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NFPA 664 Wood Processing and Woodworking Facilities 1987 Edition

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

Statement on NFPA Procedures

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

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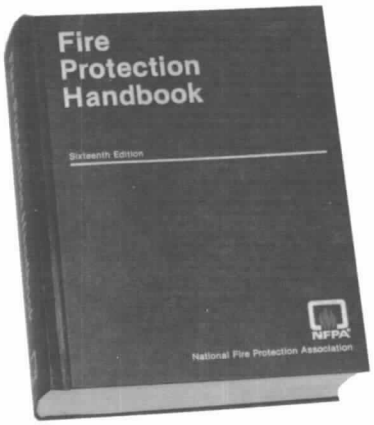

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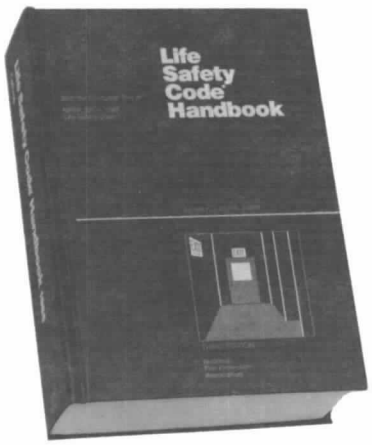

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NFPA 664

Standard for the

Prevention of Fires and Explosions in

Wood Processing and Woodworking Facilities

1987 Edition

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. at its Annual Meeting held May 18-21, 1987 in Cincinnati, Ohio. It was issued by the Standards Council on June 10, 1987, with an effective date of June 30, 1987, and supersedes all previous editions.

The 1987 edition of this standard has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

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. The 1981 edition of the standard consisted of a complete rewrite. The 1987 edition has clarified the intent of numerous existing requirements. A new chapter which covers thermal oil heating systems has been added. This was added as a result of increased use of these systems in the industry. The format of this revision more closely parallels the NFPA Manual of Style.

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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

NFPA 664

Standard for the

Prevention of Fires and Explosions in

Wood Processing and Woodworking Facilities

1987 Edition

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 Chapter 12 and Appendix B.

Chapter 1 General

1-1* Scope. This standard contains the minimum requirements for the proper construction and protection of facilities that handle, store, or process wood or wood products that produce or utilize finely divided wood particles or wood fibers.

1-2 Purpose.

1-2.1 The purpose of this standard is to provide a reasonable degree of protection for life and property against fire and explosion in facilities where finely divided wood dust is produced or handled.

1-2.2 Nothing in this standard is intended to restrict new technologies or alternate arrangements provided the level of safety prescribed by the standard is not lowered.

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

1-4 Definitions.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Standard. A Document containing only mandatory provisions using the word "shall" to indicate requirements. Explanatory material may be included only in the form of "fine print" notes, in footnotes, or in an appendix.

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 When walls are erected as fire walls between adjoining buildings, they 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 and fire partitions shall be protected by approved automatic closing fire doors having a fire endurance rating equivalent to the fire endurance rating of the fire wall or partition. Fire doors shall be installed according to NFPA 80, *Standard for Fire Doors and Windows*.

2-3.2 Openings in four-hour rated fire walls shall be protected by three-hour rated automatic closing fire doors installed on both sides of the wall.

2-3.3 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. No ducts shall penetrate four-hour fire walls.

2-3.4* Openings in walls designed to be explosion resistant shall be protected by doors that 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 that 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. Any open flame or spark-producing equipment shall not be used 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 that 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. This shall include the floor below the work floor.

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 ensure 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 in accordance with 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 the Installation of Private Fire Service Mains and Their Appurtenances*.

7-2* Automatic Sprinklers. Automatic sprinklers, when provided, shall comply with NFPA 13, *Standard for the Installation of 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 Low Expansion Foam and Combined Agent Systems*

(b) NFPA 11A, *Standard for Medium and 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, airflow-producing equipment, a discharge duct to the out-of-doors, and a 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 airflow and 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 airflow 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 airflow 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 airflow 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 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 that 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 conditions of both 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 that discharge into storage bins or silos 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, Waste, and Linen Handling Systems and Equipment*.

Chapter 9 Thermal Oil Heating Systems

9-1* Scope. This chapter shall apply to facilities that use heat transfer fluids to provide process equipment heat via piped, indirect heating systems.

9-2 General Provisions. The applicable portions of NFPA 30, *Flammable and Combustible Liquids Code*, shall apply to thermal oil systems and plant areas having thermal oil piping or utilization equipment.

9-3* Thermal Oil Heaters.

9-3.1 Location and Construction.

9-3.1.1* Thermal oil heaters shall be located and arranged to minimize the hazard from a potential oil spill.

9-3.1.2 The preferred location shall be outdoors or in a separate, detached building.

9-3.1.3 When a detached location is not practical, the heater shall be located next to an outside wall and cut off from adjacent plant areas by a fire partition having at least a two-hour fire resistance. Also, the room shall be designed to contain the largest possible oil spill using curbs, dikes, sumps, floor drains, or other suitable means.

9-3.2 Oil Leak Detection.

9-3.2.1* A means shall be provided to automatically detect a tube leak inside the oil heat exchanger and minimize damage from an ensuing oil fire.

9-3.2.2* A means shall be provided to automatically detect major oil leaks in the utilization piping and equipment, and stop the flow of oil to the equipment.

9-3.3 Fuel Burner Controls and Interlocks.

9-3.3.1 Oil- or gas-fired burners shall be designed and installed in accordance with the applicable requirements of NFPA 85A, *Standard for Prevention of Furnace Explosions in Fuel Oil- and Natural Gas-Fired Single Burner Boiler-Furnaces*.

9-3.3.2 Wood dust suspension burners shall be designed and installed in accordance with the applicable requirements of NFPA 85F, *Standard for the Installation and Operation of Pulverized Fuel Systems*.

9-3.3.3* Heaters that burn wood waste in a fluidized bed or on a grate shall provide a means to prevent the accumulation of explosive concentrations of combustibles in the heater, or any stack gas utilization equipment, following a shutdown with unburned fuel in the heater.

9-3.3.4 System heaters shall be under automatic control.

9-3.3.5 The heater shall automatically shut off on low liquid level, high liquid temperature, and low circulation rate.

9-3.3.6 When oil heater stack gas is used to heat other utilization equipment, proper purging of the heater and utilization equipment shall be accomplished by the use of isolation gates, dampers, and/or suitable burner control logic. The control logic shall anticipate all operating modes of the oil heater and utilization equipment, either singly or together, to assure safe start-up, shutdown, and upset conditions.

9-4 Thermal Oil Piping — Location and Construction.

9-4.1 Piping shall be routed outside or underground where practical.

9-4.2* Where piping must be routed indoors, spill containment features such as curbs, dikes, floor slope, drains, etc., shall be incorporated where practical.

9-4.3 Piping which is insulated shall use closed-cell, nonabsorptive insulation. Fibrous or open-cell insulation shall not be permitted.

9-4.4* Piping shall be securely supported and otherwise protected against mechanical damage with adequate clearance from combustible material.

9-5 Thermal Oil Utilization Equipment.

9-5.1* Where fire extinguishing systems are provided for utilization equipment, the system shall be designed to protect the equipment from a hot oil-spill fire or from the material being processed, whichever poses the more severe fire hazard.

Chapter 10 Wood Pulverizing Operations

10-1 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.

10-2 Location and Construction.

10-2.1* Pulverizing operations shall be separated from all other buildings to prevent fire or explosion propagation.

10-2.2 The pulverizing process area shall be considered a dust explosion hazard with respect to construction and the need for explosion venting (*see Chapters 2 and 3*).

10-3 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 approved means shall be provided to prevent flame propagation through the conveying system.

10-4 Material Handling and Process Equipment.

10-4.1* All equipment shall be installed so that constant true alignment is maintained and so that hot bearings and friction are avoided.

10-4.2* Ball or roller bearings shall be used whenever practical. All bearings shall be dust-tight.

10-4.3 Magnetic separators of the permanent magnet or self-cleaning electromagnet-type or pneumatic separators shall be installed ahead of mills and pulverizers.

10-5 Dust Control.

10-5.1 All dust-producing equipment shall be dust-tight or the equipment and dust-producing operations shall be provided with dust-tight hoods or enclosures that comply with the requirements of Section 8-3.

Chapter 11 Composite Board Plants

11-1 Scope. This chapter covers the storage, preparation, and forming of wood particles or fibers into board form, including dry process hardboard, particleboard, medium density fiberboard, and oriented-strand board.

11-2 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 that 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.

11-3 Process Equipment.

11-3.1 Size reduction and particle-handling equipment shall meet the requirements of Sections 10-3, 10-4, and 10-5.1.

11-3.2 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.

11-3.3* Dryers and board humidifiers shall be arranged and protected in accordance with the applicable requirements of NFPA 86, *Standard for Ovens and Furnaces*. The following requirements shall also apply to dryers:

11-3.3.1 Conveying equipment shall have facilities to divert burning material from the equipment downstream from the dryer to a safe dump area in the event of a fire in the dryer.

11-3.3.2* Thermal fire detectors shall be provided downstream from 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.

11-3.3.3 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.

11-3.3.4* 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 11-2(a), a nonclassified front-end loader may be used.

Chapter 12 Referenced Publications

12-1 The following documents or portions thereof are referenced within this document and shall be considered part of the requirements of this document. The edition indicated for each reference shall be the current edition

as of the date of the NFPA issuance of this document. These references shall be listed separately to facilitate updating to the latest edition by the user.

12-1.1 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 10-1984, *Standard for Portable Fire Extinguishers*

NFPA 11-1983, *Standard for Low Expansion Foam and Combined Agent Systems*

NFPA 11A-1983, *Standard for Medium and High Expansion Foam Systems*

NFPA 12-1985, *Standard on Carbon Dioxide Extinguishing Systems*

NFPA 12A-1987, *Standard on Halon 1301 Fire Extinguishing Systems*

NFPA 12B-1985, *Standard on Halon 1211 Fire Extinguishing Systems*

NFPA 13-1987, *Standard for the Installation of Sprinkler Systems*

NFPA 14-1986, *Standard for the Installation of Standpipe and Hose Systems*

NFPA 15-1985, *Standard for Water Spray Fixed Systems for Fire Protection*

NFPA 17-1985, *Standard for Dry Chemical Extinguishing Systems*

NFPA 24-1987, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*

NFPA 30-1987, *Flammable and Combustible Liquids Code*

NFPA 51B-1984, *Standard for Fire Prevention in Use of Cutting and Welding Processes*

NFPA 69-1986, *Standard on Explosion Prevention Systems*

NFPA 70-1987, *National Electrical Code*

NFPA 78-1986, *Lightning Protection Code*

NFPA 80-1986, *Standard for Fire Doors and Windows*

NFPA 82-1983, *Standard on Incinerators, Waste and Linen Handling Systems and Equipment*

NFPA 85A-1987, *Standard for Prevention of Furnace Explosions in Fuel Oil- and Natural Gas-Fired Single Burner Boiler-Furnaces*

NFPA 85F-1982, *Standard for the Installation and Operation of Pulverized Fuel Systems*

NFPA 86-1985, *Standard for Ovens and Furnaces*

NFPA 101-1985, *Life Safety Code*

NFPA 505-1987, *Fire Safety Standard for Powered Industrial Trucks*

NFPA 701-1977, *Standard Methods of Fire Tests for Flame-Resistant Textiles and Films*

Appendix A

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

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, equal to the floor being penetrated.

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

A-2-3.4 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 In all cases where explosion venting is utilized, positive measures should be taken to prevent flame propagation from the vented equipment or enclosure to other equipment or enclosures in accordance with NFPA 68, *Guide for Explosion Venting*. 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. Electrical equipment suitable for Class II locations need not be de-energized during blowdown.

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.

Also, when bag filters are used with the conveying airflow fan located ahead of the bag filters, a high-speed abort gate activated by infrared spark detectors should be used to divert burning material before it can enter the bag filter. (*See Appendix B, "Fire and Explosion Control in Bag Filter Dust Collection Systems," Frank, T. E., NFPA Fire Journal, Volume 75, No. 2, March 1981, p. 73.)*

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.

A-8-3.6 Storage bins and silos should be protected by automatic sprinklers or an approved water spray system (*see Chapter 7*). Storage bins and silos should be located outside the building on independent supporting structures and should be accessible for fire fighting. It is not advisable to locate bins or silos on the roofs of buildings.

A-8-3.7 An infrared spark detection system should be considered to shut down the sander, stop material infeed, initiate a water spray deluge in the collecting system, and activate a fire dump in the collecting system outfeed. The exhaust system main fan should be left running to purge the system of dust and to help keep dust from dropping into suspension from dust filters.

A-9-1 Thermal oil heating systems have been used to heat lumber dry kilns, plywood veneer dryers, plywood and composite board presses, composite board furnish dryers, and also for building heat.

A-9-3 A thermal oil heating system typically consists of a central heat exchanger to heat the thermal fluid. Firing can be by conventional gas or oil burners, wood dust suspension burners, or special wood waste combustors, such as fluidized bed burners or "wet cell" burners, which partially burn and gasify wood waste on a grate using sub-stoichiometric under-fire airflow, and complete the combustion in an upper plenum using secondary air injection. The hot gases then pass through a heat exchanger to indirectly heat the thermal fluid. The heat exchanger may be a separate, stand-alone unit, or an integral part of the heater. Conventional water-tube boilers have even been used as heaters, with thermal fluid replacing the water.

The thermal fluids used are typically special oils developed for this type of application, with flash points of several hundred degrees Fahrenheit. For maximum thermal efficiency, they are usually heated above their flash points, making an oil spill especially hazardous. Also, because of the high oil temperatures, it is usually necessary to keep the oil circulating through the heat exchanger at all times to prevent oil breakdown and tube fouling. Diesel-driven pumps or emergency generators are usually provided for this purpose in case of a power outage. Oil circulation may even be needed for a period of time after burner shutdown due to the latent heat in the heater.

A-9-3.1.1 Thermal oil heater rooms or buildings should be protected by automatic sprinklers designed to control a hot oil-spill fire.

A-9-3.2.1 A tube rupture during heater operation would likely result in an instantaneous fire. A small leak could result in a localized oil spray fire which could cause tube fouling from oil breakdown or tube rupture from overheating. A major leak would result in extensive damage and downtime since it is not practical to shut off the oil pumps (*see A-9-2*).

Loss of oil in the system can be detected by monitoring the oil level in the expansion tank. This in itself would not indicate a leak inside the heater. Additional flue gas instrumentation such as high temperature, combustibles, or opacity can be used to indicate a leak within the heater. These signals could then be combined to activate automatic emergency interlocks (*see Figure 1*).

Inert gas extinguishing systems (carbon dioxide, nitrogen, or steam) can be used to control fires in heaters. The feasibility of this method depends on the size and configuration of the heater. With this method, it is necessary to maintain an extinguishing concentration of inert gas inside the heater for a period of time long enough to

allow hot refractory and other heater components to cool, or else re-ignition can occur.

A novel approach to minimizing fire damage is to rapidly drain all the oil from the heater. An oil drain tank is generally provided with the heater for maintenance, and it can be used, with suitable modifications, for emergency drain purposes.

Refer to Figures 1 and 2 for simple logic and schematic diagrams of typical protection schemes.

A-9-3.2.2 Hot oil from tube leaks outside the heater can create hazardous spills. Small leaks are of less concern and would likely be detected by personnel before a large spill occurred. A low level alarm in the heater expansion tank should be used to detect gradual loss of oil in the system. Large spills or pipe breaks are of greater concern. Most systems utilize low oil-pressure interlocks to start emergency oil circulation pumps. Momentary low oil pressure would be expected from a major pipe rupture. This signal, coupled with a low expansion tank level, can be used to distinguish a major pipe rupture from some other non-hazardous low-pressure condition.

To stop the flow of oil to the utilization equipment, an alternate path must be available to keep oil flowing through the heater. If no other utilization loops are provided, an emergency loop should be provided for this purpose. It may be necessary to have a dummy cooling load so as not to overheat the oil.

Refer to Figures 1 and 2 for simple logic and schematic diagrams of typical protection schemes.

A-9-3.3.3 Fluidized bed burners and burners that combust wood waste on a grate contain a quantity of unburned fuel during normal operation. They cannot be instantly shut off like a conventional gas, oil, or pulverized fuel suspension burner. During any emergency stop or other shutdown that does not fully combust the bed of fuel, combustibles (mostly carbon monoxide with small amounts of hydrogen) will be generated due to the latent heat in the fire box and lack of enough air for complete combustion.

Heaters that exhaust directly into a stack can usually prevent the accumulation of explosive concentrations of combustibles by natural draft means. Some facilities recover additional heat from the thermal oil heater stack gas by ducting the burner exhaust into other utilization equipment. Natural draft is unreliable in these instances, and other means, such as automatic-opening emergency vents on the burner exhaust duct, isolation dampers, or inert gas padding systems, should be used to prevent build-up of explosive concentrations of combustibles.

A-9-4.2 Automatic sprinklers designed to control a hot oil-spill fire should be provided in all areas where a spill potential exists.

Concentric piping can materially lessen the spill potential as long as the annular space is monitored to detect leakage.

A-9-4.4 Proper clearance from combustibles should be determined based on the operating surface temperature of the insulated pipe. Piping should be kept free of combustible dust accumulations.

A-9-5.1 The fire hazard in process equipment such as veneer dryers, lumber dry kilns, composite panels press pits, etc., will likely be more severe than normal from a hot oil-spill fire. When this is the case, automatic sprinkler or deluge protection should be provided for the process equipment, with the system designed for the more severe hazard.

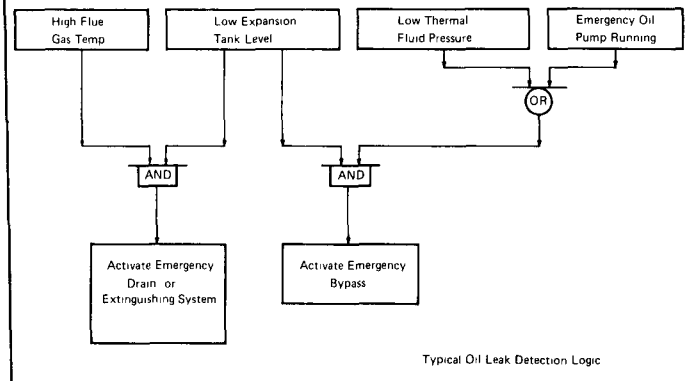

Figure 1: Typical Oil Leak Detection Logic

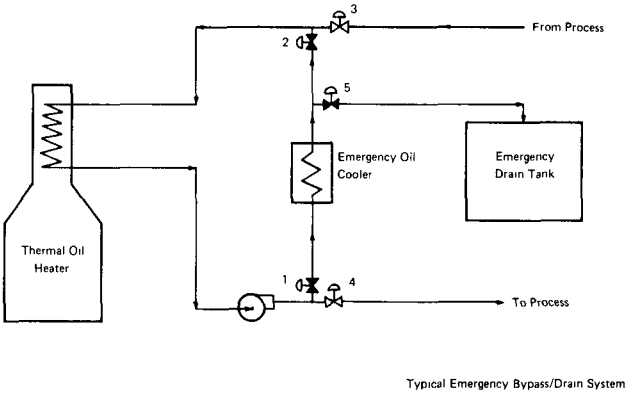

Figure 2: Thermal Oil Heating System Major Leak Detection/Protection

A-10-2.1 Separation can be accomplished by a physical distance of 50 ft (15 m) or by properly designed pressure resistant barriers with directional venting.

A-10-4.1 Equipment should be installed and arranged in unit systems so that each pulverizer will deliver to a single set of scalpers and bolters. Interconnections between sets of equipment should not be permitted unless the material passing from one unit to another is conveyed through conveyors containing positive chokes.

A-10-4.2 Bearings in dusty or inaccessible locations where overheating of bearings may result in fires or explosions should be provided with approved journal alarms.

A-11-3.3 The preferable fire protection system for a hardboard humidifier, board bake oven, or tempering oven is an automatic water spray system with manual override.

A-11-3.3.2 An infrared spark detection system located downstream from the dryer should be considered, in addition to the thermal fire detection system.

A-11-3.3.4 To further reduce the hazard, fixed automatic dry chemical extinguishing systems should be provided on these vehicles.

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within this document for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference should be the current edition as of the date of the NFPA issuance of this document. These references should be listed separately to facilitate updating to the latest edition by the user.

B-1.1 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 68-1978, *Guide for Explosion Venting*

NFPA 77-1983, *Recommended Practice on Static Electricity*

NFPA 91-1983, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*

NFPA 220-1985, *Standard on Types of Building Construction*

B-1.2 Other Publications.

"Fire and Explosion Control in Bag Filter Dust Collection Systems," Frank, T. E., *NFPA Fire Journal*, Volume 75, No. 2, March 1981, p. 73.

Industrial Ventilation, American Conference of Governmental Industrial Hygienists, P.O. Box 16135, Lansing, MI 48901.

Proceedings of the 12th Annual Particleboard Symposium, 1978, Frank, T.E., "Explosion Venting as a Means of Controlling Dust Explosions."

Ibid., Pauli, L.E. "Explosion Venting of Industrial Air Systems."

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

INSTRUCTIONS

Please use the forms which follow for submitting proposed amendments. Use a separate form for each proposal.

1. For each document on which you are proposing amendment indicate:
   (a) The number and title of the document
   (b) The specific section or paragraph.

2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.

3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.

4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.

5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.

6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include.

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269

Date 5/18/85 Name John B. Smith Tel. No. 617-555-1212

Address 9 Seattle St., Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

1. a) Document Title: Protective Signaling Systems NFPA No. & Year NFPA 72D

   b) Section/Paragraph: 2-7.1 (Exception)

2. Proposal recommends: (Check one) ☐ new text
   ☐ revised text
   ☒ deleted text.

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

   Delete exception.

4. Statement of Problem and Substantiation for Proposal:

   A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ This Proposal is original material.
   ☐ This Proposal is not original material; its source (if known) is as follows: _____

(Note: Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

I agree to give NFPA all and full rights, including rights of copyright, in this Proposal and I understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used.

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