NFPA 664

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

1998 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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NFPA 664

Standard for the

Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

1998 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 18–21, 1998, in Cincinnati, OH. It was issued by the Standards Council on July 16, 1998, with an effective date of August 5, 1998, and supersedes all previous editions.

This edition of NFPA 664 was approved as an American National Standard on August 6, 1998.

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, 1971, 1981, 1987, and 1993.

For this 1998 edition, the Committee has provided clarification on the scope and applicability of the document. In the document scope, an exclusion has been added for small facilities based on the criteria of flow rate and area of facility. The document has been revised to make the requirements more performance-based and enforceable.

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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. A key to classifications is found at the back of this document.

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: This Committee shall have primary responsibility for documents safeguarding against the fire and explosion hazards associated with 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

1998 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found 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 establishes the minimum requirements for the construction, operation, and protection of facilities that handle, store, or process wood or wood products that produce or utilize finely divided wood particles or wood fibers. Such facilities include, but are not limited to, wood flour plants, woodworking plants, lumber mills, and composite board plants.

1-1.2* This standard shall apply to dust-producing operations that occupy areas of more than 2000 ft^2 (185.8 m^2) or to areas where dust-producing equipment requires an aggregate dust collection flow rate of more than 1500 ft^3/min (2548.6 m^3/hr).

1-2 Purpose.

1-2.1 The purpose of this standard is to provide a reasonable degree of protection from loss of life and property from 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 that technical documentation is submitted to the authority having jurisdiction to demonstrate equivalency, and that the system, method, or device is approved for the intended purpose.

1-3* Applicability. The provisions of this document shall be considered necessary to provide a reasonable level of protection from loss of life and property from fire and explosion. The provisions reflect situations and the state of the art prevalent at the time the standard was issued. Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the document, except in those cases where it is determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or adjacent property.

1-4 Definitions.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

Combustible Wood Dust.* Any finely divided solid material of 420 μm (microns) or smaller in diameter (material passing a U.S. No. 40 Standard Sieve) that presents a fire or deflagration hazard.

Damage Limiting Construction.* A building construction method that incorporates exterior wall, or roof sections, or both, designed to relieve deflagration pressures without jeopardizing the structural integrity of the building and without allowing the deflagration to propagate into adjacent interior spaces.

Deflagration. Propagation of a combustion zone at a velocity that is less than the speed of sound in the unreacted medium.

Explosion. The burning or rupture of an enclosure or a container due to the development of internal pressure from a deflagration.

Hog (Wood Hog). Machine used to grind or reduce the size of wood, other feed stock, or scrap wood.

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is 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, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets identified standards or has been tested and found suitable for a specified purpose.

Shall. Indicates a mandatory requirement.

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

Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

Chapter 2 Building Construction

2-1 General Requirements.

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

Exception: Other types of building construction shall be permitted if an automatic sprinkler system is provided throughout the wood-handling areas.

2-1.2* Passive Fire Protection.

2-1.2.1 Passive fire protection features shall be utilized to prevent the spread of fire or explosions, or both, between sections of the facility with different hazards.

2-1.2.2 Raw materials storage, finished products storage, manufacturing areas, nonmanufacturing areas, and high hazard occupancies shall be considered as different hazards.

2-1.2.3 Passive fire protection features shall include separation of adjacent buildings by open space, or separation of adjoining building areas by fire walls, fire partitions, or draft curtains, as well as elimination of unnecessary openings through floors.

2-2 Wall Construction.

2-2.1 If walls are erected as fire walls between adjoining buildings, then they shall be designed for a minimum fire endurance of 4 hours.

2-2.2 Interior walls erected as fire barrier walls between adjoining areas shall be designed for a minimum fire endurance of 1 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.

2-2.4 Walls erected as fire walls shall comply with NFPA 221, *Standard for Fire Walls and Fire Barrier Walls*.

2-2.5* A room or building shall be considered to have an explosion hazard where dust accumulations exceed $^1/_8$ in. (3 mm) or where visible dust clouds exist. Rooms or buildings where dust accumulations present an explosion hazard shall be provided with damage-limiting construction, including deflagration venting to a safe outside location.

2-3 Protection of Openings.

2-3.1 All penetrations of floors and walls shall be provided with listed or approved firestopping having a fire endurance rating equal to that of the floor or wall.

2-3.2 Piping and ductwork used to convey combustible materials shall not penetrate fire walls.

2-3.3 Penetrations in barriers erected to segregate dust hazards shall be dusttight.

2-3.4 All openings, including conveyor and chute openings, in fire-rated assemblies shall be protected by listed or approved, automatic-closing fire doors or fire dampers that have a fire endurance rating equivalent to the fire-rated assembly.

Exception: Duct penetrations in fire barrier walls shall be protected in accordance with NFPA 650, Standard for Pneumatic Conveying Systems for Handling Combustible Materials.

2-3.5 Fire doors shall be installed according to NFPA 80, *Standard for Fire Doors and Fire Windows*.

2-3.6* 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 Means of Egress. The means of egress 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 Deflagration Venting

3-1* General Requirements.

3-1.1* Deflagration 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 deflagration occurs.

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

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 500 of NFPA 70, *National Electrical Code®*.

4-1.4* The use of compressed air or other similar means to remove dust accumulations from areas that are 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 Prevention of Ignition

6-1* Ignition Precautions. Precautions shall be taken to prevent ignition by eliminating or controlling sources of ignition.

6-2 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*

6-3 Static Electricity and Lightning Protection.

6-3.1* Static electricity shall be prevented from accumulating on machines or on equipment that is subject to accumulation of static electric charge by the following:

(a) Permanent grounding and bonding wires
(b) Grounded metal combs
(c) Other effective means

6-3.2 Lightning protection, where required, shall be installed in accordance with NFPA 780, *Standard for the Installation of Lightning Protection Systems*.

6-4 Smoking. Smoking shall only be allowed in safe designated areas.

6-5 Propellant-Actuated Tools.

6-5.1 Propellant-actuated tools shall not be used in areas where combustible dust or dust clouds are present.

6-5.2 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 shall be removed.

6-5.3 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.

6-6* Reduction of Process-Produced Ignitions.

6-6.1* Feed rates and machine adjustments (for the stock being processed) on wood cutting, shaping, planing, and sanding operations shall be controlled to prevent the generation of excessive heat sufficient to produce embers and sparks that can lead to the ignition of wood particles conveyed in the pneumatic wood removal system.

6-6.2* Wood cutting, shaping, and planing equipment shall be monitored for proper condition of the cutting edges and shall minimize the heat generated from the operation.

6-6.3* Abrasive cutting belts, discs surfaces, and devices shall not be used beyond their design lifetime and shall be replaced or cleaned in the manner specified by the manufacturer when showing signs of loading of the grit.

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 hose, 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.

7-3.1 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*
(b) NFPA 11A, *Standard for Medium- and High-Expansion Foam Systems*
(c) NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*
(d) NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*
(e) NFPA 17, *Standard for Dry Chemical Extinguishing Systems*
(f) NFPA 69, *Standard on Explosion Prevention Systems*
(g) NFPA 750, *Standard on Water Mist Fire Protection Systems*
(h) NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*

7-3.2 Spark detection and extinguishing systems shall be designed, installed, and maintained in accordance with the applicable sections of NFPA 72, *National Fire Alarm Code®*, NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, and NFPA 69, *Standard on Explosion Prevention Systems*.

Chapter 8 Dust-Collecting Systems

8-1* Scope. This chapter shall apply to all pneumatic systems utilized to convey wood, wood-derived particulates, and other cellulosic materials used as a substitute or supplement for wood.

8-2 System Design.

8-2.1* Dust-collecting systems shall be designed in accordance with NFPA 650, *Standard for Pneumatic Conveying Systems for Handling Combustible Materials*, and NFPA 91, *Standard for Exhaust Systems for Air Conveying of Materials*.

Exception: Dust-collecting systems specifically modified in accordance with Chapter 8 in this standard.

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 the following three conditions are met:*

(a) They are located adjacent to an exterior wall.

(b) They are vented to the outside through straight ducts not exceeding 10 ft (3 m) in length.

(c) They 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, dust-conveying, and dust-collecting system.

8-2.4 Hoods and Enclosures.

8-2.4.1 Hoods or enclosures shall be so designed, located, and placed that the wood dust or shavings generated will fall, be projected, or be drawn into the hood or enclosure in the direction of the airflow to provide the greatest possible containment 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 acts as a safety guard, the construction, strength, and material specifications shall 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; such fine material shall be swept up. Where tramp metal could be present, magnetic separators or an equivalent means shall be utilized to prevent the entry of such metal into the system.

8-2.5.5 Pneumatic conveying systems utilizing dilute phase transport shall be designed to limit the concentration of wood or wood-derived dusts in the dust-collecting system and shall ensure that ductwork remains below the minimum explosible concentration capable of supporting a deflagration.

Exception No. 1: Ductwork provided with deflagration venting to a safe outside location in conjunction with deflagration isolation.*

Exception No. 2: Protection in accordance with one of the following methods: (a) deflagration pressure containment in conjunction with deflagration isolation in accordance with NFPA 69, Standard for Explosion Prevention Systems; or (b) deflagration suppression systems in accordance with NFPA 69, Standard for Explosion Prevention Systems.

8-2.5.6* Metal ductwork shall be used and shall be bonded and grounded to prevent buildup of static electricity in the duct system.

8-2.6 Collecting Equipment.

8-2.6.1 The system shall be provided with collection equipment of sufficient size and capacity to separate the wood dust from the air before the air is vented.

8-2.6.2 The collection equipment shall be of noncombustible construction.

Exception: This rule shall not apply to the filter bags or filter media.

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 that 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; under no circumstances shall another operation that generates 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.

Exception: Unless protected by a listed explosion suppression system (see Chapter 3).

8-3.5 Exterior ducts shall be provided with deflagration venting.

8-3.6* 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 deflagration vents.

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

8-3.7* 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 practicable *(see Chapter 3)*.

8-3.8* Sander systems shall be protected by deflagration 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.

Exception: Where one of the arrangements described in 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, then 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, then the requirements of Chapter 10 shall be complied with.

8-5.3 If the wood dust is to be used as a fuel, then 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 and 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 that have 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 practicable, 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 by 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 to automatically 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 in 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, or 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 using 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 practicable.

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

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 and have adequate clearance from combustible material.

9-5 Thermal Oil Utilization Equipment.

9-5.1* Where fire-extinguishing systems are provided for utilization equipment, the systems 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 deflagration 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 practicable. 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 deflagration venting *(see 2-2.2 and Chapter 3)*.

(a) Raw material storage facilities

Exception: Where the storage facility 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 of this standard.

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 perform the following functions:

(a) Activate the fire suppression systems, if provided.
(b) Sound an alarm.
(c) Shut off the fuel supply.
(d) Divert burning material.
(e) Shut down preparatory process equipment.

11-3.3.3 Dryer systems that have a dust explosion potential shall be protected by deflagration 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, Conversions, Maintenance, and Operation*.

Exception: If the storage building complies with 11-2(a), a nonclassified 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 standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix B.

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

NFPA 10, *Standard for Portable Fire Extinguishers,* 1998 edition.

NFPA 11, *Standard for Low-Expansion Foam,* 1998 edition.

NFPA 11A, *Standard for Medium- and High-Expansion Foam Systems,* 1994 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 1998 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 1996 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 1996 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection,* 1996 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 1998 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 1995 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 1996 edition.

NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes,* 1994 edition.

NFPA 69, *Standard on Explosion Prevention Systems,* 1997 edition.

NFPA 70, *National Electrical Code®,* 1999 edition.

NFPA 72, *National Fire Alarm Code®,* 1996 edition.

NFPA 80, *Standard for Fire Doors and Fire Windows,* 1995 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment,* 1994 edition.

NFPA 86, *Standard for Ovens and Furnaces,* 1995 edition.

NFPA 91, *Standard for Exhaust Systems for Air Conveying of Materials,* 1995 edition.

NFPA *101®, Life Safety Code®,* 1997 edition.

NFPA 220, *Standard on Types of Building Construction,* 1995 edition.

NFPA 221, *Standard for Fire Walls and Fire Barrier Walls,* 1997 edition.

NFPA 505, *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation,* 1996 edition.

NFPA 650, *Standard for Pneumatic Conveying Systems for Handling Combustible Materials,* 1998 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* 1996 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems,* 1997 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* 1996 edition.

NFPA 8501, *Standard for Single Burner Boiler Operation,* 1997 edition.

NFPA 8503, *Standard for Pulverized Fuel Systems,* 1997 edition.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix contains explanatory material, numbered to correspond with the applicable text paragraphs.

A-1-1.2 Specific criteria in this standard could be advisable for facilities that fall outside this document's scope. A hazard and risk analysis should be performed to identify areas where specific criteria are appropriate.

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, 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 that is concerned with product evaluations and is thus 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, or 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 or her 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 Combustible Wood Dust. Any time a combustible dust is processed or handled, a potential for deflagration exists. The degree of deflagration hazard will vary depending on the type of combustible dust and processing methods used.

A dust explosion has four requirements:

(a) A combustible dust
(b) A dust dispersion in air or other oxidant exceeding the minimum combustible concentration
(c) An ignition source such as an electrostatic discharge, an electric current arc, a glowing ember, a hot surface, welding slag, frictional heat, or a flame
(d) Confinement

Evaluation of the hazard of a combustible dust should be determined by using actual test data. Each situation should be evaluated and applicable tests selected. The following list represents the factors that are sometimes used in determining the deflagration hazard of a dust:

(a) Minimum explosible concentration (MEC)
(b) Minimum ignition energy (MIE)
(c) Particle size distribution
(d) Moisture content as received and as tested
(e) Maximum explosion pressure at optimum concentration
(f) Maximum rate of pressure rise at optimum concentration
(g) K_{St} (normalized rate of pressure rise) as defined in ASTM E 1226, *Standard Test Method for Pressure and Rate of Pressure Rise for Combustible Dusts*
(h) Layer ignition temperature
(i) Dust cloud ignition temperature

(j) Limiting oxidant concentration to prevent ignition (LOC)
(k) Electrical resistivity
(l) Charge relaxation time
(m) Chargeability

A-1-4 Damage Limiting Construction. This method usually makes maximum use of exterior walls as pressure-relieving walls rather than relying on the minimum recommended. Pressure-resistive walls are sometimes included to help prevent explosion propagation into adjacent areas. Further information on this subject can be found in NFPA 68, *Guide for Venting of Deflagrations*.

A-1-4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations 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-2-1.2 Refer to NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures,* for buildings using open space separation techniques. See also NFPA 46, *Recommended Safe Practice for Storage of Forest Products,* for additional guidance.

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

A-2-2.5 A relatively small initial dust explosion will disturb, and suspend in air, dust that has been allowed to accumulate on the flat surfaces of a building or equipment. This dust cloud provides fuel for the secondary explosion, which usually causes the major portion of the damage. Reducing dust accumulations is, therefore, a major factor in reducing the hazard in areas where a dust hazard can exist.

Using a bulk density of 20 lb/ft^3 (320 kg/m^3) and an assumed concentration of 0.35 oz/ft^3 (350 g/m^3), it has been calculated that a dust layer that averages $^1/_8$ in. (3 mm) thick covering the floor of a building is sufficient to produce a uniform dust cloud of optimum concentration, 10 ft (3 m) high, throughout the building. This is an idealized situation and several factors should be considered.

First, the layer will rarely be uniform or cover all surfaces and, second, the layer of dust will probably not be completely dispersed by the turbulence of the pressure wave from the initial explosion. However, if only 50 percent of the $^1/_8$-in. (3-mm) thick layer is suspended, this is still sufficient material to create an atmosphere within the explosible range of most dusts.

Consideration should be given to the proportion of the building's volume that could be filled with a combustible dust concentration. The percentage of floor area covered can be used as a measure of the hazard. For example, a 10-ft × 10-ft (3-m × 3-m) room with a $^1/_8$-in. (3-mm) layer of dust on the floor is obviously hazardous and should be cleaned. Now consider this same 100 ft^2 (9.3 m^2) area in a 2025 ft^2 (188 m^2) building; this also is a moderate hazard. This area represents about 5 percent of a floor area and is about as much coverage as should be allowed in any plant. To gain proper perspective, the overhead beams and ledges should also be considered. Rough calculations show that the available surface area of the bar joist is about 5 percent of the floor area. For steel beams, the equivalent surface area can be as high as 10 percent.

From the above information, the following guidelines have been established.

(a) Dust layers $^1/_8$-in. (3-mm) thick can be sufficient to warrant immediate cleaning of the area.

(b) The dust layer is capable of creating a hazardous condition if it exceeds 5 percent of the building's floor area.

(c) Dust accumulation on overhead beams and joists contributes significantly to the secondary dust cloud and is approximately equivalent to 5 percent of the floor area. Other surfaces, such as the tops of ducts and large equipment, can also contribute significantly to the dust cloud potential.

(d) The 5 percent factor should not be used if the floor area exceeds 20,000 ft^2 (1858 m^2). In such cases, a 1000 ft^2 (93 m^2) layer of dust is the upper limit.

(e) Due consideration should be given to dust that adheres to walls, since this is easily dislodged.

(f) Attention and consideration should also be given to other projections such as light fixtures that can provide surfaces for dust accumulation.

(g) Dust collection equipment should be monitored to be certain it is operating effectively. For example, dust collectors using bags operate most effectively between limited pressure drops of 3 in. to 5 in. of water (0.74 kPa to 1.24 kPa). An excessive decrease or low drop in pressure indicates insufficient coating to trap dust.

The above guidelines will serve to establish a cleaning frequency.

A-2-3.6 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 need to be met:

(a) The dust is combustible.

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

(c) A source of ignition is present.

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

A-3-1.2 Refer to "Explosion Venting as a Means of Controlling Dust Explosions," and "Explosion Venting of Industrial Air Systems."

A-4-1.1 Woodworking and wood-derived particulate processing facilities should be equipped with a permanent vacuum system. The system should be electrically conductive, and bonded and grounded so as not to accumulate static electric charges. It should have sufficient suction pressure and capacity to allow the connection of flexible vacuum hose of a length to allow operators to effectively clean all surfaces within the dusty area. The vacuum system should be a separate dedicated system with its own dust collector.

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 this method of cleaning 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 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.*

A-6-1 Potential sources of ignition include, but are not limited to, the following: open flames; hot surfaces; radiant heat; smoking; cutting and welding and hotwork; static electricity; electrical sparks; stray electrical current; and ovens, furnaces, and heating equipment.

A-6-3.1 Grounding and bonding information can be found in NFPA 77, *Recommended Practice on Static Electricity.*

A-6-6 Whenever wood or wood-derived products are cut, shaped, planed, or smoothed, heat is generated in the process. This heat can be sufficient to raise the wood or wood-derived materials to their ignition points, igniting a fire. It is important to observe safe operating procedures if a fire is to be prevented.

A-6-6.1 High feed rates generate more heat per unit time and unit of wood processed and the heat increases the likelihood of an ignition. This is particularly important when working with wood species that exhibit wide variations in density and hardness.

A-6-6.2 The quantity of heat generated is also affected by the sharpness of the cutting tool, whether the tool is a saw, shaper, router, planer, or abrasive. Properly sharpened tools cut cooler and are far less likely to ignite the stock.

A-6-6.3 Abrasive belts have been identified as a source of ignition in a number of serious fires. This necessitates careful management of the abrasive condition. Once the grit begins loading up, all of the power dissipated by the machine motor is essentially converted to frictional heat. Extreme care should be employed with abrasive shaping and surfacing units for this reason.

A-7-1.2 Inside, $1^1/_2$-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-8-1 Wood and wood-derived materials include, but are not limited to, sawdust, sanderdust, wood planer shavings, wood fiber, wood milling or molding waste, and paper waste. Other cellulosic materials include, but are not limited to, wheat straw, flax, bagasse, coconut shells, corn stalks, hemp, rice hulls, and recycled paper. As an example, these systems include, but are not limited to, dust collection systems and pneumatic bulk conveying systems transporting material from hogs, hammermills, grinders, flakers, planers, refiners, sanders, and chippers.

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 outdoors, 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 information on the design of deflagration vents.

A-8-2.5.5 Exception No. 1. For information on design of deflagration vents, see NFPA 68, *Guide for Venting of Deflagrations.*

A-8-2.5.6 Nonconductive ducts, such as PVC pipe, should not be used. A ground wire or other grounding system for PVC pipe is not acceptable.

A-8-3.1 Air conveying systems serving production sanders, hogs, or hammermills can fall within the scope of this section depending on the moisture content, particle size, and concentration of the dust generated.

A-8-3.3 Ducts with a 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 welded steel 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. *(Refer to "Fire and Explosion Control in Bag Filter Dust Collection Systems.")*

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

A-8-3.6 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 deflagration venting or suppression is provided.

A-8-3.7 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-8-3.8 An infrared spark detection system should be considered, to perform the following functions:

(a) Shut down the sander.

(b) Stop material infeed.

(c) Initiate a water spray deluge in the collecting system.

(d) 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 A thermal oil heating system is a closed loop circulating system that heats a flammable or combustible fluid and transports it to utilization equipment for the purpose of transferring its heat to the equipment. System equipment commonly includes thermal oil heaters, vaporizers, primary pumps, thermal oil tanks, and expansion tanks.

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 could be a separate, stand-alone unit or could be 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 [refer to 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 reignition 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 might 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.