

NFPA No.

74

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# HOUSEHOLD FIRE WARNING EQUIPMENT 1972



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NATIONAL FIRE PROTECTION ASSOCIATION  
International

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Adopted Jan. 23, 1964; Revised Dec. 9, 1969 and June 26, 1973. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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This material has been developed in the interest of safety to life and property under the published procedures of the National Fire Protection Association. These procedures are designed to assure the appointment of technically competent Committees having balanced representation from those vitally interested and active in the areas with which the Committees are concerned. These procedures provide that all Committee recommendations shall be published prior to action on them by the Association itself and that following this publication these recommendations shall be presented for adoption to the Annual Meeting of the Association where anyone in attendance, member or not, may present his views. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or non-compliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

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

NFPA No. 74 — 1972

**1972 Edition of No. 74**

This Standard was adopted by the Association at its 1972 Annual Meeting, held in Philadelphia, Pa., May 15-19.

**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 Committees 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. This 1972 edition is a complete revision and supersedes all previous editions.

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SCOPE: This Committee serves as a policy-making and correlating group to administer and process reports of the various Sectional Committees dealing with signaling systems and detection devices. All codes, standards, recommended practices and manuals prepared by the Sectional Committees and having received at least a two-thirds affirmative ballot from the voting members of the responsible Sectional Committee are processed through this Committee prior to submission to the Association for action.

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SCOPE: Covers requirements for the proper installation, operation, and maintenance of all types of systems interconnecting detection and sensing devices with alarm-sounding equipment of the proper types (including local, proprietary, auxiliary, remote station and central station systems) and to develop standards on manual fire alarm systems and watchmen services. Reports to the Association through the Signaling Systems Correlating Committee.

## Interpretation Procedure of the Sectional Committee on Fire Protective Signaling Systems

Those desiring an interpretation shall supply the Chairman with five identical copies of a statement in which shall appear specific reference to a single problem, paragraph, or section. Such a statement shall be on the business stationery of the inquirer and shall be duly signed.

When applications involve actual field situations they shall so state and all parties involved shall be named.

The Interpretations Committee will reserve the prerogative to refuse consideration of any application that refers specifically to proprietary items of equipment or devices. Generally inquiries should be confined to interpretation of the literal text or the intent thereof.

Requests for interpretations should be addressed to the National Fire Protection Association, 470 Atlantic Avenue, Boston, Mass. 02210.

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

NFPA No. 74—1972

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.

### INTRODUCTION

This standard is intended to help provide reasonable fire safety for persons in one- and two-family dwellings. "Reasonable fire safety" can be produced through a four-point program.

1. Minimizing fire hazards
2. Sleeping with bedroom doors closed
3. Having and practicing an escape plan
4. Providing a fire warning system.

This standard covers the requirements of fire warning equipment for the home.

There are two extremes of fire to which the household fire warning equipment must respond. One is the hot fire. The other is the smoldering fire. Either can produce toxic gases.

Most people are not aware of the speed with which a hot fire can progress within a building. Many persons are familiar, however, with fires in stoves, furnaces or fireplaces, or fires out of doors where the heat and smoke are carried away. When fire is enclosed by a building and heat is not vented, the heat build-up can be rapid and this can promote rapid spread of the flame. Like a fire in a fireplace with the damper closed, smoke can migrate quickly throughout the building, even without any heat driving it. When a fire builds up within a closet or a room and then suddenly breaks out, both heat and smoke spread can be especially rapid.

To warn against a fire, this standard calls for heat or smoke detectors in all rooms and in all other enclosed areas where fires can occur.

The smoldering fire can be especially insidious at night when the occupants are asleep. This smoldering fire produces deadly gases

which can overcome the occupants while they are asleep. It will also produce a dense smoke which reduces visibility. Most fire casualties are the victims of smoke and gas rather than burns. To warn against a smoldering fire this standard requires at least one smoke detector, located between a family asleep and the rest of their house.

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 home.

Sleeping with bedroom doors closed should add minutes to the time available for escape.

Planning and practicing for fire conditions with accent on rapid exit from the home are important. Drills should be held so that all family members will 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 house without requiring the opening of the bedroom door is essential.

This standard cannot protect all persons at all times. For instance, the application of this standard may not protect against these three traditional fire killers:

1. Smoking in bed.
2. Leaving children home alone.
3. Cleaning parts or clothes with flammable liquids, such as gasoline.

But this standard can lead to reasonable safety from fire when used in concert with:

1. The development and use of an exit plan,
2. The thoughtful identification and careful elimination of hazards, and
3. Sleeping with bedroom doors closed.

This standard is based on analysis of many years of dwelling fire deaths and applicable test fire results. It has been written to provide reasonable life safety for persons from fires in dwellings. The fire analysis also indicates a partial system of smoke detection can provide some degree of life safety for sleeping occupants.

**CHAPTER 1. GENERAL****ARTICLE 100. DEFINITIONS**

**1010.** 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.

**Household:** A one- or two-family private dwelling.

**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 products 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 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, Shall, Should:** These three words, approved — shall — should, have specific key meanings as described on the inside front cover of this standard.

**ARTICLE 110. SCOPE****1110. General Provisions:**

1111. The provisions of this standard require an installation having fire detection and an alarm signal sufficiently loud to be heard in normally occupied parts of the household.

1112. The standard is primarily concerned with life protection, not with protection of property. It contemplates that the family has an exit plan.

1113. 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.

1114. 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 article 240 of this standard shall be maintained.

## ARTICLE 120. APPROVAL

### **1210. Equipment:**

1211. All devices, combinations of devices, and equipment constructed and installed in conformity with this standard shall be "approved" for the purposes for which they are intended.

1212. The homeowner should satisfy himself that all equipment has been listed or approved by a nationally recognized fire testing laboratory such as Underwriters' Laboratories, Inc., Factory Mutual Research Corp., and Underwriters' Laboratories of Canada.

## CHAPTER 2. BASIC REQUIREMENTS

### ARTICLE 200. POWER SUPPLIES

#### 2010. General

2011. All power supplies shall be sufficient to operate the alarm signal(s) for at least 4 continuous minutes.

#### 2020. Primary Power Supply (AC)

2021. 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.

2022. All electrical systems designed to be installed by other than a qualified electrician and wired in accordance with the National Electrical Code (NFPA No. 70) shall be powered with a Class 2 (low voltage, limited energy) power supply with an output voltage not in excess of 30 volts, as defined by Article 725 of the National Electrical Code. (For further information consult the local electrical inspector.)

2023. 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.

2024. Neither loss nor restoration of primary power shall cause an alarm signal.

#### 2030. Primary Power Supply (Monitored Battery)

2031. 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 shall be given before the battery is incapable of operating (from aging, terminal corrosion, etc.) the device(s) for alarm purposes.

(c) Following an alarm in which the battery(s) reaches its trouble point, the trouble signal shall operate for at least 7 consecutive days.

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

(e) The monitored batteries meeting these specifications shall be clearly identified on the unit near the battery compartment.

#### **2040. Secondary Power Supply:**

2041. 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.

#### **2050. Nonelectrical Power**

2051. 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 operating power is available.

### ARTICLE 210. EQUIPMENT

#### **2110. Smoke Detectors:**

2111. Each smoke detector shall be capable of detecting smoke or other products of combustion.

2112. On smoke detectors requiring a light source for operation, failure of the light source shall result in an audible trouble signal. The failure of the light source shall not cause an alarm signal.

2113. For each smoke detector requiring a light source, at least one spare light source bulb shall be provided with the detector and mounted conveniently in or on the unit or associated control unit.

#### **2120. Heat Detectors:**

2121. Each heat detector shall be capable of detecting abnormally high temperature or rate-of-temperature rise.

2122. 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.

2123. 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.

### **2130. Sounding Devices:**

2131. Every heat or smoke-detecting device shall cause the operation of alarm signaling device or devices which shall be clearly audible in all bedrooms with all intervening doors closed.

2132. All alarm sounding devices shall be rated not less than 85 decibels at 10 feet.

### **2140. Control Equipment:**

2141. The control equipment shall be automatically restoring on restoration of electrical power.

2142. The control equipment shall be of a type that "locks in" on an alarm condition. Smoke detection circuits need not lock in.

2143. If a reset switch is provided, it shall be a self-restoring type.

2144. An alarm silencing switch shall not be provided unless its silenced position is indicated by a trouble signal.

2145. Each electrical fire warning system shall have a self-restoring test button or means to permit the householder to check the system.

2146. Smoke detectors may be tested by using smoke instead of the test button described in paragraph 2145.

## ARTICLE 220. OUTSIDE ALARM

### **2210. Outside Alarm:**

2211. Provision should be made for the installation of an outside alarm sounding device or devices.

## ARTICLE 230. DETECTOR CIRCUITS

### **2310. Type of Circuit:**

2311. 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.

**2320. Circuit Wiring:**

2321. All installation wiring extended from the output side of a Class 2 power supply shall be either approved "Limited energy cable," or wired in accordance with Article 725, Class 1, of the National Electrical Code, NFPA No. 70.

2322. Wire used shall be of the solid conductor, nonstranded type.

**ARTICLE 240. DETECTOR TYPE, LOCATION,  
AND SPACING****2410. General**

2411. For complete protection this standard requires the use of smoke detectors and heat detectors in all major areas and rooms of the house.

2412. This standard recognizes that the use of partial protection can provide some degree of life safety for sleeping occupants when a basic smoke detector is installed in the immediate area(s) of, but outside of, the bedroom(s).

2413. For maximum protection, detectors should be installed in accordance with Appendix A.

**2420. Smoke Detectors**

2421. A smoke detector shall be located in the immediate vicinity of, but outside, the bedrooms. Other smoke detectors placed in strategic locations around the household and in each bedroom are recommended.

2422. Smoke detectors shall be located in or near the ceiling.

2423. In a room or partitioned area containing a properly installed smoke detector(s), heat detectors are not required.

**2430. Heat Detectors**

2431. Heat detectors shall be provided in all major areas of the house including living room, dining room, bedroom, kitchen, hallway, attics, furnace rooms, utility rooms, basements and attached garages, and should be provided in closets and small partitioned off storage areas, except as permitted in paragraph 2423.

2432. Heat detectors shall be installed within the strict limitation of their listed spacing.

2433. For maximum protection, spot-type detectors should be installed on the ceilings as near the centers of the areas they protect as practicable.

2434. On level ceilings with open joists or beams, all detectors should be mounted on the bottom of such joists or beams.

2435. 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 joisted ceiling should 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 should not exceed one-half of the listed spacing.

## CHAPTER 3. INSTALLATION

### ARTICLE 300. GENERAL

#### 3010. General Provisions

3011. All equipment shall be installed in a workmanlike manner.

3012. All devices shall be so located and mounted that accidental operation will not be caused by jarring or vibration.

3013. All apparatus shall be restored to normal as promptly as possible after each alarm or test.

3014. 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.

3015. 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.

3016. The local fire authority shall be notified of the installation.

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## CHAPTER 4. CARE OF EQUIPMENT

### ARTICLE 400. MAINTENANCE

#### 4010. Instructions

4011. 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 paragraph 2215.

#### 4020. Maintenance

4021. If batteries are used as a source of energy they shall be replaced in accordance with the recommendations of the alarm equipment manufacturer.

4022. It is recommended that a maintenance contract be executed with the installer wherever feasible.

### ARTICLE 410. TESTS

#### 4110. Testing

4111. 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.

## APPENDIX A

### THE LOCATION OF SMOKE AND HEAT DETECTION DEVICES

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

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.

#### Smoke Detection

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.

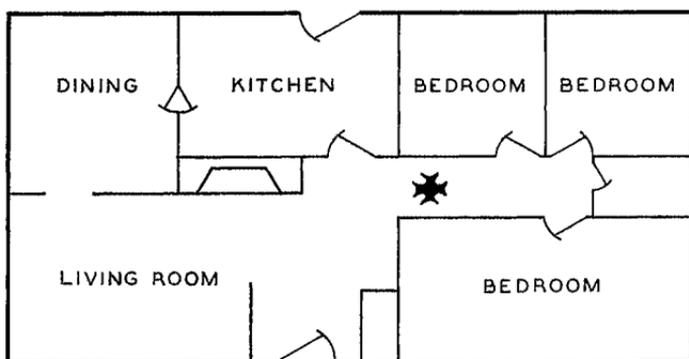


Figure 1. A basic smoke detector (indicated by cross) shall be located between the sleeping area and the rest of the house.

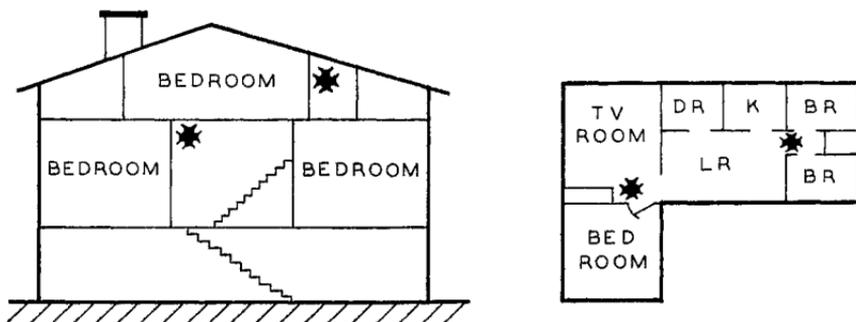


Figure 2. In homes with more than one sleeping area, a smoke detector (indicated by cross) should be provided to protect each.

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

### Where To Locate the Basic Smoke Detectors

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 1.

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 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.

### Are More Smoke 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 smoke detectors within each bedroom itself, and other areas such as basements, family rooms, etc.

### Installation of a Single "Spot-Type" Heat Detector

Each "spot-type" *heat* detector is capable of sensing fire within a defined time limit when located within a certain distance of a

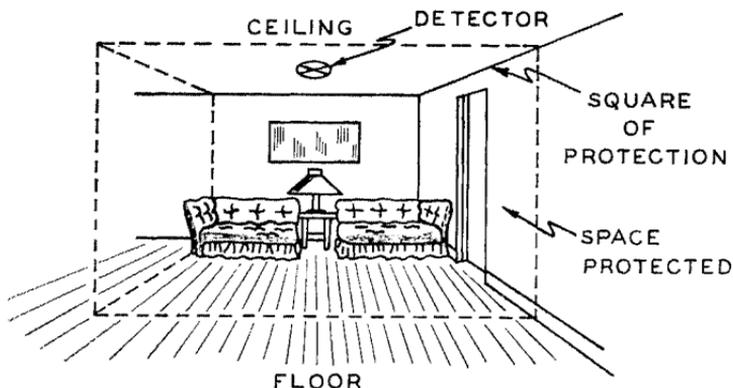


Figure 3. The space protected by a single detector extends from ceiling to floor within the square of protection.

standard fire developed and used by Underwriters' 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 3. Any fire generating sufficient heat within this space should be detected by the heat detector in the time limit established by test.

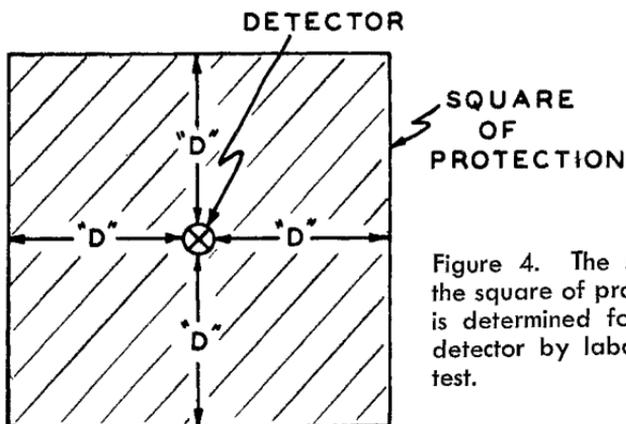


Figure 4. The size of the square of protection is determined for each detector by laboratory test.

The figure given in the laboratory listing as the "distance of the (detector) from any wall or partition" is the distance "D" shown in Figure 4. This distance "D" is measured from the detector to the side of the largest square that can be effectively protected by the detector. In the listings, distance "D" varies from 5 feet to 25 feet with different detectors.

### Proper Location of the Detector

A single detector with a "D" of 10 feet mounted on a smooth ceiling in the middle of a 20 foot by 20 foot room will cover all the space in the room as shown in Figure 5.

The space covered by the detector is tied to that detector. When the detector is moved, the space covered moves with it.

If, however, the same detector as the one shown in Figure 5 is moved to a point on the ceiling near the left wall, three feet from the rear wall, then the ceiling coverage is reduced to 10 feet by 13 feet and about two-thirds of the space in the room is left "not properly covered" as shown in Figure 6.

### Must Detectors be Mounted on the Ceiling?

Heat from a fire rises to the ceiling, spreads out across the ceiling surface and begins to bank down from the ceiling. The corner where the ceiling and the wall meet is an air space into which heat has difficulty in penetrating. In most fires, this "dead" air space

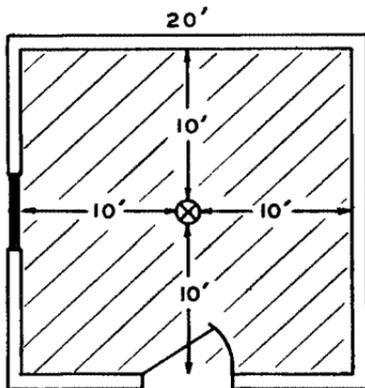


Figure 5. Room properly covered by a detector with a "D" of 10 feet.

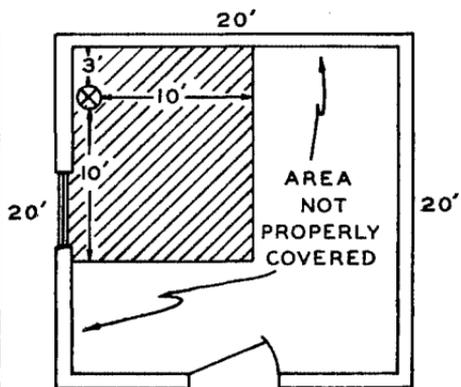


Figure 6. Room not properly covered by a detector with a "D" of 10 feet.

measures about 6 inches along the ceiling from the corner and 6 inches down the wall as shown in Figure 7. "Spot Type" detectors must not be placed in this "dead" air space.

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.

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.

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.

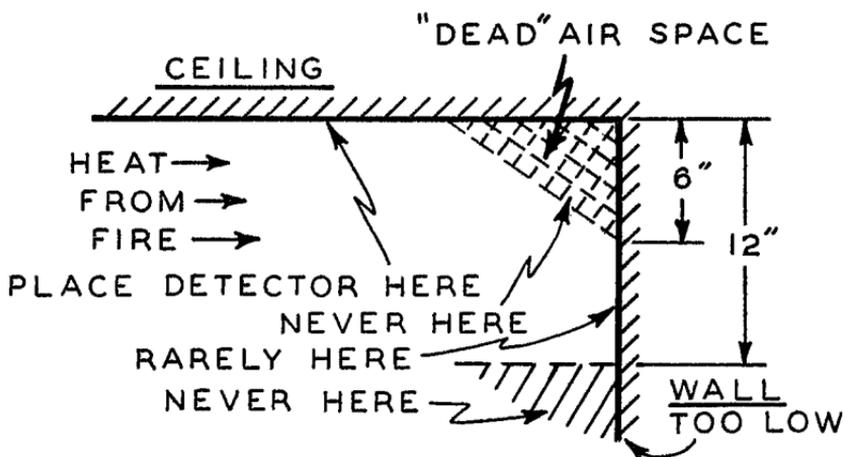


Figure 7. Example of proper mounting for spot-type detectors.

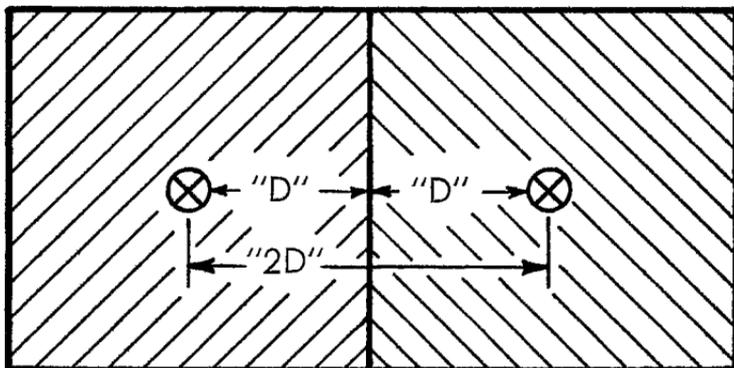


Figure 8. Proper location of detectors.

### The Use of Several Detectors

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 Research Corporation listings also give the distance *between* detectors on a smooth ceiling. This distance is twice the distance "D" illustrated in Figure 4 and is often called the detector "spacing" or "spacing guide."

Thus, for a detector with a "D" of 7.5 feet, the distance *between* detectors ( $2 \times "D"$ ) can be up to 15 feet as shown in Figure 8. Locating detectors more than " $2D$ " apart will leave areas not properly covered as shown in Figure 9. This is undesirable since it can slow detection and thus make escape more difficult.

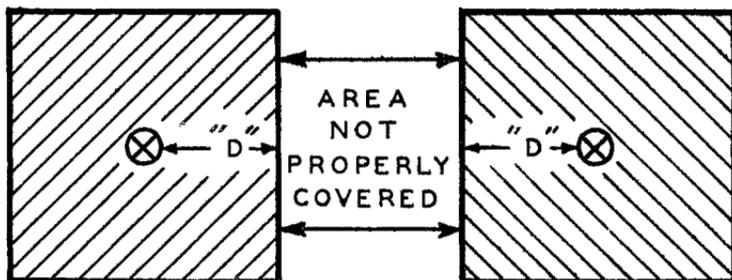


Figure 9. Detectors spaced too far apart. To provide complete protection, all areas must be properly covered.

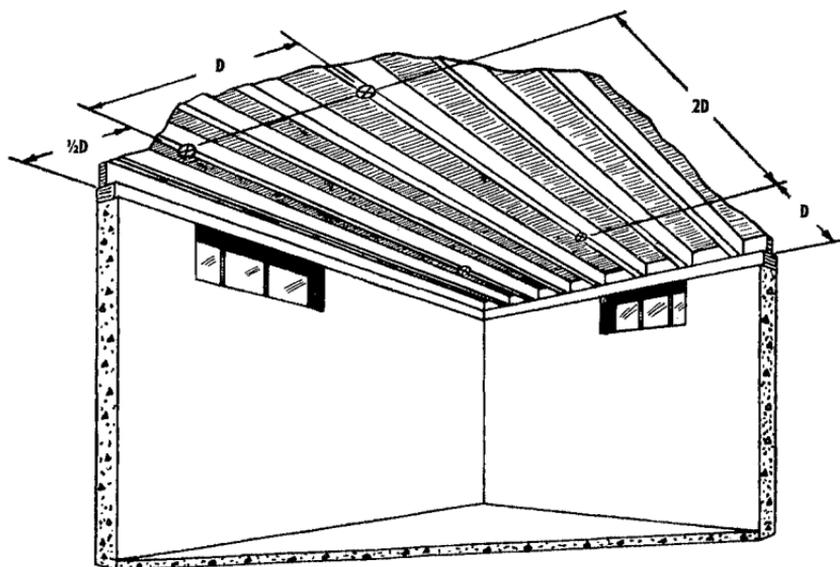


Figure 10. Open joists, attics and extra high ceilings are some of the areas that require special knowledge for installation.

### When Should the Distance Between Detectors be Further Reduced

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.

For instance, with open wood joists heat travels freely down the joist 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 10 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.

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

### **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.

# National Fire Protection Association

International

470 Atlantic Avenue, Boston, MA 02210

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection. Anyone interested may become a Member; the annual dues are \$30.00. National and regional societies and associations are eligible to be Organization Members; annual dues are \$225. Full membership information is available on request.

This is one of a large number of publications on fire safety issued by the Association. All NFPA codes, standards, and recommended practices are prepared by NFPA Technical Committees and adopted at an Annual Meeting of the Association. They are intended to prescribe reasonable measures for minimizing losses of life and property by fire.

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