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FIRE AND EXPLOSION PREVENTION

WOOD PROCESSING AND WOODWORKING FACILITIES 1981

NATIONAL FIRE PROTECTION ASSOCIATION, INC.
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Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

NFPA 664-1981

1981 Edition of NFPA 664

This edition of NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*, was prepared by the Technical Committee on Wood, Paper, and Cellulosic Dusts, released by the Correlating Committee on Dust Explosion Hazards, and acted on by the National Fire Protection Association, Inc. on May 20, 1981, at its Annual Meeting in Dallas, Texas. It was issued by the Standards Council with an effective date of June 29, 1981.

The 1971 edition of this standard was approved by the American National Standards Institute as an American National Standard. This edition has also been submitted for similar approval.

Origin and Development of NFPA 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 revised editions were adopted in 1962 and 1971.

Beginning in 1978, the Technical Committee on Wood, Paper, and Cellulosic Dusts began work on a complete update and revision of the 1971 standard. This edition of NFPA 664 is the culmination of that effort.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

Contents

Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

NFPA 664-1981

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates explanatory material on that paragraph in Appendix A.

Information on referenced publications can be found in Appendix B.

Chapter 1 General

1-1* Scope. This standard shall apply to all facilities involving the handling, storage, or processing of wood or wood products which produce or utilize finely divided wood particles or wood fibers.

1-2 Purpose. The purpose of this standard is to present the minimum requirements for safeguarding life and property against fire and explosion in areas where finely divided wood dust is produced or handled.

1-3* Retroactivity. This standard shall apply to new facilities and to those portions of existing facilities being rebuilt or remodeled.

1-4 Applicability. The requirements of Chapters 2 through 8 apply to all facilities; the requirements of Chapters 9 and 10 apply to specific facilities, as set forth in the scopes of these chapters.

Chapter 2 Building Construction

2-1 General Requirements.

2-1.1* The construction features of this chapter shall apply in addition to those required by state or local building codes.

2-1.2* Precautions shall be taken to prevent the spread of fire from one section of the plant to another. These precautions shall include separation of adjoining buildings by fire walls and fire partitions, as well as elimination of all unnecessary openings through floors.

2-2 Wall Construction.

2-2.1 Walls erected as fire walls between adjoining buildings shall be designed for a minimum fire endurance of four hours.

2-2.2 Interior walls erected as fire partitions between adjoining areas shall be designed for a minimum fire endurance of one hour.

2-2.3* Interior walls erected to isolate dust explosion hazards shall be designed for sufficient explosion resistance to preclude damage to these walls before the explosion pressure can be safely vented to the outside.

2-3 Protection of Wall Openings.

2-3.1 Openings in fire walls shall be protected by approved automatic closing fire doors suitable for Class A openings and having a fire endurance rating equivalent to the fire endurance rating of the fire wall. Fire doors shall be installed according to NFPA 80, *Standard for Fire Doors and Windows.*

2-3.2 All pipe openings through fire walls and fire partitions shall be tight. All duct openings through fire walls shall be protected by approved fire dampers.

2-3.3* Openings in walls designed to be explosion resistant shall be protected by doors which provide the same degree of explosion protection as the walls. Such doors shall be kept closed at all times when not actually being used. Such doors shall not be considered as part of a means of egress to satisfy the requirements of NFPA *101®* , *Life Safety Code®*

2-4 Stairways, Elevators, and Fire Escapes. Exits, interior stairs, and elevators shall comply with NFPA *101, Life Safety Code*.

2-5 Surfaces and Ledges in Dusty Areas.

2-5.1 Interior surfaces and ledges shall be designed to minimize dust accumulation.

2-5.2* Surfaces not readily accessible for cleaning shall be inclined at an angle of not less than 45 degrees from the horizontal to minimize dust accumulation.

Chapter 3 Explosion Venting

3-1 General Requirements.

3-1.1 Explosion venting, as used in this standard, is intended to encompass the design and installation of devices and systems to vent the gases and overpressure resulting from a deflagration so as to minimize structural or mechanical damage to the equipment, room, building, or other enclosure in which the explosion occurs.

3-1.2* If a dust explosion hazard exists in equipment, rooms, buildings, or other enclosures, such areas shall be provided with explosion venting. An acceptable alternative to explosion venting is an approved explosion suppression system installed in accordance with NFPA 69, *Standard on Explosion Prevention Systems*.

Chapter 4 Housekeeping

4-1 Removal of Static Dust.

4-1.1 Provisions shall be made for systematic, thorough cleaning of the entire plant at frequent intervals to remove the accumulations of finely divided wood dust which might be dislodged and lead to an explosion.

4-1.2 Spills shall be cleaned up without delay.

4-1.3* Powered cleaning apparatus, such as sweepers or vacuum cleaning equipment, used in dusty areas shall be approved for Class II, Division 1 Group G locations as defined in Article 502 of NFPA 70, *National Electrical Code®*

4-1.4* The use of compressed air or other similar means to remove dust accumulations from areas not readily accessible for cleaning by other methods shall be permitted only if done frequently enough to prevent hazardous concentrations of dust in suspension. Efforts shall be made to eliminate all ignition sources in the area during blowdown.

4-2 Metal Scrap. Provisions shall be made for separately collecting and disposing of any metal scrap, such as nails, band iron, or any wood containing metal, so that it will not enter the wood handling or processing equipment, the dust collecting system, or the scrap wood hog.

4-3* Hydraulic Fluids. Combustible hydraulic fluid leaks, especially in press areas, shall be controlled by regular maintenance. Spilled fluid shall be cleaned up promptly.

4-4 Oil and Resin. Buildup of residue from condensation of oil and resin volatiles shall be removed from board curing ovens at regular intervals.

4-5 Flammable Liquids. Flammable liquids shall be handled and stored according to the requirements of NFPA 30, *Flammable and Combustible Liquids Code.*

Chapter 5 Electrical Equipment

5-1 Electrical Wiring and Equipment.

5-1.1 All electrical wiring and equipment shall comply with the requirements of NFPA 70, *National Electrical Code*.

5-1.2 In local areas of the plant where a hazardous quantity of dust accumulates or is present in suspension in the air, all electrical equipment and installations in those local areas shall comply with Article 502 of NFPA 70, *National Electrical Code*.

Chapter 6 Control of Ignition Sources

6-1 Cutting and Welding.

6-1.1 Cutting and welding shall comply with applicable requirements of NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes*, and with the following specific requirements.

6-1.1.1 Written permission shall be obtained from the facility manager or his designated representative before each cutting or welding procedure is begun.

6-1.1.2 All machinery and dust producing operations within the area of the cutting or welding procedure or within range of sparks shall be shut down prior to beginning the procedure and shall remain inoperative until the procedure has been completed and final inspection has been made.

6-1.1.3 The area within 35 ft (10.7 m) surrounding the cutting or welding work, including the floor below, shall be cleaned or wet down before the work is begun. Where practical, all floor and wall openings in this area shall be tightly covered to prevent passage of sparks.

6-1.1.4 All combustible material which cannot be wet down or removed from the work area shall be protected by flame resistant covers meeting the test requirements of NFPA 701, *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films*.

6-1.1.5 A fire watch shall be maintained in all areas within range of cutting or welding sparks, including adjoining areas around or below the work area and areas where sparks or heat may penetrate.

6-1.1.6 After completion of the cutting or welding work, a final inspection of the entire area, including floors above and below, shall be made. These areas shall be patrolled for at least 30 minutes after the final inspection to make certain that no smoldering fires have developed.

6-2 Static Electricity and Lightning Protection.

6-2.1* Static electricity shall be prevented from accumulating on machines or equipment subject to static electricity buildup by permanent grounding and bonding wires and from moving belts by grounded metal combs or other effective means.

6-2.2 Lightning protection, where required, shall be installed in accordance with NFPA 78, *Lightning Protection Code*.

6-3 Smoking. Smoking shall only be allowed in safe designated areas.

6-4 Propellant Actuated Tools.

6-4.1 Propellant actuated tools shall not be used in areas where combustible dust or dust clouds are present.

6-4.2 When the use of propellant actuated tools becomes necessary, all dust producing machinery in the area shall be shut down, all equipment, floors, and walls shall be carefully cleaned, and all dust accumulations removed.

6-4.3 A careful check shall be made after the work is completed to be sure that no cartridges or charges are left on the premises where they could enter equipment or be accidentally discharged after operation of the dust producing or handling machinery is resumed.

Chapter 7 Fire Protection

7-1 Fire Extinguishers and Hose.

7-1.1 Portable fire extinguishers shall be provided throughout all buildings according to the requirements of NFPA 10, *Standard for Portable Fire Extinguishers.*

7-1.2* Standpipes and hose, when provided, shall conform to NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

7-1.3 Private outside protection, including outside hydrants and hoses, when provided, shall comply with NFPA 24, *Standard for Outside Protection.*

7-2* Automatic Sprinklers. Automatic sprinklers, when provided, shall comply with NFPA 13, *Standard for the Installation of Automatic Sprinkler Systems.*

7-3 Special Fire Protection Systems. Automatic extinguishing systems or special hazard extinguishing systems, when provided, shall be designed, installed, and maintained in accordance with the following standards, as applicable:

(a) NFPA 11, *Standard for Foam Extinguishing Systems.*

(b) NFPA 11A, *Standard for High Expansion Foam Systems.*

(c) NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems.*

(d) NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems.*

(e) NFPA 12B, *Standard on Halon 1211 Fire Extinguishing Systems.*

(f) NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection.*

(g) NFPA 17, *Standard for Dry Chemical Extinguishing Systems.*

(h) NFPA 69, *Standard on Explosion Prevention Systems.*

Chapter 8 Woodworking Dust Control Systems

8-1 Scope. This chapter shall apply to pneumatic systems utilized to collect and convey finely divided wood particles, fibers, or shavings in the course of woodworking operations.

8-2 Conveying and Collecting Equipment.

8-2.1* Each system shall consist of branch ducts connected to hoods or enclosures, one or more main ducts, air flow producing equipment, discharge duct to the out-of-doors, and means for separating the entrained wood particles from the air flowing in the system.

8-2.2 All cutting, shaping, planing, sanding, or other machines which produce finely divided wood dust or shavings shall be provided with a dust pickup, conveying and collecting system.

8-2.3 Hoods and Enclosures.

8-2.3.1 Hoods or enclosures shall be so designed, located and placed that the finely divided wood dust or shavings generated will fall, be projected, or be 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.

8-2.3.2 All hoods and enclosures shall be of noncombustible construction. If the hood or enclosure also must act as a safety guard, the construction, strength, and material specifications must be such that the machine is adequately protected.

8-2.3.3 The rate of air flow into every hood and enclosure shall be sufficient to control the wood dust or shavings and cause them to be carried into the duct system.

8-2.4 Duct System.

8-2.4.1 Every branch duct and every section of main duct shall be sized for not less than the minimum air velocity and volume required to transport the wood dust or shavings through the ducting and into the collection equipment.

8-2.4.2 The capacity of the system shall be calculated on the basis of all hoods and other openings connected to the system being open.

8-2.4.3 Dampers, gates, or orifice plates provided for the specific purpose of balancing the air flow in the system shall be fastened to prevent inadvertent manipulation.

8-2.4.4 In addition to the intakes at the individual machines, connections to the system shall be permitted at floor level in convenient locations to provide for the removal of such fine material as may accumulate around the machines and be swept up.

8-2.5 Collecting Equipment. The system shall be provided with collecting equipment of sufficient size and capacity to separate the wood dust from the air before the air is vented. The collecting equipment shall be of noncombustible construction except for filter bags, if provided.

8-2.6 Fans. The system shall be connected to a fan or blower that will maintain the required rate of air flow in all parts of the system and is of a type and size suitable for handling the conveyed material. Where conditions permit, the fan shall be located beyond the air cleaning equipment so as to handle only cleaned air.

8-2.7 Exhausting Dissimilar Matter. Woodworking exhaust systems shall be restricted to handling wood residues and under no circumstances shall another operation generating sparks, such as from grinding wheels, be connected to a woodworking exhaust system.

8-3 Hazardous Systems.

8-3.1* The additional requirements of this section shall apply to systems which handle finely divided wood dust with an explosion potential.

8-3.2 All hoods and enclosures shall be constructed of welded steel. Riveted construction shall not be acceptable.

8-3.3* Ducts shall be constructed of welded steel or other noncombustible material of equivalent strength. Ducts shall be properly supported and shall be protected against corrosion.

8-3.4* Ducts shall be protected by explosion vents or an approved explosion suppression system (*see Chapter 3*) unless the duct is sufficiently strong to withstand maximum explosion pressures. Explosion dampers shall be used, where practical, to minimize the possibility of explosion flashback from the collecting equipment through the duct system.

8-3.5* Cyclone collectors, if used, shall be designed and constructed entirely of noncombustible material of adequate strength and rigidity to meet both conditions of service and installation requirements. Cyclone collectors or bag filters shall be protected by explosion vents or by an approved explosion suppression system. (*See Chapter 3.*)

8-3.6* Wood dust from collectors which discharge into a storage bin or silo shall do so in a manner that will minimize the generation of dust clouds. The discharge arrangement shall be constructed to minimize dust leaks and shall contain a choke to prevent explosion propagation between the collecting equipment and the storage facilities. Bins or silos shall be provided with explosion relief where practical (*see Chapter 3.*)

8-3.7* Sander systems shall be protected by explosion venting or an approved explosion suppression system (*see Chapter 3*).

8-4 Recycling Exhaust Air.

8-4.1 Filtered air shall not be recycled back into the building unless the following conditions are met.

(a) The system shall be equipped with an approved spark detection and suppression system.

(b) The recycled air duct shall be fitted with an abort damper that would be actuated by the spark detector bypassing the air to atmosphere, away from the plant.

(c) The abort damper shall be provided with a manual reset so that, after it has aborted, it can only be returned to the closed position at the damper. Automatic or remote reset shall not be allowed.

8-5 Wood Scrap Disposal.

8-5.1 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 discharge from such processing shall be handled as required in Sections 8-2 and 8-3.

8-5.2 If the scrap wood is to be processed by mills delivering a pulverized product, the requirements of Chapter 9 shall be complied with.

8-5.3 If the finely divided wood dust is to be used as a fuel, the applicable sections of NFPA 85F, *Standard for the Installation and Operation of Pulverized Fuel Systems*, shall be adhered to.

8-5.4 Where wood waste is disposed of in an incinerator, it shall be in accordance with the requirements of NFPA 82, *Standard on Incinerators and Rubbish Handling*.

Chapter 9 Wood Pulverizing Operations

9-1 Scope. This chapter shall apply to those facilities involved in the manufacturing of wood flour or the pulverizing of wood to a size smaller than 100 mesh for other uses.

9-2 Location and Construction.

9-2.1 Pulverizing operations shall be located in buildings detached from all other buildings.

9-2.1.1 Conveying equipment passing through explosion resistant walls or floors shall be protected in accordance with Section 9-3.

9-2.2 The pulverizing process area shall be considered a dust explosion hazard with respect to need for explosion venting. (*See 2-2.2 and Chapter 3.*)

9-3 Protection of Openings. When material presenting a dust explosion hazard is delivered to or from the pulverizing operation, chokes, rotary valves, explosion suppression systems, or other means shall be provided to prevent flame propagation through the conveying system.

9-4 Material Handling and Process Equipment.

9-4.1* All equipment shall be installed so that constant true alignment is maintained and so that hot bearings and friction are avoided.

9-4.2* Ball or roller bearings shall be used whenever practical. All bearings shall be dusttight.

9-4.3 Magnetic separators of the permanent magnet or self-cleaning electromagnet type or pneumatic separators shall be installed ahead of mills and pulverizers.

9-5 Dust Control.

9-5.1 All dust producing equipment shall be dusttight or the equipment and dust producing operations shall be provided with dusttight hoods or enclosures which comply with the requirements of Chapter 8.

9-5.2 Exhaust fans shall not be located between collectors and pulverizers.

Chapter 10 Composite Board Plants

10-1 Scope. This chapter covers the storage, preparation, and forming of wood particles or fibers into board form, including dry process hardboard, particleboard, and medium density fiberboard.

10-2 Location and Construction. The following facilities shall be located outdoors or in separate buildings detached from the rest of the plant. These facilities shall be considered dust explosion hazards with respect to the need for explosion venting (*see 2-2.2 and Chapter 3*).

(a) Raw Material Storage.

Exception: Storage which does not contain hazardous quantities of combustible dust or where the moisture content of the material stored is greater than 20 percent.

(b) Size Reduction Facilities.

Exception: Where moisture content of the material being pulverized is greater than 20 percent, or where effective dust control measures prevent generation and accumulation of static or airborne dust in hazardous quantities.

(c) Particle Drying Facilities.

Exception: Where effective dust control measures prevent generation and accumulation of static or airborne dust in hazardous quantities.

10-3 Process Equipment.

10-3.1 Size reduction and particle handling equipment shall meet the requirements of Sections 9-3, 9-4, and 9-5.1.

10-3-2 Where conveying equipment passes between buildings or rooms which are designed to be isolated from each other, a conveyor choke or other approved means shall be provided to prevent explosion propagation.

10-3.3* Dryers and board humidifiers shall be arranged and protected in accordance with the applicable requirements of NFPA 86A, *Standard on Ovens and Furnaces*. The following requirements shall also apply to dryers:

10-3.3.1 Conveying equipment shall have facilities to divert burning material from the equipment downstream of the dryer to a safe dump area in the event of a fire in the dryer.

10-3.3.2* Thermal fire detectors shall be provided downstream of the dryers, normally in the ductwork at the dryer exit. The detection system shall be arranged to accomodate normal temperature surges associated with firing up of the unloaded dryer. Detectors shall activate the fire suppression systems, if provided, sound an alarm, shut off the fuel supply, divert burning material, and shut down preparatory process equipment.

10-3.3.3 Dryer systems having a dust explosion potential shall be protected by explosion venting or an approved explosion suppression system, unless the equipment can withstand the maximum expected explosion pressures (*see Chapter 3*). Dryer exhaust systems shall be designed in accordance with Chapter 8.

10-3.3.4* Diesel-powered front-end loaders used to handle or reclaim raw material inside storage buildings shall comply with the requirements for DS classification as described in NFPA 505, *Fire Safety Standard for Powered Industrial Trucks.*

Exception: If the storage building complies with 10-2(a), a nonclassified front-end loader may be used.

Appendix A

A-1-1 Such facilities include, but are not limited to, wood flour plants, woodworking plants, lumber mills, and composite board plants.

A-1-3 It is recommended that, wherever feasible, existing installations be modified to comply with the requirements of this standard.

A-2-1.1 All buildings should be of Type I or Type II construction, as defined in NFPA 220, *Standard on Types of Building Construction.*

A-2-1.2 All conveyor, chute, and pipe openings through floors should be tight or should be protected by doors having a fire endurance rating of 1 hour.

A-2-2.3 A pressure resistance of five times the vent operating pressure is recommended.

A-2-3.3 Such doors should be marked "Not An Exit." The unique requirements of doors in explosion resistant walls preclude their use as a means of egress because the *Life Safety Code* requires exit doors from high hazard areas to swing in the direction of exit travel.

A-2-5.2 As much as a 60-degree angle of inclination may be necessary for maximum effectiveness with many types of wood dust.

A-3-1.2 NFPA 68, *Guide for Explosion Venting*, provides useful information for designing explosion vents. See also "Explosion Venting as a Means of Controlling Dust Explosions," Frank, T.E., and "Explosion Venting of Industrial Air Systems," Pauli, L.E., Proceedings of the 12th Annual Particleboard Symposium, Washington State University, Pullman, WA, 1978.

A-4-1.3 Unapproved vacuum cleaning equipment may be used if the powered suction source is located in a remote, nondusty area.

A-4-1.4 It is recommended that cleaning by this method be done when the portion of the plant being cleaned is not operating.

A-4-3 Consideration should be given to the use of fire resistant hydraulic fluids to reduce the fire hazards of hydraulic systems in plant process equipment.

A-6-2.1 Grounding and bonding information can be found in NFPA 77, *Recommended Practice on Static Electricity*.

A-7-1.2 Inside 1½-in. (3.8-cm) hose stations are recommended throughout all major woodworking facilities. Directional water spray nozzles or combination straight stream/water spray nozzles are recommended since careless use of straight hose streams may cause dust explosions by throwing hazardous quantities of dust into suspension.

A-7-2 Automatic sprinkler protection is recommended throughout all major woodworking facilities. Press pits, press hoods, and hood ventilating fans should be protected by automatic sprinkler systems, deluge systems, or both. It is important that sprinkler and deluge heads be located so that hard-to-reach places, such as spaces between press cylinders, are properly protected.

A-8-2.1 The system should comply with the requirements of NFPA 91, *Standard for the Installation of Blower and Exhaust Systems*.

A-8-3.1 Air conveying systems, such as from a hog or hammermill, may fall within the scope of this section depending on the moisture content and particle size of the dust generated.

A-8-3.3 Ducts with circular cross section are preferable to square or rectangular ducts. Welded steel of 12 gage minimum thickness is normally strong enough to prevent failure during an explosion. This is especially true for small ducts. However, for large rectangular ducts, 12 gage may not be adequate.

A-8-3.4 An approved spark detection and extinguishing system should be considered to quench burning material before it can be conveyed into the collecting equipment.

A-8-3.5 Collecting equipment should be protected by automatic sprinklers or an approved water spray system (*see Chapter 7*). Where bag filters are used, consideration should be given to their use as primary collectors, eliminating the cyclone. Collectors and filters should be located outside the building, on independent supporting structures, and should be accessible for fire fighting. It is not advisable to locate collectors and filters on the roofs of buildings. Welded steel of 12 gage minimum thickness is normally of sufficient strength to prevent structural failure during an explosion, if adequate explosion venting or suppression is provided.