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D. PEARSELL MTC.

HOUSEHOLD FIRE WARNING EQUIPMENT 1975



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NATIONAL FIRE PROTECTION ASSOCIATION

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**Standard for the Installation,
Maintenance, and Use of
Household Fire Warning Equipment**

NFPA No. 74 — 1975

1975 Edition of No. 74

This Standard was adopted by the Association at its 1975 Fall Meeting, held in Pittsburgh, PA, November 17-20. This 1975 edition supersedes all previous editions.

Origin and Development of No. 74

Work on this Standard followed the withdrawal of an NFPA Manual on Home Fire Alarm Systems (designated No. 74M) at the 1965 NFPA Annual Meeting. At the 1966 Annual Meeting, the sponsoring Sectional Committee submitted for Tentative Adoption this proposed Standard. Favorable action was taken at the 1966 Annual Meeting but extensive discussion of the 1966 draft resulted in the Committee making considerable revisions in the 1967 edition and a complete revision in 1972.

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Standard for Household Fire Warning Equipment

NFPA No. 74 — 1975

Chapter 1 General

THIS STANDARD

1-1 Scope. Covers the requirements for the proper selection, installation, operation and maintenance of fire warning equipment for use within family living units.

1-2 General Provisions.

1-2.1 This standard is primarily concerned with life protection, not with protection of property. It contemplates that the family has an exit plan.

1-2.2 A control and associated equipment, multiple or single station alarm device(s), or any combination thereof, may be used to form a household fire warning system.

1-2.3 The detection or alarm systems covered by this standard are for the sole use of the protected household. If the alarm is to be extended to any other location such as a fire department the total system should follow, as applicable, NFPA Standards Nos. 71, 72A, 72B, 72C, or 72D: except that the requirements of section 2-5 of this standard shall be maintained.

1-2.4 The installation of wiring and equipment shall be in accordance with Article 760, Fire Protective Signaling Systems of the National Electrical Code, NFPA No. 70-1975.

1-3 Approval.

1-3.1 Equipment.

1-3.1.1 All devices, combinations of devices, and equipment to be installed in conformity with this standard shall be approved or listed for the purposes for which they are intended.

1-3.1.2 A device or system of devices having materials or forms different from those detailed in this standard may be examined and tested according to the intent of the standard and if found equivalent, may be approved.

1-4 Definitions.

1-4.1 Throughout this standard the following meanings are intended:

Household Fire Warning System: A system of devices that produce an audible alarm signal in the household for the purpose of notifying the occupants of the presence of a fire so they may evacuate the premises.

Alarm Signal: An audible signal indicating a fire condition.

Trouble Signal: An indication distinctive from the alarm signal warning of a malfunction or failure of the system.

Smoke Detector: A device which detects visible or invisible particles of combustion.

Heat Detector: A device which detects abnormally high temperature or rate-of-temperature rise.

Single Station Alarm Device: An assembly incorporating the detector, control equipment, and the alarm-sounding device in one unit, operated from a power supply either in the unit, or obtained at the point of installation.

Multiple Station Alarm Device: Single station alarm devices, two or more, which may be interconnected so that actuation of one causes all integral or separate audible alarms to operate. It may also consist of one single station alarm device having connections for other detectors or manual stations.

Exit Plan: Plan for the emergency evacuation of the premises.

Approved, Listed, Shall, Should: These four words have specific meanings as described on the inside front cover of this standard.

Household: The family living unit in single-family detached dwellings, single-family attached dwellings, multifamily buildings, and mobile homes.

Living Room: Means any room frequently occupied as a living area, such as, living room, family rooms, recreation rooms, etc.

Family Living Unit: That structure, area, room, or combination of rooms in which a family (or individual) lives. This is meant to cover living area only and not common usage areas in multifamily buildings such as corridors, lobbies, basements, etc. (*Also, see paragraph 1-2.3.*)

Separate Sleeping Area: By sleeping area is meant the area or areas of the family living unit in which the bedrooms (or sleeping rooms) are located. Bedrooms (or sleeping rooms) separated by other use areas, such as kitchens or living rooms (but not bathrooms), shall be considered as separate sleeping areas for purposes of this standard.

Combination System: A household fire warning system whose components may be used in whole or in part, in common with a nonfire emergency signalling system, such as a Burglar Alarm System or an Intercom System, without degradation of or hazard to the fire warning system.

Chapter 2 Basic Requirements

2-1 Power Supplies.

2-1.1 General.

2-1.1.1 All power supplies shall be sufficient to operate the alarm signal(s) for at least 4 continuous minutes.

2-1.1.2 For electrically powered devices, an AC primary power source shall be utilized in all new construction. In existing households, AC primary power is preferred. However, where such is not practical, a monitored battery primary power source is permitted.

2-1.2 Primary Power Supply (AC).

2-1.2.1 An AC primary source of electric power, if used, shall be a dependable commercial light and power supply source. A visible "power on" indicator shall be provided.

2-1.2.2 All electrical systems designed to be installed by other than a qualified electrician shall be powered from a source not in excess of 30 volts and meeting the requirements for power limited fire protective signaling circuits as defined in Article 760 of the National Electrical Code, NFPA No. 70.

2-1.2.3 A cord-connected installation is acceptable provided the installation makes use of a receptacle *not* subject to loss of power by a wall switch. A restraining means shall be used at the plug-in.

2-1.2.4 Neither loss nor restoration of primary power shall cause an alarm signal.

2-1.3 Primary Power Supply (Monitored Battery).

2-1.3.1 Household fire warning equipment may be powered by a battery provided that the battery is monitored to assure that the following conditions are met:

(a) All power requirements are met for at least one year's life, including routine testing.

(b) A distinctive audible trouble signal is given before the battery is incapable of operating (from aging, terminal corrosion, etc.) the device(s) for alarm purposes.

(c) For a unit employing a lock-in alarm feature, automatic transfer is provided from alarm to a trouble condition. If a unit does not have a lock-in feature, automatic transfer from alarm to trouble is not required.

(d) The unit is capable of producing an alarm signal for at least four minutes at the battery voltage at which a trouble signal is normally obtained followed by seven days of trouble signal operation.

(e) The audible trouble signal is produced at least once every minute for seven consecutive days.

(f) The monitored batteries meeting these specifications are clearly identified on the unit near the battery compartment.

2-1.4 Secondary Power Supply.

2-1.4.1 A secondary source of power is desirable. When a secondary source of power is provided, it should be of sufficient capacity to operate the system for 24 hours and thereafter to sound alarm devices for not less than four minutes. *not at night*

2-1.5 Primary Power (Nonelectrical)

2-1.5.1 The source of power for a nonelectrical portion of a system, or for single or multiple station device(s) may consist of suitable tanks of nonflammable compressed or liquefied gas approved for the purpose, or suitable mechanically operated devices approved for the purpose. A visible indication shall be provided to show whether sufficient operating power is available.

2-1.6 Combination System.

2-1.6.1 When common wiring is employed for a combination system, the equipment for other than the fire warning signaling system shall be connected to the common wiring of the system so that short circuits, open circuits, grounds, or any fault in this equipment or interconnection between this equipment and the fire warning system wiring shall not interfere with either the supervision of the fire warning system or prevent alarm or trouble signal operation.

2-1.6.2 In a Fire/Burglar System, the operation shall be as follows:

(a) A fire alarm signal shall take precedence or be clearly recognizable over any other signal even when the nonfire alarm signal is initiated first.

(b) Distinctive alarm signals shall be obtained between fire alarm and other functions, such as burglar alarm. The use of a common sounding appliance for fire and burglar alarm is acceptable if distinctive signals are obtained. A steady, continuous sound for one alarm function and a pulsing sound for the other alarm function is acceptable.

2-2 Equipment Performance.

2-2.1 General.

2-2.1.1 The failure of any nonreliable or short-life component which renders the detector inoperative shall be readily apparent to the occupant of the living unit without the need for test.

2-2.2 Smoke Detectors.

2-2.2.1 Each smoke detector shall be capable of detecting abnormal quantities of smoke that may occur in a dwelling and shall properly operate in the normal environmental conditions of a household.

2-2.2.2 Smoke detectors shall be capable of detecting gray smoke having a minimum smoke obscuration of 4 percent per foot (optical density of 0.0177 per foot).

2-2.3 Heat Detectors.

2-2.3.1 Each heat detector shall be capable of detecting abnormally high temperature or rate-of-temperature rise.

2-2.3.2 When fixed temperature detectors are used in areas of the home where ceiling temperatures do not exceed 100° F, detectors rated not lower than 135° F and not higher than 165° F shall be used.

2-2.3.3 When fixed temperature detectors are used in areas of the home where ceiling temperatures occasionally exceed 100° F, detectors rated not lower than 175° F and not higher than 225° F shall be used. Common examples of such areas are attics, the space near hot air registers, and some furnace rooms.

2-2.4 Alarm Sounding Devices.

2-2.4.1 Each detection device shall cause the operation of an alarm which shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed. The tests of audibility level shall be conducted with all household equipment, which may be in operation at night, in full operation. Examples of such equipment are window air conditioners and room humidifiers.

2-2.4.2 All alarm sounding devices shall have a minimum rating of 85 dBA at 10 feet.

2-2.5 Control Equipment.

2-2.5.1 The control equipment shall be automatically restoring on restoration of electrical power.

~~2-2.5.2~~ The control equipment shall be of a type that "locks in" on an alarm condition. Smoke detection circuits need not lock in.

^{2-2.5.2} 2-2.5.3 If a reset switch is provided, it shall be a self-restoring type.

^{2-2.} 2-2.5.4 Any alarm silencing switch or an audible trouble silencing switch shall not be provided unless its silenced position is indicated by a readily apparent signal.

2-2.5.5 Each electrical fire warning system shall have a self-restoring test button or means to permit the householder to check the system.

2-2.5.6 Smoke detectors may be tested by using smoke instead of the test button described in section 2-2.4.5.

2-3 Detector Circuits.

2-3.1 Type of Circuit.

2-3.1.1 This standard requires a detector circuit where a break in the wiring will not cause an alarm signal, but will cause an audible trouble signal, using either a closed loop detector circuit or normally open contact detectors with end of line resistor or equivalent.

2-3.2 Circuit Wiring.

2-3.2.1 All installation wiring extended from the output side of a power limited supply shall either use conductors and cables approved for use with power limited fire protective signaling circuits or be wired in accordance with the requirements for nonpower limited fire protective signaling circuits of Article 760 of the National Electrical Code, NFPA No. 70.

2-3.2.2 Wire used shall be of the solid conductor, non-stranded type.

2-4 Levels of Protection.

2-4.1 General.

2-4.1.1 For purposes of this standard, the phrase "levels of protection" shall mean the levels described in section 2-4.3 together with all requirements of section 2-5. Refer to Appendixes B and C for additional information.

2-4.2 Responsibility for Choice of Level of Protection.

2-4.2.1 Each authority having jurisdiction shall determine the level of protection to be provided.

2-4.2.2 For those jurisdictions not having household fire warning equipment requirements, it is the responsibility of the seller to provide the purchaser with the level-of-protection guidelines presented herein.

2-4.2.3 For those jurisdictions not having household fire warning equipment requirements, it is the responsibility of the householder to determine the level of protection to be installed using the guidelines presented herein.

2-4.3 Description of Levels of Protection.

2-4.3.1 A level of protection may be selected from one of the following four predetermined levels or intervening levels. The minimum level of protection shall not be less than Level 4. Table 2-4.3 summarizes the four predetermined levels of protection.

2-4.3.2 **Level 1.** The installation of one or more basic smoke detectors plus additional heat or smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area and at the head of each basement stairway.

(b) Heat or smoke detectors shall be installed in all other major areas and rooms of the living unit including each living room, dining room, bedroom, kitchen, hallway, attic, furnace room, utility room, basement and integral or attached garage.

2-4.3.3 **Level 2.** The installation of one or more basic smoke detectors plus additional heat or smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area.

(b) Heat or smoke detectors shall be installed in each living room, bedroom, kitchen, attic, furnace room, and basement.

2-4.3.4 **Level 3.** The installation of one or more basic smoke detectors plus additional heat or smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area.

(b) Heat or smoke detectors shall be installed in each living room, kitchen, furnace room, and basement.

2-4.3.5 **Level 4.** The installation of one or more basic smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area and at the head of each stairway leading to an occupied area.

Table 2-4.3
Levels of Protection

Level	Detection Equipment Required	Where to be Installed	
		Smoke Detectors	Smoke or Heat Detectors
1	One or more smoke detectors plus additional smoke or heat detectors	To protect each separate sleeping area and at the head of each basement stairs	All other major areas and rooms of the living unit including any basement
2	One or more smoke detectors plus additional smoke or heat detectors	To protect each separate sleeping area	Basement, kitchen, living room, bedrooms, attic, furnace (utility) rooms
3	One or more smoke detectors plus additional smoke or heat detectors	To protect each separate sleeping area	Basement, kitchen, living room, furnace (utility) rooms
4	One or more smoke detectors	To protect each separate sleeping area and at the head of each stairway to occupied areas	Not applicable

2-5 Detector Location and Spacing.

2-5.1 Smoke Detectors.

2-5.1.1 Smoke detectors in rooms with ceiling slopes greater than one-foot rise per 8-feet horizontally shall be located at the high side of the room.

2-5.1.2 A smoke detector installed at the head of stairs shall be so located as to assure that smoke rising in the stairwell cannot be prevented from reaching the detector by an intervening door or obstruction. *in a stairwell*

2-5.1.3 A smoke detector installed to protect a sleeping area in accordance with 2-4.3.2(a), 2-4.3.3(a), 2-4.3.4(a), or 2-4.3.5 shall be located outside of the bedrooms but in the immediate vicinity of the sleeping area.

Exception: Where one smoke detector can be located so as to simultaneously comply with both 2-5.1.2 and 2-5.1.3, one smoke detector may be so located and used rather than two or more.

2-5.1.4 * Smoke detectors shall be located on or near the ceiling.

2-5.2 Heat Detectors.

2-5.2.1 Heat detectors shall be installed within the strict limitation of their listed spacing in rooms with smooth, level ceilings.

2-5.2.2 The maximum installed spacing shall be 50 percent of the listed spacing in the uphill direction from a detector in a room with a ceiling slope greater than one-foot rise per eight-feet horizontally.

2-5.2.3 Spot-type detectors shall be installed on or near the ceilings.

2-5.2.4 On level ceilings with open joists or beams, all detectors shall be mounted on the bottom of such joists or beams.

2-5.2.5 Reduced spacing may be required due to structural characteristics of the protected area, possible drafts, or other conditions affecting detector operation. Detectors installed on a *AN* *JOIST* joisted ceiling shall have their smooth ceiling spacing reduced where this spacing is measured at right angles to solid joists; in the case of spot detectors this spacing shall not exceed one half of the listed spacing.

Chapter 3 Installation

3-1 General.

3-1.1 General Provisions.

3-1.1.1 All equipment shall be installed in a workmanlike manner.

3-1.1.2 All devices shall be so located and mounted that accidental operation will not be caused by jarring or vibration.

3-1.1.3 Installed household fire warning equipment shall be mounted so as to be supported independently of its attachment to wires.

3-1.1.4 All apparatus shall be restored to normal as promptly as possible after each alarm or test.

3-1.1.5 Upon completion of the system the installer in the presence of the householder, shall test each self-restoring device for proper operation. He shall then instruct the owner on the operation and maintenance of the system.

3-1.1.6 The supplier or installing contractor shall provide the owner with:

(a) An instruction booklet illustrating typical installation layouts.

(b) Instruction charts describing the operation, testing, and proper maintenance of the household fire warning system.

(c) Printed information for establishing a household emergency evacuation plan.

(d) Printed information to inform the owner where he may obtain repair or replacement service and where and how parts requiring regular replacement (such as batteries or bulbs) may be obtained within two weeks.

3-1.1.7 The local fire authority shall be notified of the installation.

Chapter 4 Care of Equipment

4-1 Maintenance.

4-1.1 Instructions.

4-1.1.1 Each supplier of equipment for installation by the householder, or installer of equipment in the home shall furnish to the householder the booklets and charts specified in section 3-1.1.6.

4-1.2 Maintenance.

4-1.2.1 If batteries are used as a source of energy they shall be replaced in accordance with the recommendations of the alarm equipment manufacturer.

4-1.2.2 It is recommended that a maintenance contract be executed with the installer wherever feasible.

4-2 Tests.

4-2.1 Testing.

4-2.1.1 Tests and examinations, as recommended by the manufacturer, should be made weekly by the householder. It is good practice to establish a definite day for these tests.

Chapter 5 Markings

5-1 General.

5-1.1 Markings.

5-1.1.1 All household fire warning equipment or systems shall be plainly marked with the following:

- (a) Manufacturer's or listee's name, address and model number.
- (b) A mark or certification that the unit has been approved or listed by a nationally recognized testing laboratory.
- (c) Electrical rating (if applicable).
- (d) Temperature rating (if applicable).
- (e) Spacing rating (if applicable).
- (f) Operating instructions.
- (g) Test instructions.
- (h) Maintenance instructions.
- (i) Replacement and service instructions.

Exception: An exception to this section is allowed when space limitations prohibit inclusion of items 5-1.1.1(g), (h) and (i). When such limitations exist, a permanent label or plaque suitable for permanent attachment within the living unit shall be provided with the equipment and referenced on the equipment. In case of a household fire warning system, the required information shall be prominently displayed at the control panel.

5-1.2 Other Marking Requirements.

5-1.2.1 The markings required in Section 5-1.1.1 shall be repeated in all sales, advertising, instruction, or operation manuals where instructions for use are given.

Appendix A

Household Fire Warning Protection

This Appendix is not part of this NFPA Standard No. 74 but is included for information purposes only.

A-1 Fire Danger in the Home. Fire is the third leading cause of accidental death. Residential occupancies account for most fire fatalities and most of these deaths occur at night during the sleeping hours.

Most fire injuries also occur in the home. Of the 300,000 Americans who are injured by fire every year, nearly 50,000 lie in hospitals for a period ranging from six weeks to two years. Many never resume normal lives. The direct cost of medical treatment for just 14 percent of the fire injuries classified as "serious" has been estimated to average \$8,000 per patient.

The chances are that the average family will experience one serious fire every generation.

A-2 Fire Safety in the Home. This standard is intended to provide reasonable fire safety for persons in family living units. "Reasonable fire safety" can be produced through a three-point program

- (a) Minimizing fire hazards
- (b) Providing a fire warning system
- (c) Having and practicing an escape plan.

A-2.1 Fire Warning System. There are two extremes of fire to which household fire warning equipment must respond. One is the rapidly developing, high heat fire. The other is the slow, smoldering fire. Either can produce smoke and toxic gases.

Household fires are especially dangerous at night when the occupants are asleep. Fires produce smoke and deadly gases which can overcome occupants while they are asleep. Further dense smoke reduces visibility. Most fire casualties are the victims of smoke and gas rather than burns. To warn against a fire this standard requires at least one smoke detector located between a family asleep and the rest of their residence and recommends heat or smoke detectors in all other major areas.

A-2.2 Family Escape Plan. There often may be very little time between detection of a fire and the time it becomes deadly. This interval may be as little as one or two minutes. Thus the standard requires detection to give a family some advance warning of the development of conditions that will become dangerous to life

within a short period of time. Such warning, however, may be wasted unless the family has planned in advance for rapid exit from their residence. Therefore, in addition to the fire warning system, this standard requires exit plan information to be furnished.

Planning and practicing for fire conditions with accent on rapid exit from the residence are important. Drills should be held so that all family members know what to do. Each person should plan for the possibility that exit out of the bedroom window may be necessary. An exit out of the residence without requiring the opening of a bedroom door is essential.

A-2.3 Minimizing Life Safety Hazards. This standard cannot protect all persons at all times. For instance, the application of this standard may not protect against the three traditional fire killers:

- (a) Smoking in bed
- (b) Leaving children home alone
- (c) Cleaning with flammable liquids, such as gasoline.

But this standard can lead to reasonable safety from fire when the three items under A-2 above are observed.

Appendix B

The Location of Smoke and Heat Detection Devices

This Appendix is not a part of this NFPA Standard No. 74 but is included for information purposes only.

B-1 General.

B-1.1 One of the most critical factors of any fire alarm system installation is the location of the fire detecting devices.

B-1.2 This Appendix is not a technical study. It is an attempt to state some fundamentals on detector installation. For simplification, only the "spot-type" *heat* detector and the smoke detector will be used to illustrate the principles involved. Not covered in this Appendix are other types of detection devices (e.g., continuous "line-type" heat detectors, combustion products and flame-sensitive detectors) although these detectors likewise must be installed with regard to their performance limitations and the principles involved. Also not covered in this Appendix are the special problems that require engineering judgment, such as installation in attics and in rooms with high ceilings.

B-2 Smoke Detection.

B-2.1 The pattern of home fires varies, depending on circumstances. Some fires produce intense heat and limited smoke. Others produce little heat and intense volumes of smoke or "fire gases." A slow-burning fire in bedding and upholstery, for example, may generate enough smoke and deadly gas in a home to cause unconsciousness before producing sufficient heat to activate a heat detector.

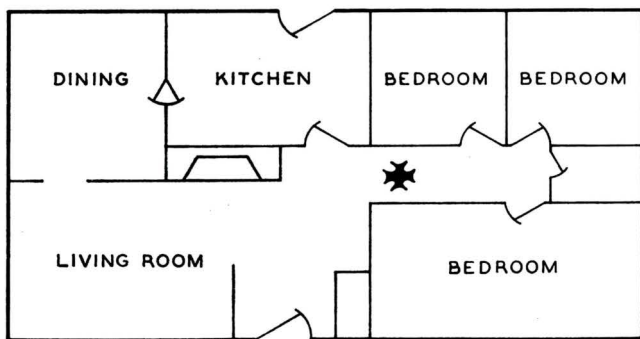


Figure B-2.1.1 A basic smoke detector (indicated by cross) shall be located between the sleeping area and the rest of the house.

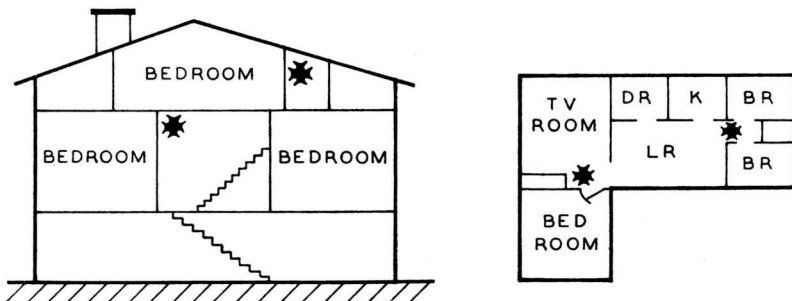


Figure B-2.1.2 In homes with more than one sleeping area, a smoke detector (indicated by cross) should be provided to protect each.

B-2.2 Good practice dictates a detection system capable of sensing smoke or fire gases as well as heat.

B-3 Where To Locate the Basic Smoke Detectors.

B-3.1 The major threat from fire in a dwelling is at night when everyone is asleep. The principal threat to persons in sleeping areas comes from fires in the remainder of the house, therefore, basic smoke detector(s) are best located between the bedroom areas and the rest of the house. In homes with only one bedroom area on one floor, the basic smoke detector shall be located as shown in Figure B-2.1.1.

B-3.2 In homes with more than one bedroom area or with bedrooms on more than one floor, more than one basic smoke detector will be needed as shown in Figure B-2.1.2. Location of the smoke detector outside the bedrooms presupposes that the occupants sleep with their doors shut to provide a barrier to the smoke thus gaining additional seconds for escape.

B-4 Are More Detectors Desirable? The location of the *basic* smoke detector(s) does not provide protection for the occupants from a fire starting within their bedroom. It may be desirable, therefore, to have additional detectors within each bedroom itself, and other areas such as basements, family rooms, etc.

B-5 Installation of a Single "Spot-Type" Heat Detector.

B-5.1 Each "spot-type" *heat* detector is capable of sensing fire within a defined time limit when located within a certain distance of a standard fire developed and used by Underwriters

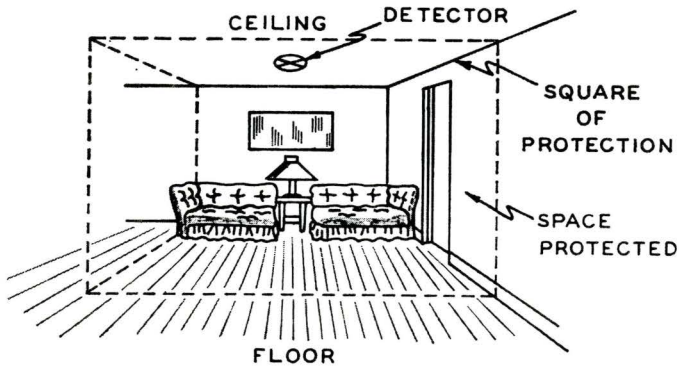


Figure B-5.1.1 The space protected by a single detector extends from ceiling to floor within the square of protection.

Laboratories Inc., Underwriters' Laboratories of Canada, or Factory Mutual Research Corporation for testing these devices. Thus, each detector has an effective "square of protection." This square is based on the detector being mounted on a smooth ceiling. For normal ceiling heights, the "square of protection" on the ceiling extends down to the floor forming a space as shown in Figure B-5.1.1. Any fire generating sufficient heat within this space should be detected by the heat detector in the time limit established by test.

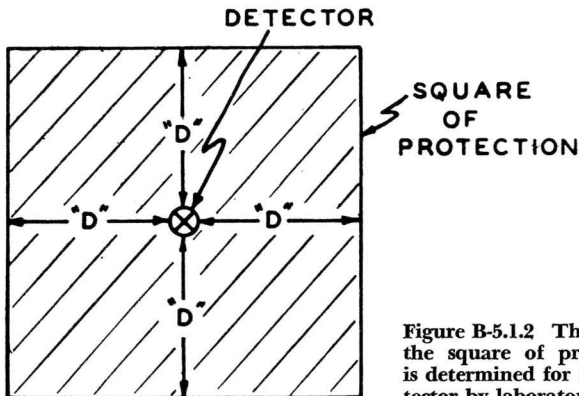


Figure B-5.1.2 The size of the square of protection is determined for each detector by laboratory test.

2-4.2 Responsibility for Choice of Level of Protection.

2-4.2.1 Each authority having jurisdiction shall determine the level of protection to be provided.

2-4.2.2 For those jurisdictions not having household fire warning equipment requirements, it is the responsibility of the seller to provide the purchaser with the level-of-protection guidelines presented herein.

2-4.2.3 For those jurisdictions not having household fire warning equipment requirements, it is the responsibility of the householder to determine the level of protection to be installed using the guidelines presented herein.

2-4.3 Description of Levels of Protection.

2-4.3.1 A level of protection may be selected from one of the following four predetermined levels or intervening levels. The minimum level of protection shall not be less than Level 4. Table 2-4.3 summarizes the four predetermined levels of protection.

2-4.3.2 Level 1. The installation of one or more basic smoke detectors plus additional heat or smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area and at the head of each basement stairway.

(b) Heat or smoke detectors shall be installed in all other major areas and rooms of the living unit including each living room, dining room, bedroom, kitchen, hallway, attic, furnace room, utility room, basement and integral or attached garage.

2-4.3.3 Level 2. The installation of one or more basic smoke detectors plus additional heat or smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area.

(b) Heat or smoke detectors shall be installed in each living room, bedroom, kitchen, attic, furnace room, and basement.

2-4.3.4 Level 3. The installation of one or more basic smoke detectors plus additional heat or smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area.

(b) Heat or smoke detectors shall be installed in each living room, kitchen, furnace room, and basement.

2-4.3.5 Level 4. The installation of one or more basic smoke detectors as follows:

(a) A basic smoke detector shall be installed to protect each separate sleeping area and at the head of each stairway leading to an occupied area.

air space measures about 6 inches along the ceiling and 6 inches down the wall as shown in Figure B-7.1.1. "Spot Type" detectors must not be placed in this "dead" air space.

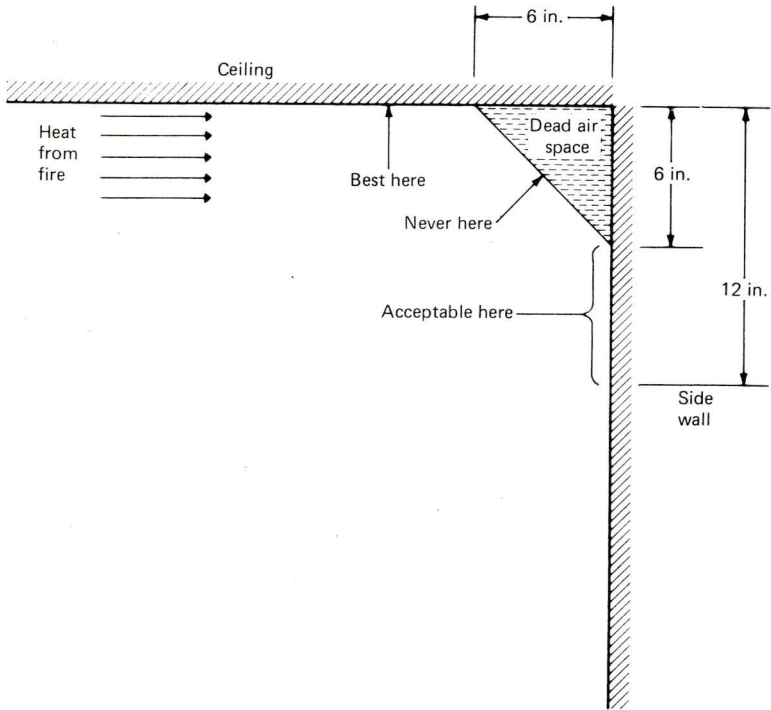


Figure B-7.1.1 Example of proper mounting for spot-type detectors.

B-7.2 The placement of the detector is critical if maximum speed of fire detection is desired. If we could foretell the future, detectors could be located directly over the point where the next fire would originate. This view of the future is not present. Thus, the most desirable location for a spot-type detector is the center of the ceiling. At this location, the detector is closest to all areas of the room.

B-7.3 If the detector cannot be located in the center of the ceiling, a location on the ceiling is preferred. In this off-center location, however, heat from a fire on the far side of the room will take longer to trigger the detector than a center ceiling mounting. The time lost in detection will be time that otherwise could have been used for evacuation.

B-7.4 The least desirable location for mounting spot-type detectors is on the side wall. In this location, heat from a fire across the room will reach the detector after it would have operated any ceiling mounted device. Should it be absolutely necessary to mount a detector on the side wall, care should be taken to avoid anything that might further prevent heat from reaching the detector and further delaying the alarm. Any detector mounted on the side wall should be located as near as possible to the ceiling but below the "dead" air space. A detector mounted on the side wall should, thus, be located at least 6 and not more than 12 inches from the ceiling.

B-8 The Use of Several Detectors.

B-8.1 In a room too large for protection by a single detector, several detectors must be used. It is important that they be properly located so all parts of the room are covered. To provide for this coverage, the Underwriters' Laboratories or Factory Mutual System listings also give the distance *between* detectors on a smooth ceiling. This distance is twice the distance "D" illustrated in Figure B-5.1.2 and is often called the detector "spacing" or "spacing guide."

B-8.2 Thus, for a detector with a "D" of 7.5 feet, the distance *between* detectors ($2 \times \text{"D"}$) can be up to 15 feet as shown in Figure B-8.2.1. Locating detectors more than "2D" apart will leave areas not properly covered as shown in Figure B-8.2.2. This is undesirable since it can slow detection and thus make escape more difficult.

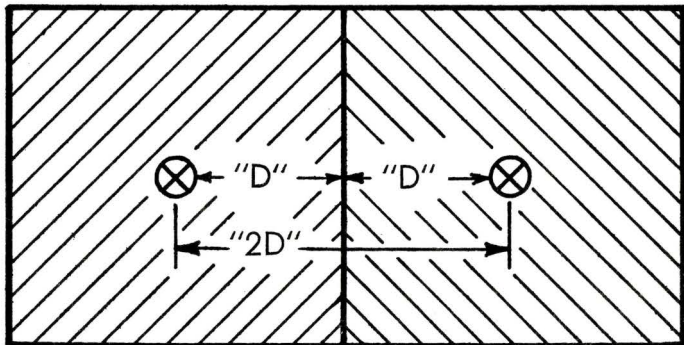


Figure B-8.2.1 Proper location of detectors.

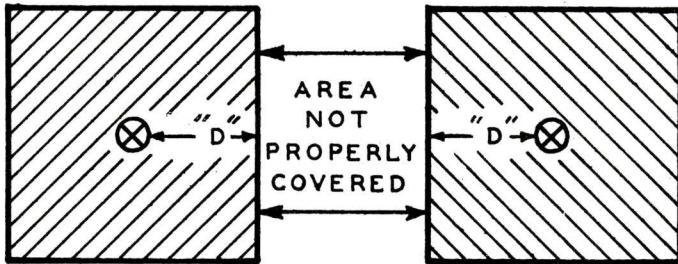


Figure B-8.2.2 Detectors spaced too far apart. To provide complete protection, all areas must be properly covered.

B-9 When Should the Distance Between Detectors be Further Reduced.

B-9.1 The distance *between* detectors is based on data obtained from the spread of heat across a smooth ceiling. If the ceiling is not smooth, then the placement of the detector will have to be tailored to the situation.

B-9.2 For instance, with open wood joists heat travels freely down the joists channels so that the maximum distance *between* detectors (" $2D$ ") can be used. Heat, however, has trouble spreading across the joists so the distance in this direction should be one-half the distance allowed *between* detectors. Since $\frac{1}{2} \times 2D$ is D , the distance *between* detectors *across* open wood joists should not exceed " D " as shown in Figure B-9.2.1 and the "distance to the wall" is reduced ($\frac{1}{2} \times "D"$) to " $\frac{1}{2}D$." Detectors should be mounted on the bottom of the joists and not up in the joist channels.

B-9.3 Walls, partitions, doorways, ceiling beams and open joists interrupt the normal flow of heat, thus creating new areas to be protected.

B-10 What is Complete Protection? Closets and bathrooms are areas often improperly omitted from fire alarm system coverage. Such omissions produce a "hole" in the protection of a structure. These "holes" are dangerous since the initial progress of a fire in these areas will not be automatically detected. When fire breaks out from these spaces, it may be too late to escape. "Holes" are also created when detectors are placed at greater distances than their listing permits. Complete protection exists only when all detectors have been installed in accordance with their distance limitations *and all* fire confining spaces have been covered.

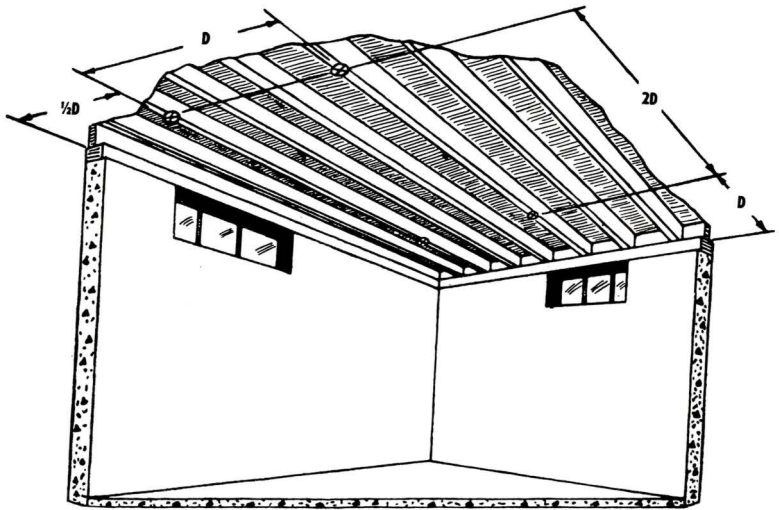


Figure B-9.2.1 Open joists, attics and extra high ceilings are some of the areas that require special knowledge for installation.

Appendix C

Levels of Protection

This Appendix is not part of this NFPA Standard No. 74 but is included for informational purposes only.

C-1 General.

C-1.1 It is possible to specify various levels of protection, depending on the desires of the authorities having jurisdiction. The levels of protection are obtained by varying the types and quantities of detection equipment selected. It may be argued that a single installed detector, be it smoke or heat, offers a degree of life-saving potential. The installation of additional detectors will result in higher degrees of protection. However, a basic level of protection must be established, based on the types of fires to be expected within a living unit, and reflecting also the kinds of fires that historically have resulted in the maximum loss of life. This must be done if the householder is to be provided with a reasonable level of protection at the basic level.

C-1.2 Higher levels of protection may be specified beyond the basic level and, indeed may be necessary, depending on the size and configuration of the living unit. The levels of protection described herein proceed from the most desirable protection scheme to a level representing the basic level of protection believed desirable.

C-1.3 It can be stated with a degree of certainty that all hostile fires in living units generate smoke to a greater or lesser degree. The same statement can be made with respect to heat buildup from fires. But the results of full-scale experiments conducted over the years here in the U.S., using typical fires in living units, indicate that detectable quantities of smoke precede detectable heat levels in nearly all cases. In addition, it is the slowly developing, smoldering fire that is nearly always responsible for the liberation of toxic gases, such as carbon monoxide. Under these conditions, high levels of carbon monoxide may be produced without any significant increase in the room's temperature. Again, the results of experiments indicate that detectable quantities of smoke precede the development of lethal atmospheres in nearly all cases.

For these reasons, each of the levels of protection described below include at least one smoke detector.

C-2.1 Level 1.

C-2.1.1 This level represents the highest level of protection recognized by this standard. Higher levels of protection are possible, such as by reducing the spacings of detection devices or by the combination of detectors sensing different fire parameters, but the significantly higher costs of these modifications may not warrant the extra measures of protection gained.

C-2.1.2 Level 1 requires the placement of a smoke detector in the vicinity of each sleeping area. This detector serves to alert the occupants of the sleeping area to the presence of smoke on the escape route from the bedrooms before untenable conditions can exist in either the escape route or in the bedrooms from fires in other parts of the residence. For those residences having more than one sleeping area, i.e., sleeping areas located on more than one floor of the living unit or sleeping areas separated by common usage rooms, such as kitchens or living rooms, a smoke detector is required in the vicinity of each sleeping area.

A closed door can effectively delay the movement of smoke to the smoke detector allowing a fire in a large room to develop great intensity before it breaks out of the room. The basement is one area that can be large, remote from the smoke detector, and equipped with some type of closure at the top of the stairs. The basement also accounts for a significant number of fires. For these reasons, Level 1 requires a smoke detector at the head of the stairs from the basement.

C-2.1.3 In addition to the basic smoke detectors described in C-2.1.2 above, Level 1 requires detection devices in all other major areas and rooms of the living unit. These detection devices may be either heat or smoke detectors. Level 1 contemplates complete coverage of the living unit with detection devices. Consequently this level requires heat or smoke detectors in all spaces subject to an outbreak of fire. Major areas and rooms are living rooms, dining rooms, bedrooms, kitchens, hallways, attics, furnace rooms, utility rooms, attached garages and basement. Note that, with regard to basements, there appears to be some redundancy in that detectors are required in the basement in addition to the basic smoke detector at the top of the stairs. Basements tend to be large, quite often with the same floor area as the living unit above, may have partitioned rooms, and generally contain a fuel-fired heating plant. This is the reason for the requirement for detection devices in the basement as well as the basic smoke detector at the top of the stairs.

Hallways are another area requiring detection devices. Where the hallways are outside of and serve the bedrooms, the basic

smoke detector of C-2.1.2 can suffice and additional detection devices are not needed.

C-2.2 Level 2

C-2.2.1 Level 2 requires the same basic smoke detector installation as Level 1 (with the exception of the basement stairway) and for the same reasons. (*See C-2.1.2 above.*)

C-2.2.2 In addition to the basic smoke detectors, heat or smoke detectors are required in living rooms, kitchens, bedrooms, attics, basements, and furnace (utility) rooms. The differences between Level 1 and Level 2 are that the Level 2 requirements are reduced to requiring detectors only in those rooms and areas having a record of higher fire frequencies.

C-2.3 Level 3.

C-2.3.1 Again, as in Level 1, this level requires basic smoke detector installations in the vicinity of each sleeping area.

C-2.3.2 With respect to the additional heat or smoke detectors, the requirements are the same as Level 2 except that detection devices have been deleted from the attics and the bedrooms. In other words, Level 3 does not include protection to the occupants of a bedroom against fire originating in their bedroom. However, the basic smoke detector in the hallway is expected to detect this bedroom fire before it poses a threat to occupants of other bedrooms.

C-2.4 Level 4.

C-2.4.1 This is the lowest level of protection recognized by this standard. Level 4 requires the same basic smoke detector installation as in Level 1 but no additional heat or smoke detectors are required beyond the basic smoke detectors. In other words, Level 4 requires a smoke detector in the vicinity of each separate sleeping area and at the head of each stairway leading to an occupied area. If there is only one sleeping area and no basement, then the minimum would be one smoke detector. By the nature of these requirements, it is anticipated that the provision of only one smoke detector would only apply to most mobile homes, efficiency apartments, apartments with clustered bedrooms, and small single-family homes without basements. In all probability, any living unit larger than the above would require two or more basic smoke detectors.

Official NFPA Definitions

APPROVED: means "acceptable to the authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment or materials nor does it approve or evaluate testing laboratories.

In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of nationally recognized testing laboratories, inspection agencies, or other organizations concerned with product evaluations which are in a position to determine compliance with appropriate standards for the current production of listed items, and the satisfactory performance of such equipment or materials in actual usage.

AUTHORITY HAVING JURISDICTION: The "authority having jurisdiction" is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA standards 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 delegated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

LABELED: Equipment or materials to which has been attached a label, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling is indicated compliance with nationally recognized standards or tests to determine suitable usage in a specified manner.

LISTED: Equipment or materials included in a list published by a nationally recognized testing laboratory, inspection agency, or other organization 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 nationally recognized standards or has been tested and found suitable for use in a specified manner.

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

SHALL: is intended to indicate requirements.

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

Notes and footnotes are informative only and are not mandatory.

TYPICAL POCKET EDITIONS OF NFPA STANDARDS

List revised as of July, 1977. Titles are abbreviated. Write for prices and complete list of NFPA publications.

- 1 Fire Prevention Code '75
 3M Health Care Emerg. Preparedness '75
 4 Organization, Fire Services '71
 9 Training Reports, Records '70
 10 Portable Extinguishers '75
 10L Model Enabling Act '75
 11 Foam Ext. Systems '76
 11A High Expansion Foam Syst. '76
 11B Synthetic Foam, Combined Agent '74
 12 Carbon Dioxide Systems '77
 12A Halon 1301 Systems '77
 12B Halon 1211 Systems '77
 13 Sprinkler Systems '76
 13A Sprinkler Maintenance '76
 13D Sprinkler Sys., Dwellings '75
 13E Sprinklered Prop., F.D. Operations at '73
 14 Standpipe, Hose Systems '76
 15 Water Spray Fixed Syst. '77
 16 Foam-Water Systems '74
 17 Dry Chem. Ext. Systems '75
 18 Wetting Agents '72
 19B Respiratory Prot. Equip. '71
 194 Hose Connection Threads '74
 196 Fire Hose '74
 197 Initial Fire Attack '66
 198 Fire Hose, Care of '72
 20 Centrifugal Fire Pumps '76
 22 Water Tanks '76
 24 Outside Protection '77
 26 Supv'n, Water Supply Valves '76
 27 Private Fire Brigades '75
 291 Fire Hydrants '74
 292M Water Charges '74
 295 Wildfire Control '73
 30 Flam. Liquids Code '76
 31 Oil Burning Equipment '74
 32 Drycleaning Plants '74
 321 Class. Flam. Liquids '76
 325A Flashpoint Index of Trade Name Liquids '72
 325M Prop. Flam. Liquids '69
 327 Cleaning Small Tanks '75
 328 Manholes, Sewers, Flam. Liquids and Gases in '75
 329 Underground Leakage, Flam. Liquid Tanks '72
 33 Spray Application '73
 34 Dip Tanks '74
 35 Mfg. Organic Coatings '76
 36 Solvent Extraction '74
 37 Combustion Engines '75
 385 Tank Vehicles '74
 386 Portable Shipping Tanks '74
 393 Gasoline Blow Torches '74
 395 Farm Stg. Flam. Liquid '72
 40 Motion Picture Film '74
 40E Pyroxylin Plastic '75
 43A Liquid, Solid Oxidizing Materials '75
 43C Gaseous Oxidizing Materials '75
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 44A Fireworks, Mfg. Trans. Stge. '74
 45 Labs Using Chemicals '75
 46 Timber, Outdoor Storage '73
 46A Wood Chips, Storage '73
 46B Outdoor Storage of Logs '76
 47 Lumber Storage Yards '73
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 481 Titanium '74
 482M Zirconium '74
 49 Hazardous Chem. Data '75
 490 Ammonium Nitrate '75
 491M Chem. Reactions '75
 492 Ammon. Nitrate, Sep. Dist. '76
 493 Intrinsically Safe Apparatus '75
 494L State Fireworks Law '74
 495 Explosives, Stge., Use '73
 496 Purged Enclosures '74
 497 Class. of Class I Haz. Locations for Elec. Inst. '75
 498 Explosives, Motor Term. '76
 50 Bulk Oxygen Systems '74
 50A Gaseous Hydrogen Syst. '73
 50B LH-Syst., Consumer Sites '73
 51 Welding and Cutting '74
 51A Acetylene Charging Plants '74
 51B Welding Processes '76
 53M Oxy. Atmospheres '74
 54 Nat'l Fuel Gas Code '74
 56 Inhalation Anesthetics '73
 56B Respiratory Therapy '76
 56C Labs in Health Inst. '73
 56D Hyperbaric Facilities '76
 56E Hyperbaric Facilities '77
 56F Nonflam. Med. Gases '74
 56G Inhalation Anesthetics '75
 56HM Home Resp. Therapy '76
 57 Fumigation '73
 58 LP-Gas Storage, Use '76
 59 LP-Gas, Utility Plants '76
 59A LN-Gas, Stg., Handling '75
 60 Pulverized Fuel Sys. '73
 61A Starch, Mfg. Handling '73
 61B Grain Elevators '73
 61C Feed Mills '73
 61D Agricultural Commodities '73
 63 Explosions Indus. Plants '75
 65 Aluminum Processing '75
 65I Aluminum, Magnesium Powder '74
 653 Coal Preparation Plants '71
 654 Plastics, Expl. Prevent. '75
 655 Sulfur Fires '71
 656 Spice Grinding Plants '71
 66 Pneumatic Conveying '73
 66A Woodworking, Wood Flour '71
 68 Explosion Venting '74
 69 Explosion Prev. Syst. '73
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 70A Dwelling Electrical Code '75
 70B Elect. Equip. Maint. '77
 71 Central Station Sig. '77
 72A Local Protective Syst. '77
 72B Auxiliary Sig. System '75
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 91 Blower and Exhaust Syst. '73
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 96 Vapor Removal Cooking Eq. '76
 97M Heating Terms, Glossary '72
 101 Life Safety Code '76
 102 Tents, Grandstands, Air-Supported Structures '72
 203M Roof Coverings '70
 204 Smoke, Heat Venting '68
 206M Building Areas '76
 211 Chimneys, Venting Syst. '72
 214 Water Cooling Towers '76
 220 Std. Types Bldg. Const. '75
 224 Homes, Forest Areas '74
 231 Indoor General Storage '74
 231A Outdoor Gen'l. Storage '75
 231B Cellular Rubber, Storage '74
 231C Rack Storage of Matls. '75
 231D Storage of Rubber Tires '75
 232 Protection of Records '75
 232AM Archives Centers '72
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 252 Fire Tests Door Assem. '76
 255 Flamespread Tests '72
 256 Tests Roof Coverings '76
 257 Window Assemblies '75
 258 Tests Smoke Generated '76
 259 Tests Heat of Bldg. Mat'ls '76
 302 Motor Craft '72
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 306 Gas Hazards on Vessels '75
 307 Marine Terminals '67
 312 Vessels, Constr.-Repair '76
 402 Aircraft Rescue Proced. '73
 403 Aircraft Rescue Services '75
 406M Aircraft Resc., Fire Fighting, Using Structural Equip. '75
 407 Aircraft Fuel Servicing '75
 408 Aircraft Extinguishers '73
 409 Aircraft Hangars '75
 410A Aircraft Elec. Maint. '75
 410B Oxygen Syst. Maint. '71
 410C Fuel Syst. Maint. '72
 410D Aircraft Painting '71
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 410F Aircraft Cabin Clean. '75
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 501B Mobile Homes '77
 501BM MH Heating, Cooling Calculations '76
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 601A Guard Operations '75
 701 Fire Tests, Textiles, Films '76
 702 Wearing Apparel '75
 704 Ident. of Materials '75
 801 Radioactive Matl. Facil. '75
 802 Nuclear Reactors '74
 901 Uniform Coding for F. P. '76
 902M Field Incident Manual '76
 910 Library Collections '75
 911 Museum Collections '74
 1001 Fire Fighter Prof. Qual. '74
 1002 Driver Prof. Qual. '76
 1021 Fire Officer Prof. Qual. '76
 1031 Fire Inspector Prof. Qual. '77
 1041 Fire Instructor Prof. Qual. '76
 1122L Unmanned Rockets Code '76
 1201 Fire Dept. Organization '76
 1202 Fire Suburban & Rural Water Supplies '75
 1501 Fire Dept. Safety Officer '77
 1901 Automotive Fire Apparatus '75
 1904 Aerial Ladders & Elev. Platforms '75
 1921 Portable Pumping Units '75
 1931 Fire Dept. Ground Ladders '75
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