ANSI/NFPA 664 An American National Standard August 20, 1993

NFPA 664 Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities 1993 Edition

NFPA®

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101

NOTICE

All questions or other communications relating to this document should be sent only to NFPA Headquarters, addressed to the attention of the Committee responsible for the document.

For information on the procedures for requesting Technical Committees to issue Formal Interpretations, proposing Tentative Interim Amendments, proposing amendments for Committee consideration, and appeals on matters relating to the content of the document, write to the Secretary, Standards Council, National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

A statement, written or oral, that is not processed in accordance with Section 16 of the Regulations Governing Committee Projects shall not be considered the official position of NFPA or any of its Committees and shall not be considered to be, nor be relied upon as, a Formal Interpretation.

Users of this document should consult applicable Federal, State and local laws and regulations. NFPA does not, by the publication of this document, intend to urge action which is not in compliance with applicable laws and this document may not be construed as doing so.

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.

NFPA has no power or authority to police or enforce compliance with the contents of this document and any certification of products stating compliance with requirements of this document is made at the peril of the certifier.

Join over 63,000 professionals like yourself. Belong to NFPA!

You can have impact on issues that affect the fire safety industry—How?

When you belong to NFPA you'll receive special membership benefits that help you make informed decisions and make your voice a stronger one in the fire safety community. Your benefits include:

1. **Voting privileges** on proposed changes to existing codes and standards, and on new codes and standards.
2. The ***NFPA Journal,*** *Fire News* newsletter, and *NFPA Journal Reference Directory & Buyers' Guide*—your source for fire statistics, reports, investigations, manufacturers, and codes and standards references.
3. **10% discount** on all products and services.
4. **Special invitations** to Annual, Fall, and Regional Meetings—where you can compare notes with your colleagues and take a position on issues that affect you. All these benefits—plus the pride and confidence that comes with membership in an internationally acclaimed organization can be yours for annual dues of $95.00. Join today!

☐ **YES! Send me an application to join my colleagues at NFPA today!**

Name _____ Date _____

Address _____ Signature _____

City, State, Zip _____

Code PA1

You can't beat this value on NFPA codes and standards...

Stay up-to-date on fire codes with this super, money-saving service!

In the dynamic world of fire protection, you need to keep up with current fire code requirements, recent changes, and new developments. The *National Fire Codes® Subscription Service* makes that an easier job! This complete service delivers every NFPA code and standard directly to you—over 280 essential codes in all! As a subscriber, you automatically receive new and revised documents from NFPA's Annual and Fall Meetings—as soon as they are published. Plus, additional mailings keep you informed of changes as they happen, so you are always working with the latest requirements.

☐ **YES! Start my subscription today! (Item No. 2H-NFCSS) $600.00 (NFPA Members $540.00*)**

Total amount enclosed $ _____ NFPA Member No. _____

☐ I enclose a check (payable to NFPA).

☐ Please bill me.

Name _____

Address _____

City, State, Zip _____

For easy ordering, call toll-free
1-800-344-3555!
Monday–Friday, 8:30 AM–8:00 PM, ET

* *Prices subject to change.*

Thank you for your purchases!

NFPA listens to our customers. Please let us know what you think.

What types of products would you like to see more of?

☐ seminars
☐ code handbooks
☐ general reference books
☐ videos
☐ training packages
☐ informational brochures
☐ electronic media
☐ other _____

In what subject area(s) would you like to see more products?

☐ electrical
☐ Fire Prevention Week
☐ public education
☐ other _____
☐ life safety
☐ fire service
☐ hazardous materials

How can NFPA better serve your needs?

_____

_____

_____

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 3376 BOSTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

NATIONAL FIRE PROTECTION ASSOCIATION
1 BATTERYMARCH PARK
PO BOX 9101
QUINCY MA 02269-9904

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 3376 BOSTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

NATIONAL FIRE PROTECTION ASSOCIATION
1 BATTERYMARCH PARK
PO BOX 9101
QUINCY MA 02269-9904

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL
FIRST CLASS MAIL PERMIT NO. 3376 BOSTON, MA

POSTAGE WILL BE PAID BY ADDRESSEE

NATIONAL FIRE PROTECTION ASSOCIATION
1 BATTERYMARCH PARK
PO BOX 9101
QUINCY MA 02269-9904
Attn: Product Development

NFPA 664

Standard for the

Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

1993 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 and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 24-27, 1993, in Orlando, FL. It was issued by the Standards Council on July 23, 1993, with an effective date of August 20, 1993, and supersedes all previous editions.

The 1993 edition of this document 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 clarified the intent of numerous existing requirements. A new chapter which covered thermal oil heating systems was added as a result of increased use of these systems in industry. The format of the 1987 revision was to conform with the NFPA *Manual of Style*.

For this 1993 edition, the Committee has provided information on the characteristics of wood dust covered by the standard, clarified the dust collection requirements including the provisions for recycling exhaust air, and incorporated minor editorial revisions to comply with the NFPA *Manual of Style*.

Technical Committee on Wood, Paper and Cellulosic Dusts

Peter H. Billing, Nat'l Forest Products Assn., FL
Byron G. Bombay, KraftMaid Cabinetry (Masco Inc.), OH
Kenneth W. Dungan, Professional Loss Control Inc., TN
Thomas E. Frank, Factory Mutual Engr Assn., WA
James M. Ingalls, Industrial Risk Insurers, CT
(Rep. Industrial Risk Insurers)
Lowell E. Pauli, Lowell E. Pauli & Assoc. Inc., OR
C. Curtis Peterson, American Hardboard Assn., IL
Glyn H. Stock, 3S, Inc., OH

Alternates

Kenneth E. Bland, Nat'l Forest Products Assn., NH
(Alt. to P. H. Billing)
Edward D. Leedy, Industrial Risk Insurers, IL
(Alt. to J. M. Ingalls)
Larry J. Moore, Factory Mutual Research Corp., MA
(Alt. to T. E. Frank)

Martha H. Curtis, NFPA Staff Liaison

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.

Committee Scope: Responsible for documents for the prevention, control, and extinguishment of fires and explosions resulting from dusts produced from the handling, processing, or storage of wood and paper and other cellulosic materials.

Contents

NFPA 664

Standard for the

Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

1993 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.

1-1.1* 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.

1-1.2* This standard shall apply to production or industrial-scale woodworking operations.

Exception: It does not apply to small-scale woodworking operations that are incidental to the principal occupancy.

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 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard, provided technical documentation is submitted to the authority having jurisdiction to demonstrate equivalency and the system, method, or device is approved for the intended purpose.

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."

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

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.

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 adjacent buildings by open space or adjoining buildings by fire walls or fire partitions, as well as elimination of all unnecessary openings through floors.

2-2 Wall Construction.

2-2.1 Where 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 partitions shall be protected by approved automatic closing fire doors having a fire endurance rating equivalent to the fire endurance rating of the fire partition. Fire doors shall be installed according to NFPA 80, *Standard for Fire Doors and Fire 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 partitions shall be protected by approved fire dampers. No ducts shall penetrate 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 sufficient intervals to prevent 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 or Article 503 of NFPA 70, *National Electrical Code*, as applicable.

Chapter 6 Control of Ignition Sources

6-1 Cutting and Welding. Cutting and welding shall comply with applicable requirements of NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes*.

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 780, *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, where 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, where provided, shall comply with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*.

7-2* Automatic Sprinklers. Automatic sprinklers, where 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, where 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* Dust collection systems shall comply with the requirements of NFPA 91, *Standard for Exhaust Systems for Air Conveying of Materials*.

8-2.2* Dust collectors shall be located outside of buildings.

Exception No. 1: Dust collectors shall be permitted to be located inside of buildings if they are located adjacent to an exterior wall, are vented to the outside through straight ducts not exceeding 10 ft (3 m) in length, and have explosion vents.*

Exception No. 2: Dust collectors shall be permitted to be located inside of buildings if protected by an explosion suppression system meeting the requirements of NFPA 69, Standard on Explosion Prevention Systems.

8-2.3 All cutting, shaping, planing, sanding, or other machines that produce finely divided wood dust or shavings shall be provided with a dust pickup, conveying, and collecting system.

8-2.4 Hoods and Enclosures.

8-2.4.1 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.

8-2.4.2 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.

8-2.4.3 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.

8-2.5 Duct System.

8-2.5.1 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.

8-2.5.2 The capacity of the system shall be calculated on the basis of all hoods and other openings connected to the system being open.

8-2.5.3 Dampers, gates, or orifice plates provided for the specific purpose of balancing the airflow in the system shall be fastened to prevent inadvertent manipulation.

8-2.5.4 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 that accumulates around the machines and be swept up.

8-2.6 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.

8-2.7 Fans or Blowers. 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.

8-2.8 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* Interior ducts shall be sufficiently strong to withstand maximum explosion pressures unless protected by a listed explosion suppression system (*see Chapter 3*). Exterior ducts shall be provided with explosion venting.

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.

Exception: A listed explosion suppression system designed in accordance with NFPA 69, Standard on Explosion Prevention Systems, is an acceptable alternative to explosion venting.

8-3.6* Wood dust 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 a listed explosion suppression system (*see Chapter 3*).

8-4 Recycling Exhaust Air. Filtered air shall not be recycled back into the building unless one of the following arrangements (8-4.1 or 8-4.2) is provided:

8-4.1 The system shall be equipped with a listed spark detection and suppression system. The recycled air duct shall be fitted with an abort damper that would be activated by the spark detector by passing the air to atmosphere, away from the plant. 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.

8-4.2 The system shall be equipped with a listed spark detection and suppression system. The recycled air duct shall be provided with either an automatic fast-acting valve system or flame front diverter installed in accordance with NFPA 69, *Standard on Explosion Prevention Systems.*

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 8503, *Standard for 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 heater rooms or buildings shall be protected by automatic sprinklers designed to control a hot oil-spill fire.

9-3.1.2 Thermal oil heaters shall be located and arranged to minimize the hazard from a potential oil spill.

9-3.1.3 The preferred location shall be outdoors or in a separate, detached building.

9-3.1.4 Where 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 8501, *Standard for Single Burner Boiler Operation.*

9-3.3.2 Wood dust suspension burners shall be designed and installed in accordance with the applicable requirements of NFPA 8503, *Standard for 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 Where 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, 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 ensure 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 that 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 wherever practical. All bearings shall be dusttight.

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. All dust-producing equipment shall be dusttight or the equipment and dust-producing operations shall be provided with dusttight 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 and 10-4, and 10-5.1.

11-3.2 Where conveying equipment passes between buildings or rooms that 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 accommodate 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 Including Type Designations, Areas of Use, Maintenance, and Operation*.

Exception: If the storage building complies with 11-2(a), a non-classified front-end loader shall be permitted to 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 is the current edition as of the date of the NFPA issuance of this document.

12-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. 9101, Quincy, MA 02269-9101.

NFPA 10, *Standard for Portable Fire Extinguishers*, 1990 edition.

NFPA 11, *Standard for Low Expansion Foam and Combined Agent Systems*, 1988 edition.

NFPA 11A, *Standard for Medium- and High-Expansion Foam Systems*, 1988 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 1993 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 1992 edition.

NFPA 12B, *Standard on Halon 1211 Fire Extinguishing Systems*, 1990 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1991 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 1993 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 1990 edition

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 1990 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 1992 edition.

NFPA 30, *Flammable and Combustible Liquids Code*, 1993 edition.

NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes*, 1989 edition.

NFPA 69, *Standard on Explosion Prevention Systems*, 1992 edition.

NFPA 70, *National Electrical Code*, 1993 edition.

NFPA 80, *Standard for Fire Doors and Fire Windows*, 1992 edition.

NFPA 82, *Standard on Incinerators, Waste, and Linen Handling Systems and Equipment*, 1990 edition.

NFPA 86, *Standard for Ovens and Furnaces*, 1990 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Materials*, 1992 edition.

NFPA *101*, *Life Safety Code*, 1991 edition.

NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Maintenance, and Operation*, 1992 edition.

NFPA 780, *Lightning Protection Code*, 1992 edition.

NFPA 8501, *Standard for Single Burner Boiler Operation*, 1992 edition.

NFPA 8503, *Standard for Pulverized Fuel Systems*, 1992 edition.

Appendix A Explanatory Material

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

A-1-1.1 Such facilities include, but are not limited to, wood flour plants, woodworking plants, lumber mills, composite board plants, and large pattern shops in foundries.

A-1-1.2 Incidental operations are those typically limited to 6 to 8 people. Small-scale operations would not have more than 1 or 2 small dust collectors.

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

A-1-4 Approved. 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.

A-1-4 Authority Having Jurisdiction. 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."

A-1-4 Listed. 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.

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 approved automatic closing fire doors or fire dampers having a fire endurance rating equal to the floor being penetrated.

Buildings using open space separation techniques should refer to NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures.*

A-2-2.3 See NFPA 68, *Guide for Venting of Deflagrations*, for guidance on the strength of relieving and resisting walls.

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 NFPA *101, 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 might be necessary for maximum effectiveness with many types of wood dust.

A-3-1 In general, dust particles need to be below 420 μm (microns) (U.S. sieve No. 40) to create a dust explosion hazard. The degree of explosion hazard will vary depending on the type of combustible dust and processing methods used. A dust explosion has three requirements, all of which must be met:

(a) The dust must be combustible

(b) The dust particles must form a cloud at or exceeding the minimum explosion concentration

(c) A source of ignition must be present.

A-3-1.1 Refer to NFPA 68, *Guide for Venting of Deflagrations*, for sizing of explosion vents.

A-3-1.2 See "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 can 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-5-1.2 Refer to NFPA 497B, *Recommended Practice for the Classification of Class II Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.*

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 can 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 Each system should 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.

A-8-2.2 Although the exceptions allow dust collectors indoors under certain conditions, the preferred location is outdoors.

A-8-2.2 Exception No. 1. See NFPA 68, *Guide for Venting of Deflagrations*, for designing explosion venting.

A-8-3.1 Air conveying systems, such as from a hog or hammermill, can 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-gauge 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 gauge might 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, Frank, T. E., "Fire and Explosion Control in Bag Filter Dust Collection Systems," NFPA Fire Journal, Vol. 75, No. 2, March 1981, p. 73.*)

It is advisable for outdoor ducts to be provided with explosion venting to help minimize the overall pressure buildup resulting from a deflagration. For information on explosion venting, see NFPA 68, *Guide for Venting of Deflagrations.*

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-gauge 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 substoichiometric 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 can even be needed for a period of time after burner shutdown due to the latent heat in the heater.

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-9-3*).

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 A-9-5.1(a)*].

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 A-9-5.1(a) and A-9-5.1(b) 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 nonhazardous 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 A-9-5.1(a) and A-9-5.1(b) 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 buildup of explosive concentrations of combustibles.

A-9-4.2 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.

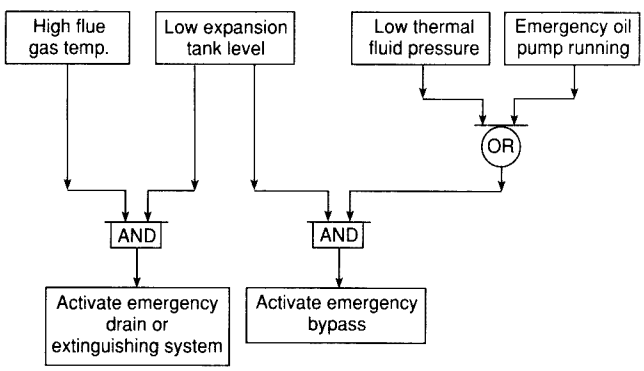
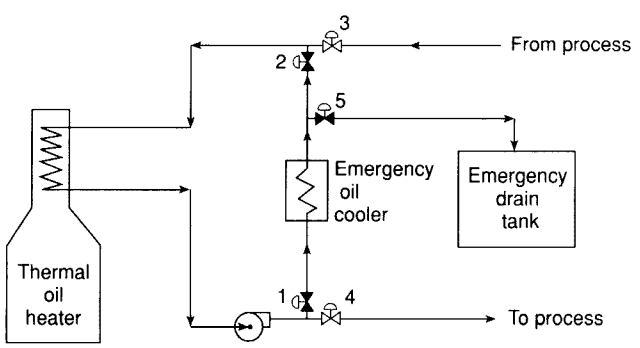


Figure A-9-5.1(a) Typical oil leak detection logic.



Typical emergency bypass/drain system

Emergency bypass–Valves 1 and 2 open; valves 3 and 4 closed
Emergency drain–Valves 1 and 5 open; valves 2, 3, and 4 closed

Figure A-9-5.1(b) 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 can 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 is the current edition as of the date of the NFPA issuance of this document.

B-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 68, *Guide for Venting of Deflagrations*, 1988 edition.

NFPA 77, *Recommended Practice on Static Electricity*, 1993 edition.

NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, 1993 edition.

NFPA *101*, *Life Safety Code*, 1991 edition.

NFPA 220, *Standard on Types of Building Construction*, 1992 edition.

NFPA 497B, *Recommended Practice for the Classification of Class II Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, 1991 edition.

B-1.2 Other Publications.

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

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

Pauli, L. E. "Explosion Venting of Industrial Air Systems," *Proceedings* of the 12th Annual Particleboard Symposium, 1978.

Index