal from the premises, provision should be made for loading without releasing excessive quantities of dust to the air.

1352. USED AS FUEL. If the finely divided wood particles are to be used as fuel the vault or vaults should discharge through a conveyor to magazines at each furnace where the wood fuel is to be used. The discharge system shall be so designed that either by means of a choke feeder or choke conveyor, a positive cut-off is provided to prevent a flashback from the magazine to the vault. The operation of vaults should be so controlled that their outlets will be at all times covered with the fuel to a depth of at least a foot as an added means of preventing a flashback.

136. Magazine Feeders.

1361. DESIGN. The discharge from feed magazines to furnaces shall be so designed that either by means of a choke feeder or choke conveyor, a positive cut-off is provided between the furnace and the magazine. The installation of a steam spray in the discharge line from the magazine to the furnace blowing steam in the direction of the fuel flow is recommended, as it provides an added safety factor in preventing a flashback.

1362. CONTROL. The operation of the magazines should be so controlled that their outlets will at all times be covered with the fuel to a depth of at least a foot.

1363. VENTING. Each magazine shall be equipped with a vent duct leading as directly as possible to the outside air and provided with a swinging cap or damper so designed as to be normally closed but to open freely in the event of development of excessive pressure in the magazine. The area of this vent at the magazine and throughout its length shall be at least one square foot for every 80 cubic feet of magazine volume.

137. Incinerators.

1371. Where wood waste is disposed of in incinerators, NFPA No. 82, the Standard on Incinerators and Rubbish Handling, shall apply.

PART B—WOOD FLOUR MANUFACTURING

Chapter 14. Location and Structural Features

141. Location.

1411. The processes of pulverizing should preferably be carried on in a detached building used for no other purpose and located at a safe distance from other property.

1412. If it is necessary to locate the pulverizing building so as to expose other buildings, walls between the pulverizing building and other buildings should be blank, parapeted and have a fire resistance of four (4) hours. Walls of pulverizing building, except as noted, shall be of light noncombustible materials.

1413. If, owing to the layout of the plant, the processes cannot be carried on in a location as recommended in Section 1411, the portion of the plant devoted to pulverizing processes shall be segregated in such manner as to minimize the possibility of an explosion or fire reaching other portions of the plant.

142. Construction.

1421. When the pulverizing processes are carried on in locations as designated in Section 1413, such buildings shall be of fire resistive construction or noncombustible construction. (See NFPA No. 220, Standard Types of Building Construction.)

1422. Buildings of protected noncombustible construction shall not exceed two (2) stories in height, and buildings of unprotected noncombustible construction shall not exceed one (1) story in height.

1423. Walls, floors and ceilings separating the pulverizing department from the rest of the building shall be constructed to resist the force of an explosion.

1424. Surfaces and ledges shall be in accord with Article 112.

143. Communications.

1431. Access to the pulverizing department should be from the outside. On floors above the ground floor, this can be accomplished by means of balconies. Where this is not feasible and direct communications are required, these shall be protected in accordance with requirements of NFPA No. 80, Standard for Fire Doors and Windows.

1432. Doors should swing outward from the room unless safe egress is provided to the outer air in which case standard automatic sliding fire doors, normally kept closed, shall be used to protect these openings.

1433. Individual motor drive of approved dustproof design is preferable. Where power is transmitted to apparatus within the room from any driving mechanism or unit, outside of the pulverizing department, the transmission medium (belt or chain) shall be encased both inside and outside of the pulverizing department in practically dust-tight enclosures, constructed of substantial noncombustible material. Where power is transmitted by means of shafts, these shall pass through close fitting shaft holes in walls or partitions.

1434. All pipe openings through walls or partitions shall be tight.

1435. Conveyors, spouts, chutes, and elevator enclosures shall be of substantial metal construction and practically dust tight.

1436. With the exception of spouts and conveyors for raw material or for finished product in bulk, no conveyors, spouts, chutes, etc., shall pass through any of the walls or floors separating the pulverizing department from other portions of the building unless such conveyors, etc., are provided with a positive choke at a point immediately inside of the wall of the pulverizing department. When the finished product is delivered from the pulverizing department through spouts, it shall be conveyed from the apparatus, hoppers or bins within the pulverizing department to the spouts by means of screw conveyors from which a portion of the blade equivalent to at least one diameter of the screw has been omitted and

pins substituted therefor, or an equally effective means of producing a "choke" between the delivery section of the apparatus and the spout shall be provided (Sections 1513 and 1525).

1437. Air may be used for conveying raw material to supply bins in the pulverizing department but it shall not be used for conveying material directly to the pulverizers nor for conveying the finished product from the pulverizing department to other departments of the plant nor for conveying material within the pulverizing department except between the pulverizers and separators where air currents generated within the mills or by fans operated in conjunction with the mills are generally used. (See NFPA No. 91, Standard for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.)

144. Explosion Venting.

1441. Explosion venting of the pulverizing department shall be provided in accordance with NFPA No. 68, Guide for Explosion Venting.

Chapter 15. Material Handling and Process Equipment

151. General Requirements.

1511. All equipment shall be properly and securely installed to insure constant true alignment and to avoid hot bearings or friction and no moving parts such as belts, pulleys, drive chains, fan blades, etc., shall be fitted close to or come in contact with any part of the enclosures or the structure.

1512. Equipment should preferably be installed and arranged in unit systems so that each pulverizer will deliver to but one set of scalpers and bolters; inter-connections between sets of equipment should not be permitted, unless the material passing from one unit to another is conveyed through screw conveyors containing positive chokes. (See Section 1436.)

1513. All equipment shall be provided with devices which will minimize the amount of dust in the atmosphere and shall be provided with such devices as will prevent ignition, or confine the result of ignition.

1514. Ball or roller bearings should be used whenever practical and all bearings shall be of a dust tight design. Bearings in dusty and inaccessible locations where over-heating of bearings may cause fire or explosion should be provided with approved journal alarms.

1515. Where inspection openings are required in the equipment, the openings shall be provided with wire mesh screens of not less than four meshes to the inch.

1516. Static electricity shall be removed from such machines or equipment as accumulate a charge by permanent ground wires, and from belts by grounded metal combs or other equally efficient systems. Grounds shall be attached to equipment and to the earth in accordance with the recommendations of NFPA No. 77, Static Electricity.

152. Material Handling Equipment.

1521. CONVEYORS. Screw conveyors shall be fully enclosed in tight, substantial metal housings; if the tops of these housings are removable, they shall be well secured. (This should not be understood to prohibit the use of pressure relief vents at the discharge end of the conveyor.)

1522. SEPARATORS. Approved magnetic separators of the permanent magnet or self-cleaning electro-magnetic types or approved pneumatic separators shall be installed ahead of mills and pulverizers. The installation shall be of sufficient size and proper design to insure the removal of all ferrous material from the substance to be ground. One separator if of sufficient size and strength, may serve a group of mills.

1523. MILL OR PULVERIZER FEED. If the material is dumped into a delivery hopper from a floor above the mill or pulverizer, such hopper shall have a curbing at least 6 inches above the floor.

1524. MILL OR PULVERIZER DELIVERY. The mills shall either discharge the pulverized product directly through spouts or screw conveyors into screens, bins, or bulk containers, or the product may be discharged from the mills by air currents set up by the centrifugal force of the blades or beaters and an enclosed fan, or the pulverized product may be removed by means of an exhaust fan.

1525. Mills delivering directly through spouts should be provided with devices in or underneath the discharges which retard the flow of product in such a manner as to keep a small space immediately underneath or near the discharge filled up with the pulverized product, thus smothering any spark that may originate in the mill. This can be effected either by means of a revolving choke valve, or if material is delivered directly into the screw conveyor, by omitting a small portion of the blade and substituting pins therefor.

Chapter 16. Dust Control

161. Control and Removal of Suspended Dust.

1611. All dust producing equipment shall be of dust-tight construction or the equipment and dust producing operations shall be provided with dust-tight enclosures or properly designed and arranged hoods, connected to one or more mechanical exhaust systems which shall provide efficient dust control and conform with Chapter 12 and the following:

1612. Blowers or exhaust fans shall be installed on proper foundations and secured in a substantial manner. Where practicable the exhaust fan shall be located beyond the collector. When located between the collector and the pulverizing apparatus or any portion thereof from which the dust is to be removed, the blades and spider should be of bronze or other nonsparking metal, or the casing consist of or be lined with similar material. Ample clearance shall be provided between the blades and the casing. The fan bearings shall not extend into the casings. (See NFPA No. 91, Standard for the Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.)

1613. Screens (scalpers, bolters, etc.) shall have their reels or sieves in dust-tight enclosures. When connected to dust collectors, the ducts shall be of metal, and the collectors shall be properly vented to the outside of the building.

1614. All dust collectors (except those of cloth type) shall be constructed throughout of noncombustible materials. Cloth type collectors should be provided with dust-tight metal enclosures or their equivalent. The fabric of cloth type collectors should be electrically grounded in an effective manner. (See Section 1516.)

1615. All dust collectors used in connection with the pulverizing system should be located on the roof, in segregated sections of the plant or in separate buildings. If this is not possible they shall be located within the pulverizing department and shall be properly vented to a safe point outside of the building.

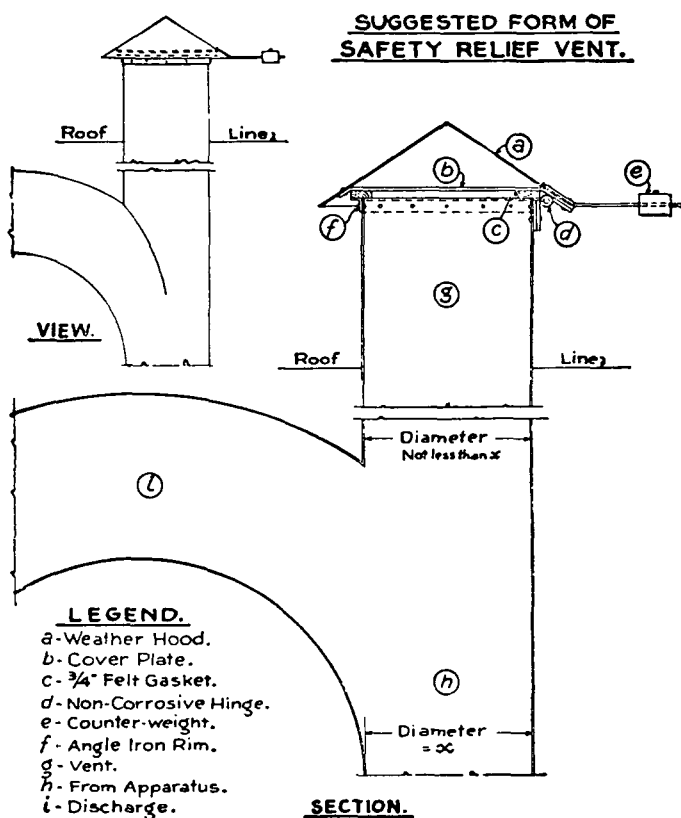


Figure 1. Example of explosion pressure relief vent.

1616. VENTING. Pressure relief vents shall be of ample size. These are especially required at certain types of mills, screens, dust collectors, and elevator heads. The vent stacks shall be substantially constructed of metal and be carried out-of-doors as directly and as nearly vertically as possible, avoiding especially short turns—never through an adjoining building or room—and be properly proportioned. Vent outlets should be provided with cowls or hoods and where the nonescape of dust is essential with counter balanced relief valves or covers provided with a soft felt gasket at least

$\frac{3}{4}$ -inch thick. (See Figure 1 for illustration of safety relief vent.) Reference is also directed to NFPA No. 68, Guide for Explosion Venting.

162. Housekeeping.

1621. Good housekeeping is essential and accumulation of dust shall not be tolerated in the building. Equipment must be designed which will not leak and permit escape of dust or sifting out of material. (See Chapter 17.)

1622. PAINTING. It is recommended that the interior of the pulverizing department be painted a color which is in contrast with that of the dust.

1623. WELDING REPAIRS. No open flames of any kind nor any operations or repairs resulting in sparks or utilizing direct fire heat shall be permitted in the pulverizing department until all equipment has ceased operating and the room has been carefully cleaned including the wiping down of equipment near the point where it is necessary to use the open flame or direct fire heat. Care shall be taken to see that the air in the room is free from dust and that the first aid fire protection in the form of small hose or extinguishers is close at hand during such periods.

PART C—GENERAL FIRE PREVENTION AND PROTECTION

Chapter 17. Housekeeping

171. Good Housekeeping.

1711. Good housekeeping and clean premises are the first essentials in the elimination of the dust explosion hazard, consequently this code is not intended to lessen in any way the responsibility of the owner or operator in this respect.

172. Dust Removal.

1721. Provision shall be made for systematic, thorough cleaning of the entire plant at sufficiently frequent intervals to prevent the accumulation of any considerable amounts of finely divided wood dust which might be dislodged by a minor explosion and lead to a major explosion.

1722. Cleaning that is likely to result in production of dust clouds shall not be done while machinery is in operation due to the possibility of the dust being ignited.

1723. Interior surfaces shall be cleaned in such a manner as to minimize the scattering of dust to other locations. Therefore, if it can feasibly be applied, cleaning shall be by vacuum sweeping apparatus.

1724. If vacuum or portable vacuum apparatus is used, the hoses shall be properly grounded and regularly checked for electrical continuity from pick-up nozzle to piping system. Such equipment and its installation, if electrical, shall be in accordance with the requirements of Article 502 of NFPA No. 70, the National Electrical Code.

1725. Blowing down of any surfaces by compressed air is prohibited.