

NFPA 72[®]

National Fire Alarm Code[®]

2007 Edition



NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
An International Codes and Standards Organization

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NFPA 72®

National Fire Alarm Code®

2007 Edition

This edition of *NFPA 72®*, *National Fire Alarm Code®*, was prepared by the Technical Committees on Fundamentals of Fire Alarm Systems, Initiating Devices for Fire Alarm Systems, Protected Premises Fire Alarm Systems, Notification Appliances for Fire Alarm Systems, Supervising Station Fire Alarm Systems, Public Fire Reporting Systems, Testing and Maintenance of Fire Alarm Systems, and Single- and Multiple-Station Alarms and Household Fire Alarm Systems; released by the Technical Correlating Committee on Signaling Systems for the Protection of Life and Property; and acted on by NFPA at its June Association Technical Meeting held June 4–8, 2006, in Orlando, FL. It was issued by the Standards Council on July 28, 2006, with an effective date of August 17, 2006, and supersedes all previous editions.

Tentative interim amendments (TIAs) to 5.7.3.2.3.1 and 6.8.2.1 were issued on July 28, 2006. For further information on tentative interim amendments, see Section 5 of the NFPA Regulations Governing Committee Projects available at:

<http://www.nfpa.org/assets/files/PDF/CodesStandards/TIAErrataFI/TIAREgs.pdf>

This edition of *NFPA 72* was approved as an American National Standard on August 17, 2006.

Origin and Development of NFPA 72

The development of NFPA's signaling standards dates back to 1898 with the appointment of the Committee on Thermo-Electric Fire Alarms. The 1905 edition of NBFU 71A, *Rules and Requirements of the National Board of Fire Underwriters for the Construction, Installation, and Use of Signaling Systems Used for the Transmission of Signals Affecting the Fire Hazard as Recommended by the National Fire Protection Association*, and related documents dating back to 1903 were among the first of numerous signaling standards published in conjunction with the National Fire Protection Association. The descendants of these earlier standards have now been consolidated into the *National Fire Alarm Code*, *NFPA 72*.

The first edition of the *National Fire Alarm Code*, published in 1993, was a consolidation of the 1989 edition of NFPA 71, *Standard for the Installation, Maintenance, and Use of Signaling Systems for Central Station Service*; the 1990 edition of NFPA 72, *Standard for the Installation, Maintenance, and Use of Protective Signaling Systems*; the 1990 edition of NFPA 72E, *Standard on Automatic Fire Detectors*; the 1989 edition of NFPA 72G, *Guide for the Installation, Maintenance, and Use of Notification Appliances for Protective Signaling Systems*; the 1988 edition of NFPA 72H, *Guide for Testing Procedures for Local, Auxiliary, Remote Station, and Proprietary Protective Signaling Systems*; and the 1989 edition of NFPA 74, *Standard for the Installation, Maintenance, and Use of Household Fire Warning Equipment*. Many of the requirements of these standards were identical or very similar. The recommendations that were taken from the guides (NFPA 72G and NFPA 72H) were changed to mandatory requirements.

The 1996 edition of *NFPA 72* incorporated many changes of a technical nature. These changes related to issues such as the Americans with Disabilities Act, software testing, fire modeling, and communications.

The 1999 edition represented a major change in code content and organization. The chapters were arranged to facilitate user friendliness and provide a logical structure. A new chapter on public fire reporting was added, and many technical revisions were made. Annex B (formerly Appendix B) was streamlined to facilitate ease of use, many unenforceable terms were removed, and Chapter 3 was reorganized to facilitate a more logical approach.

The 2002 edition reflected an extensive editorial revision of the Code to comply with the latest edition of the *Manual of Style for NFPA Technical Committee Documents*. These revisions included the addition of three administrative chapters at the beginning of the Code: "Administration," "Referenced Publications," and "Definitions." Eight technical chapters followed the administrative chapters in the same sequence as in the 1999 edition. Other editorial revisions included the breakout of paragraphs with multiple requirements into individually numbered paragraphs for each requirement, the minimization of use of exceptions, the use of consistent headings for sections and section subdivisions, and reorganization to limit paragraph numbering to six digits.

The 2002 edition contained a number of technical revisions throughout the Code. These included a major revision of the power supply requirements; a new requirement addressing impairments to fire alarm systems; additional requirements concerning the review and approval of performance-based detection system designs; revision of the rules for system survivability from attack by fire; the introduction of rules for an alternate approach for audible signaling; the addition of requirements to address performance-based designs for visible signaling; the relocation of testing and maintenance requirements for single- and multiple-station alarms and household fire alarm systems to the testing and maintenance chapter; and revisions to re-establish the prescriptive rules for household fire-warning equipment from the 1996 edition of the Code.

The 2007 edition contains a number of technical revisions including many to accommodate new technology and to take advantage of new research. Changes have also been made to better address the integration of mass notification systems and other systems with fire alarm systems. Revisions have also been made in several areas of the Code for clarity and to enhance its usability.

Some of the more significant revisions in the Code address protection of fire alarm control units, personnel qualification, heat detector response time, smoke detector spacing, smoke detection in ducts, detectors that use multiple sensing inputs, video image smoke and flame detection, synchronization of visible notification appliances, exit marking audible notification appliances, tactile notification appliances, different types of protected premises fire alarm system, and in-building enhancement systems for firefighter radio communications.

Significant changes to the requirements for smoke alarms in residential applications include revisions to require the interconnection of smoke alarms for existing occupancies, revisions to require additional smoke alarms for larger dwelling units, and revisions to allow voice messages to be included as a part of the smoke alarm notification signal.

Revisions to enhance and clarify the Code include those that address suppression system inputs to the fire alarm system, emergency/voice alarm communications systems, fire alarm system interface with elevator systems, and the means to indicate central station service. In addition, a complete revision of the Record of Completion Form along with examples of filled-out forms have been provided.

Other significant changes include the addition of two new annexes — one to provide guidance for the design of mass notification systems and one to replace previous annex material for the design of fire service interfaces with a separate industry standard.

Prior editions of this document have been translated into languages other than English, including Spanish.



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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 on the installation, performance, maintenance, testing, and use of signaling components and signaling systems for the protection of life and property.

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Jack McNamara, Bosch Security Systems, NY [M]

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Rep. U.S. Naval Historical Center

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Committee Scope: This Committee shall have primary responsibility for documents on common system fundamentals for signaling systems, including definitions, requirements for approvals, installation, service, power supplies, equipment locations, compatibility, and system interfaces.



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Noura Milardo, FM Global, MA [I]
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Technical Committee on Protected Premises Fire Alarm Systems (SIG-PRO) (Chapter 6)

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Scott T. Martorano, The Viking Corporation, MI [M]
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James McFadden, AFA Protective Systems, Inc., NY [IM]
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Technical Committee on Notification Appliances for Fire Alarm Systems (SIG-NAS) (Chapter 7)

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Thomas Carrie, Jr., Schirmer Engineering Corporation,
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Daniel M. Grosch, Underwriters Laboratories Inc.,
IL [RT]
Rein Haus, Wheelock, Inc., NJ [M]
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Jeffrey M. Klein, System Sensor, IL [M]
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Navin D. Mehta, U.S. Department of Defense, VA [U]

Warren E. Olsen, Hoffman Estates Fire
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Paul Parker, Building Systems Integration Corporation,
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Maurice M. Pilette, Mechanical Designs Ltd., MA [SE]
Jack Poole, Poole Consulting Services, Inc., KS [SE]
Sam (Sat) Salwan, Environmental Systems Design, Inc.,
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Robert P. Schifiliti, R. P. Schifiliti Associates, Inc., MA [SE]
Daniel L. Seibel, Shaw Fire Detection Services, Inc.,
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(Alt. to D. E. Becker)

Lee F. Richardson, NFPA Staff Liaison

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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 on the installation and operation of notification appliances for signaling systems.

Technical Committee on Supervising Station Fire Alarm Systems (SIG-SSS) (Chapter 8)

Art Black, *Chair*

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Lee F. Richardson, NFPA Staff Liaison

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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 on the installation and operation of off-premises signaling systems, including the signal-receiving facility and the communications between the protected premises and the off-premises signal-receiving facility.



Technical Committee on Public Fire Reporting Systems (SIG-PRS) (Chapter 9)

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Lee F. Richardson, NFPA Staff Liaison

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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 on the proper configuration, performance, installation, and operation of public fire alarm reporting systems and auxiliary fire alarm systems. The Committee scope shall include systems that use a communication infrastructure that is publicly owned, operated, and controlled.

Reporting of alarms by voice over the public switched telephone network utilizing the Universal Emergency Number 9-1-1, or any other telephone number that can be dialed, is outside the scope of this Committee.

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Merton W. Bunker, Jr., U.S. Department of State, DC [U]

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Lee F. Richardson, NFPA Staff Liaison

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Committee Scope: This Committee shall have primary responsibility for documents on the proper testing and maintenance of signaling systems, their components, and the interface equipment.



Technical Committee on Single- and Multiple-Station Alarms and Household Fire Alarm Systems (SIG-HOU) (Chapter 11)

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H. Wayne Boyd, U.S. Safety & Engineering Corporation,
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Rep. California Automatic Fire Alarm Association Inc.
Lawrence Brown, National Association of Home
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Rep. Automatic Fire Alarm Association, Inc.
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AL [E]
Jeffrey L. Okun, Nuko Security, Inc., LA [IM]
John R. Pacelli, Gentex Corporation, MI [M]
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John L. Parssinen, Underwriters Laboratories Inc.,
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Forrest J. Pecht, U.S. Access Board, DC [C]
Larry Ratzlaff, Kidde Safety, IL [M]
Michael L. Savage, Sr., Middle Department Inspection
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Lee F. Richardson, NFPA Staff Liaison

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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 on the performance, installation, operation, and use of single- and multiple-station alarms and household alarm systems for fire warning.

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NFPA 72®

National Fire Alarm Code®

2007 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

A reference in brackets [] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex G. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex G.

Chapter 1 Administration

1.1 Scope.

1.1.1 NFPA 72 covers the application, installation, location, performance, inspection, testing, and maintenance of fire alarm systems, fire warning equipment and emergency warning equipment, and their components.

1.1.2 The provisions of this chapter apply throughout the Code unless otherwise noted.

1.2* Purpose.

1.2.1 The purpose of this Code is to define the means of signal initiation, transmission, notification, and annunciation; the levels of performance; and the reliability of the various types of fire alarm systems.

1.2.2 This Code defines the features associated with these systems and also provides information necessary to modify or upgrade an existing system to meet the requirements of a particular system classification.

1.2.3 This Code establishes minimum required levels of performance, extent of redundancy, and quality of installation but does not establish the only methods by which these requirements are to be achieved.

1.2.4* This Code shall not be interpreted to require a level of fire protection that is greater than that which would otherwise be required by the applicable building or fire code.

1.3 Application.

1.3.1 Fire alarm systems shall be classified as follows:

- (1) Household fire alarm systems
- (2) Protected premises (local) fire alarm systems
- (3) Supervising station fire alarm systems
 - (a) Central station (service) fire alarm systems
 - (b) Remote supervising station fire alarm systems
 - (c) Proprietary supervising station fire alarm systems
- (4) Public fire alarm reporting systems
 - (a) Auxiliary fire alarm systems — local energy type
 - (b) Auxiliary fire alarm systems — shunt type

1.3.2 Any reference or implied reference to a particular type of hardware shall be for the purpose of clarity and shall not be interpreted as an endorsement.

1.3.3 The intent and meaning of the terms used in this Code shall be, unless otherwise defined herein, the same as those of NFPA 70, *National Electrical Code*®.

1.4 Retroactivity.

1.4.1 Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document.

1.4.2 In those cases where it is determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or property, retroactive application of the provisions of this document shall be permitted.

1.5 Equivalency.

1.5.1 Nothing in this Code shall prevent the use of systems, methods, devices, or appliances of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this Code.

1.5.2 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.3 The systems, methods, devices, or appliances that are found equivalent shall be approved.

1.6 Units and Formulas.

1.6.1 The units of measure in this Code are presented in the International System (SI) of units. Where presented, U.S. customary units (inch-pound units) follow the SI units in parentheses.

1.6.2 Where both systems of units are presented, either system shall be acceptable for satisfying the requirements in this Code.

1.6.3 Where both systems of units are presented, users of this Code shall apply one set of units consistently and shall not alternate between units.

1.6.4* The values presented for measurements in this Code are expressed with a degree of precision appropriate for practical application and enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.



1.6.5 Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.

1.7 Code Adoption Requirements. This Code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. (See Annex D for sample wording for enabling legislation.)

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this code and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2007 edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2005 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2007 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2002 edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2006 edition.

NFPA 70, *National Electrical Code*®, 2005 edition.

NFPA 75, *Standard for the Protection of Information Technology Equipment*, 2003 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2002 edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2005 edition.

NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2005 edition.

NFPA 601, *Standard for Security Services in Fire Loss Prevention*, 2005 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2004 edition.

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2007 edition.

2.3 Other Publications.

2.3.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI A-58.1, *Building Code Requirements for Minimum Design Loads in Buildings and Other Structures*.

ANSI S1.4a, *Specifications for Sound Level Meters*, 1985.

ANSI S3.2, *Method for Measuring the Intelligibility of Speech Over Communications Systems*, 1995.

ANSI S3.41, *American National Standard Audible Emergency Evacuation Signal*, 1996.

ANSI/ASME A17.1, *Safety Code for Elevators and Escalators*, 2004, 2005 Addendum, and 2005 Supplement.

ANSI/IEEE C2, *National Electrical Safety Code*, 2007.

ANSI/UL 217, *Standard for Safety Single and Multiple Station Smoke Alarms*, 1997, revised January 2004.

ANSI/UL 268, *Standard for Safety Smoke Detectors for Fire Alarm Signaling Systems*, 1996, revised October 2003.

ANSI/UL 827, *Standard for Safety Central-Station Alarm Services*, 1996, revised April 1999.

ANSI/UL 985, *Standard for Safety Household Fire Warning System Units*, 2000, revised April 2004.

ANSI/UL 1730, *Standard for Safety for Smoke Detector Monitors and Accessories for Individual Living Units of Multifamily Residences and Hotel/Motel Rooms*, 1998, revised May 1999.

ANSI/UL 1971, *Standard for Safety Signaling Devices for Hearing Impaired*, 2002, revised May 2004.

2.3.2 EIA Publication. Electronic Industries Alliance, 2500 Wilson Boulevard, Arlington, VA 22201-3834.

EIA Tr 41.3, *Telephones*.

2.3.3 IEC Publications. International Electrotechnical Commission, 3 rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland. IEC documents are available through ANSI.

IEC 60849, *Sound systems for emergency purposes*, second edition, 1998.

IEC 61260, *Electroacoustics — Octave-Band and Fractional-Octave-Band Filters*, 1995.

2.3.4 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003

2.4 References for Extracts in Mandatory Sections.

NFPA 101®, *Life Safety Code*®, 2006 edition.

NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, 2006 edition.

NFPA 720, *Standard for the Installation of Carbon Monoxide (CO) Warning Equipment in Dwelling Units*, 2005 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this code. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3* Code. A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

3.2.4 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.

3.2.5* 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 appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.6 Shall. Indicates a mandatory requirement.

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

3.3 General Definitions.

3.3.1 Acknowledge. To confirm that a message or signal has been received, such as by the pressing of a button or the selection of a software command. (SIG-SSS)

3.3.2 Active Multiplex System. A multiplexing system in which signaling devices such as transponders are employed to transmit status signals of each initiating device or initiating device circuit within a prescribed time interval so that the lack of receipt of such a signal can be interpreted as a trouble signal. (SIG-SSS)

3.3.3 Addressable Device. A fire alarm system component with discrete identification that can have its status individually identified or that is used to individually control other functions. (SIG-IDS)

3.3.4 Adverse Condition. Any condition occurring in a communications or transmission channel that interferes with the proper transmission or interpretation, or both, of status change signals at the supervising station. (See also 3.3.172.7, *Trouble Signal*.) (SIG-SSS)

3.3.5 Alarm. A warning of danger. (SIG-FUN)

3.3.5.1 Nuisance Alarm. Any alarm caused by mechanical failure, malfunction, improper installation, or lack of proper maintenance, or any alarm activated by a cause that cannot be determined. (SIG-FUN)

3.3.6 Alarm Service. The service required following the receipt of an alarm signal. (SIG-SSS)

3.3.7 Alarm Signal. See 3.3.172, *Signal*.

3.3.8 Alarm Verification Feature. A feature of automatic fire detection and alarm systems to reduce unwanted alarms wherein smoke detectors report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period after being reset, in order to be accepted as a valid alarm initiation signal. (SIG-PRO)

3.3.9 Alert Tone. An attention-getting signal to alert occupants of the pending transmission of a voice message. (SIG-PRO)

3.3.10 Analog Initiating Device (Sensor). See 3.3.89, *Initiating Device*.

3.3.11 Annunciator. A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a circuit, condition, or location. (SIG-FUN)

3.3.12 Apartment Building. A building or portion thereof containing three or more dwelling units with independent cooking and bathroom facilities. (SIG-HOU)

3.3.13 Audible Notification Appliance. See 3.3.113, *Notification Appliance*.

3.3.14 Automatic Extinguishing System Supervisory Device. See 3.3.89, *Initiating Device*.

3.3.15 Automatic Fire Detector. See 3.3.43, *Detector*.

3.3.16 Auxiliary Box. See 3.3.63, *Fire Alarm Box*.

3.3.17 Auxiliary Fire Alarm System. See 3.3.67, *Fire Alarm System*.

3.3.18* Average Ambient Sound Level. The root mean square, A-weighted, sound pressure level measured over the period of time that any person is present, or a 24-hour period, whichever time period is the lesser. (SIG-NAS)

3.3.19 Beam Construction. See 3.3.24, *Ceiling Surfaces*.

3.3.20 Carrier. High-frequency energy that can be modulated by voice or signaling impulses. (SIG-SSS)

3.3.21 Carrier System. A means of conveying a number of channels over a single path by modulating each channel on a different carrier frequency and demodulating at the receiving point to restore the signals to their original form. (SIG-SSS)

3.3.22 Ceiling. The upper surface of a space, regardless of height. Areas with a suspended ceiling have two ceilings, one visible from the floor and one above the suspended ceiling. (SIG-IDS)

3.3.22.1 Level Ceilings. Ceilings that are level or have a slope of less than or equal to 1 in 8. (SIG-IDS)

3.3.22.2 Sloping Ceiling. A ceiling that has a slope of more than 1 in 8. (SIG-IDS)

3.3.22.3* Sloping Peaked-Type Ceiling. A ceiling in which the ceiling slopes in two directions from the highest point. Curved or domed ceilings can be considered peaked with the slope figured as the slope of the chord from highest to lowest point. (SIG-IDS)

3.3.22.4* Sloping Shed-Type Ceiling. A ceiling in which the high point is at one side with the slope extending toward the opposite side. (SIG-IDS)

3.3.23 Ceiling Height. The height from the continuous floor of a room to the continuous ceiling of a room or space. (SIG-IDS)

3.3.24 Ceiling Surfaces.

3.3.24.1 Beam Construction. Ceilings that have solid structural or solid nonstructural members projecting down from the ceiling surface more than 100 mm (4 in.) and spaced more than 0.9 m (3 ft), center to center. (SIG-IDS)

3.3.24.2 Girder. A support for beams or joists that runs at right angles to the beams or joists. If the top of the girder is within 100 mm (4 in.) of the ceiling, the girder is a factor in determining the number of detectors and is to be considered a beam. If the top of the girder is more than 100 mm (4 in.) from the ceiling, the girder is not a factor in detector location. (SIG-IDS)

3.3.24.3* Smooth Ceiling. A ceiling surface uninterrupted by continuous projections, such as solid joists, beams, or



ducts, extending more than 100 mm (4 in.) below the ceiling surface. (SIG-IDS)

3.3.24.4 Solid Joist Construction. Ceilings that have solid structural or solid nonstructural members projecting down from the ceiling surface for a distance of more than 100 mm (4 in.) and spaced at intervals of 0.9 m (3 ft) or less, center to center. (SIG-IDS)

3.3.25 Central Station. See 3.3.194, Supervising Station.

3.3.26 Central Station Fire Alarm System. See 3.3.67, Fire Alarm System.

3.3.27 Central Station Service. See 3.3.195, Supervising Station Service.

3.3.28 Central Supervising Station. See 3.3.194, Supervising Station.

3.3.29* Certification of Personnel. A formal program of related instruction and testing as provided by a recognized organization or the authority having jurisdiction. (SIG-FUN)

3.3.30 Channel. A path for voice or signal transmission that uses modulation of light or alternating current within a frequency band. (SIG-SSS)

3.3.30.1 Communications Channel. A circuit or path connecting a subsidiary station(s) to a supervising station(s) over which signals are carried. (SIG-SSS)

3.3.30.2 Derived Channel. A signaling line circuit that uses the local leg of the public switched network as an active multiplex channel while simultaneously allowing that leg's use for normal telephone communications. (SIG-SSS)

3.3.30.3* Radio Channel. A band of frequencies of a width sufficient to allow its use for radio communications. (SIG-SSS)

3.3.30.4 Transmission Channel. A circuit or path connecting transmitters to supervising stations or subsidiary stations on which signals are carried. (SIG-SSS)

3.3.31 Circuit Interface. A circuit component that interfaces initiating devices or control circuits, or both; notification appliances or circuits, or both; system control outputs; and other signaling line circuits to a signaling line circuit. (SIG-PRO)

3.3.32 Cloud Chamber Smoke Detection. See 3.3.181, Smoke Detection.

3.3.33 Coded. An audible or visible signal that conveys several discrete bits or units of information. Notification signal examples are numbered strokes of an impact-type appliance and numbered flashes of a visible appliance. (SIG-NAS)

3.3.34 Combination Detector. See 3.3.43, Detector.

3.3.35 Combination Fire Alarm and Guard's Tour Box. See 3.3.63, Fire Alarm Box.

3.3.36 Combination System. See 3.3.67, Fire Alarm System.

3.3.37 Compatibility Listed. A specific listing process that applies only to two-wire devices, such as smoke detectors, that are designed to operate with certain control equipment. (SIG-FUN)

3.3.38 Contiguous Property. See 3.3.138, Property.

3.3.39 Control Unit. A system component that monitors inputs and controls outputs through various types of circuits. (See also 3.3.64, Fire Alarm Control Unit.) (SIG-PRO)

3.3.39.1 Wireless Control Unit. A component that transmits/ receives and processes wireless signals. (SIG-PRO)

3.3.40 Day-Care Home. A building or portion of a building in which more than three but not more than 12 clients receive care, maintenance, and supervision, by other than their relative(s) or legal guardians(s), for less than 24 hours per day. [101, 2006] (SIG-HOU)

3.3.41 Delinquency Signal. See 3.3.172, Signal.

3.3.42 Derived Channel. See 3.3.30, Channel.

3.3.43 Detector. A device suitable for connection to a circuit that has a sensor that responds to a physical stimulus such as heat or smoke. (SIG-IDS)

3.3.43.1 Air Sampling-Type Detector. A detector that consists of a piping or tubing distribution network that runs from the detector to the area(s) to be protected. An aspiration fan in the detector housing draws air from the protected area back to the detector through air sampling ports, piping, or tubing. At the detector, the air is analyzed for fire products. (SIG-IDS)

3.3.43.2 Automatic Fire Detector. A device designed to detect the presence of a fire signature and to initiate action. For the purpose of this Code, automatic fire detectors are classified as follows: Automatic Fire Extinguishing or Suppression System Operation Detector, Fire-Gas Detector, Heat Detector, Other Fire Detectors, Radiant Energy-Sensing Fire Detector, Smoke Detector. (SIG-IDS)

3.3.43.3 Automatic Fire Extinguishing or Suppression System Operation Detector. A device that automatically detects the operation of a fire extinguishing or suppression system by means appropriate to the system employed. (SIG-IDS)

3.3.43.4* Combination Detector. A device that either responds to more than one of the fire phenomena or employs more than one operating principle to sense one of these phenomena. Typical examples are a combination of a heat detector with a smoke detector or a combination rate-of-rise and fixed-temperature heat detector. This device has listings for each sensing method employed. (SIG-IDS)

3.3.43.5 Electrical Conductivity Heat Detector. A line-type or spot-type sensing element in which resistance varies as a function of temperature. (SIG-IDS)

3.3.43.6 Fire-Gas Detector. A device that detects gases produced by a fire. (SIG-IDS)

3.3.43.7* Fixed-Temperature Detector. A device that responds when its operating element becomes heated to a predetermined level. (SIG-IDS)

3.3.43.8* Flame Detector. A radiant energy-sensing fire detector that detects the radiant energy emitted by a flame. (Refer to A.5.8.2.) (SIG-IDS)

3.3.43.9 Heat Detector. A fire detector that detects either abnormally high temperature or rate of temperature rise, or both. (SIG-IDS)

3.3.43.10 Line-Type Detector. A device in which detection is continuous along a path. Typical examples are rate-of-rise pneumatic tubing detectors, projected beam smoke detectors, and heat-sensitive cable. (SIG-IDS)

3.3.43.11* Multi-Criteria Detector. A device that contains multiple sensors that separately respond to physical stimulus

such as heat, smoke, or fire gases, or employs more than one sensor to sense the same stimulus. This sensor is capable of generating only one alarm signal from the sensors employed in the design either independently or in combination. The sensor output signal is mathematically evaluated to determine when an alarm signal is warranted. The evaluation can be performed either at the detector or at the control unit. This detector has a single listing that establishes the primary function of the detector. (SIG-IDS)

3.3.43.12* Multi-Sensor Detector. A device that contains multiple sensors that separately respond to physical stimulus such as heat, smoke, or fire gases, or employs more than one sensor to sense the same stimulus. A device capable of generating multiple alarm signals from any one of the sensors employed in the design, independently or in combination. The sensor output signals are mathematically evaluated to determine when an alarm signal is warranted. The evaluation can be performed either at the detector or at the control unit. This device has listings for each sensing method employed. (SIG-IDS)

3.3.43.13 Other Fire Detectors. Devices that detect a phenomenon other than heat, smoke, flame, or gases produced by a fire. (SIG-IDS)

3.3.43.14 Pneumatic Rate-of-Rise Tubing Heat Detector. A line-type detector comprising small-diameter tubing, usually copper, that is installed on the ceiling or high on the walls throughout the protected area. The tubing is terminated in a detector unit containing diaphragms and associated contacts set to actuate at a predetermined pressure. The system is sealed except for calibrated vents that compensate for normal changes in temperature. (SIG-IDS)

3.3.43.15 Projected Beam-Type Detector. A type of photoelectric light obscuration smoke detector wherein the beam spans the protected area. (SIG-IDS)

3.3.43.16 Radiant Energy-Sensing Fire Detector. A device that detects radiant energy, such as ultraviolet, visible, or infrared, that is emitted as a product of combustion reaction and obeys the laws of optics. (SIG-IDS)

3.3.43.17* Rate Compensation Detector. A device that responds when the temperature of the air surrounding the device reaches a predetermined level, regardless of the rate of temperature rise. (SIG-IDS)

3.3.43.18* Rate-of-Rise Detector. A device that responds when the temperature rises at a rate exceeding a predetermined value. (SIG-IDS)

3.3.43.19 Smoke Detector. A device that detects visible or invisible particles of combustion. (SIG-IDS)

3.3.43.20 Spark/Ember Detector. A radiant energy-sensing fire detector that is designed to detect sparks or embers, or both. These devices are normally intended to operate in dark environments and in the infrared part of the spectrum. (SIG-IDS)

3.3.43.21 Spot-Type Detector. A device in which the detecting element is concentrated at a particular location. Typical examples are bimetallic detectors, fusible alloy detectors, certain pneumatic rate-of-rise detectors, certain smoke detectors, and thermoelectric detectors. (SIG-IDS)

3.3.44 Digital Alarm Communicator Receiver (DACR). A system component that accepts and displays signals from digital

alarm communicator transmitters (DACTs) sent over the public switched telephone network. (SIG-SSS)

3.3.45 Digital Alarm Communicator System (DACS). A system in which signals are transmitted from a digital alarm communicator transmitter (DACT) located at the protected premises through the public switched telephone network to a digital alarm communicator receiver (DACR). (SIG-SSS)

3.3.46 Digital Alarm Communicator Transmitter (DACT). A system component at the protected premises to which initiating devices or groups of devices are connected. The DACT seizes the connected telephone line, dials a preselected number to connect to a DACR, and transmits signals indicating a status change of the initiating device. (SIG-SSS)

3.3.47 Digital Alarm Radio Receiver (DARR). A system component composed of two subcomponents: one that receives and decodes radio signals, the other that annunciates the decoded data. These two subcomponents can be coresident at the central station or separated by means of a data transmission channel. (SIG-SSS)

3.3.48 Digital Alarm Radio System (DARS). A system in which signals are transmitted from a digital alarm radio transmitter (DART) located at a protected premises through a radio channel to a digital alarm radio receiver (DARR). (SIG-SSS)

3.3.49 Digital Alarm Radio Transmitter (DART). A system component that is connected to or an integral part of a digital alarm communicator transmitter (DACT) that is used to provide an alternate radio transmission channel. (SIG-SSS)

3.3.50 Display. The visual representation of output data, other than printed copy. (SIG-NAS)

3.3.51 Dormitory. A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities. [101, 2006] (SIG-HOU)

3.3.52* Double Doorway. A single opening that has no intervening wall space or door trim separating the two doors. (SIG-IDS)

3.3.53 Dual Control. The use of two primary trunk facilities over separate routes or different methods to control one communications channel. (SIG-SSS)

3.3.54 Dwelling Unit. One or more rooms arranged for the use of one or more individuals living together, providing complete, independent living facilities, including permanent provisions for living, sleeping, eating, cooking, and sanitation. (SIG-HOU)

3.3.54.1 Multiple Dwelling Unit. A building containing three or more dwelling units. (SIG-HOU)

3.3.54.2 Single Dwelling Unit. A building consisting solely of one dwelling unit. (SIG-HOU)

3.3.55 Effective Masked Threshold. The minimum sound level at which the tone signal is audible in ambient noise. (SIG-NAS)

3.3.56* Ember. A particle of solid material that emits radiant energy due either to its temperature or the process of combustion on its surface. (See also 3.3.186, *Spark*.) (SIG-IDS)

3.3.57 Emergency Voice/Alarm Communications. Dedicated manual or automatic equipment for originating and distributing voice instructions, as well as alert and evacuation signals



pertaining to a fire emergency, to the occupants of a building. (SIG-PRO)

3.3.58* Evacuation. The withdrawal of occupants from a building. (SIG-PRO)

3.3.59 Evacuation Signal. See 3.3.172, Signal.

3.3.60 Evacuation Signaling Zone. See 3.3.218, Zone.

3.3.61 Exit Plan. A plan for the emergency evacuation of the premises. (SIG-FUN)

3.3.62 Field of View. The solid cone that extends out from the detector within which the effective sensitivity of the detector is at least 50 percent of its on-axis, listed, or approved sensitivity. (SIG-IDS)

3.3.63 Fire Alarm Box.

3.3.63.1 Auxiliary Box. A fire alarm box that can only be operated from one or more remote initiating devices or an auxiliary fire alarm system used to send an alarm to the public fire service communications center. (SIG-PRS)

3.3.63.2 Combination Fire Alarm and Guard's Tour Box. A manually operated box for separately transmitting a fire alarm signal and a distinctive guard patrol tour supervisory signal. (SIG-IDS)

3.3.63.3 Manual Fire Alarm Box. A manually operated device used to initiate an alarm signal. (SIG-IDS)

3.3.63.4 Master Box. A publicly accessible fire alarm box that can also be operated by one or more remote initiating devices or an auxiliary fire alarm system used to send an alarm to the public fire service communications center. (SIG-PRS)

3.3.63.5 Publicly Accessible Fire Alarm Box. An enclosure, accessible to the public, housing a manually operated transmitter used to send an alarm to the public fire service communications center. (SIG-PRS)

3.3.64* Fire Alarm Control Unit. A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). (SIG-PRO)

3.3.64.1 Master Fire Alarm Control Unit. A fire alarm control unit that serves the protected premises or portion of the protected premises as a local fire alarm control unit and accepts inputs from other fire alarm control units. (SIG-PRO)

3.3.64.2 Protected Premises (Local) Control Unit. A fire alarm control unit that serves the protected premises or a portion of the protected premises. (SIG-PRO)

3.3.64.2.1 Dedicated Function Fire Alarm Control Unit. A protected premises fire alarm control unit which is intended to provide operation of a specifically identified fire safety function, such as sprinkler alarm and supervisory control unit or an elevator recall control and supervisory control unit. (SIG-PRO)

3.3.64.2.2 Releasing Service Fire Alarm Control Unit. A protected premises fire alarm control unit specifically listed for releasing service that is part of a fire suppression system and which provides control outputs to release a fire suppression agent based on either automatic or manual input. (SIG-PRO)

3.3.65 Fire Alarm/Evacuation Signal Tone Generator. A device that produces a fire alarm/evacuation tone upon command. (SIG-PRO)

3.3.66 Fire Alarm Signal. See 3.3.172, Signal.

3.3.67 Fire Alarm System. A system or portion of a combination system that consists of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals. (SIG-FUN)

3.3.67.1* Auxiliary Fire Alarm System. A system used to connect a protected premises fire alarm system to a public fire alarm reporting system for transmitting an alarm to the public fire service communications center. (SIG-PRS)

3.3.67.1.1 Local Energy Type Auxiliary Fire Alarm System. An auxiliary system that employs a locally complete arrangement of parts, initiating devices, relays, power supply, and associated components to automatically activate a master box or auxiliary box over circuits that are electrically isolated from the public fire alarm reporting system circuits. (SIG-PRS)

3.3.67.1.2 Shunt-Type Auxiliary Fire Alarm System. An auxiliary system electrically connected to the public fire alarm reporting system extending a public fire alarm reporting circuit to interconnect initiating devices within a protected premises, which, when operated, opens the public fire alarm reporting circuit shunted around the trip coil of the master box or auxiliary box. The master box or auxiliary box is thereupon energized to start transmission without any assistance from a local source of power. (SIG-PRS)

3.3.67.2* Combination System. A fire alarm system in which components are used, in whole or in part, in common with a non-fire signaling system. (SIG-PRO)

3.3.67.3 Household Fire Alarm System. A system of devices that uses a fire alarm control unit to produce an alarm signal in the household for the purpose of notifying the occupants of the presence of a fire so that they will evacuate the premises. (SIG-HOU)

3.3.67.4 Municipal Fire Alarm System. A public fire alarm reporting system. (SIG-PRS)

3.3.67.5* Protected Premises (Local) Fire Alarm System. A fire alarm system located at the protected premises. (SIG-PRO)

3.3.67.5.1 Building Fire Alarm System. A protected premises fire alarm system that includes any of the features identified in 6.3.3.1 and that serves the general fire alarm needs of a building or buildings and that provides fire department or occupant notification or both. (SIG-PRO)

3.3.67.5.2 Dedicated Function Fire Alarm System. A protected premises fire alarm system installed specifically to perform fire safety function(s) where a building fire alarm system is not required. (SIG-PRO)

3.3.67.5.3 Releasing Fire Alarm System. A protected premises fire alarm system that is part of a fire suppression system and/or which provides control inputs to a fire suppression system related to the fire suppression systems sequence of operations and outputs for other signaling and notification. (SIG-PRO)

3.3.67.6 Public Fire Alarm Reporting System. A system of alarm-initiating devices, receiving equipment, and communication infrastructure (other than a public telephone

network) used to transmit alarms to the public fire service communications center to provide any combination of manual or auxiliary fire alarm service. (SIG-PRS)

3.3.67.6.1 Type A Public Fire Alarm Reporting System. A system in which an alarm from a fire alarm box is received and is retransmitted to fire stations either manually or automatically. (SIG-PRS)

3.3.67.6.2 Type B Public Fire Alarm Reporting System. A system in which an alarm from a fire alarm box is automatically transmitted to fire stations and, if used, is transmitted to supplementary alerting devices. (SIG-PRS)

3.3.67.7 Supervising Station Fire Alarm Systems.

3.3.67.7.1 Central Station Service Fire Alarm System. A system or group of systems in which the operations of circuits and devices are transmitted automatically to, recorded in, maintained by, and supervised from a listed central station that has competent and experienced servers and operators who, upon receipt of a signal, take such action as required by this Code. Such service is to be controlled and operated by a person, firm, or corporation whose business is the furnishing, maintaining, or monitoring of supervised fire alarm systems. (SIG-SSS)

3.3.67.7.2 Proprietary Supervising Station Fire Alarm System. An installation of fire alarm systems that serves contiguous and noncontiguous properties, under one ownership, from a proprietary supervising station located at the protected premises, or at one of multiple non-contiguous protected premises, at which trained, competent personnel are in constant attendance. This includes the protected premises fire alarm system(s): proprietary supervising station; power supplies; signal-initiating devices; initiating device circuits; signal notification appliances; equipment for the automatic, permanent visual recording of signals; and equipment for initiating the operation of emergency building control services. (SIG-SSS)

3.3.67.7.3 Remote Supervising Station Fire Alarm System. A protected premises fire alarm system (exclusive of any connected to a public fire reporting system) in which alarm, supervisory, or trouble signals are transmitted automatically to, recorded in, and supervised from a remote supervising station that has competent, and experienced servers and operators who, upon receipt of a signal, take such action as required by this Code. (SIG-SSS)

3.3.68 Fire Command Center. The principal attended or unattended location where the status of the detection, alarm communications, and control systems is displayed and from which the system(s) can be manually controlled. (SIG-PRO)

3.3.69 Fire Extinguisher Monitoring Device. A device connected to a control unit that monitors the fire extinguisher in accordance with the requirements of NFPA 10, *Standard for Portable Fire Extinguishers*. (SIG-IDS)

3.3.70 Fire Rating. The classification indicating in time (hours) the ability of a structure or component to withstand a standardized fire test. This classification does not necessarily reflect performance of rated components in an actual fire. (SIG-FUN)

3.3.71 Fire Safety Function Control Device. The fire alarm system component that directly interfaces with the control system that controls the fire safety function. (SIG-PRO)

3.3.72 Fire Safety Functions. Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of the harmful effects of fire. (SIG-PRO)

3.3.73 Fire Warden. A building staff member or a tenant trained to perform assigned duties in the event of a fire emergency. (SIG-PRO)

3.3.74 Fire Warning Equipment. Any detector, alarm, device, or material related to single- and multiple-station alarms or household fire alarm systems. (SIG-HOU)

3.3.75 Fixed Temperature Detector. See 3.3.43, Detector.

3.3.76 Flame. A body or stream of gaseous material involved in the combustion process and emitting radiant energy at specific wavelength bands determined by the combustion chemistry of the fuel. In most cases, some portion of the emitted radiant energy is visible to the human eye. (SIG-IDS)

3.3.77 Flame Detector. See 3.3.43, Detector.

3.3.78 Flame Detector Sensitivity. The distance along the optical axis of the detector at which the detector can detect a fire of specified size and fuel within a given time frame. (SIG-IDS)

3.3.79 Gateway. A device that is used in the transmission of serial data (digital or analog) from the fire alarm control unit to other building system control units, equipment, or networks and/or from other building system control units to the fire alarm control unit. (SIG-PRO)

3.3.80 Guard's Tour Reporting Station. A device that is manually or automatically initiated to indicate the route being followed and the timing of a guard's tour. (SIG-IDS)

3.3.81 Guard's Tour Supervisory Signal. See 3.3.172, Signal.

3.3.82 Guest Room. An accommodation combining living, sleeping, sanitary, and storage facilities within a compartment. [101, 2006] (SIG-HOU)

3.3.83 Guest Suite. An accommodation with two or more contiguous rooms comprising a compartment, with or without doors between such rooms, that provides living, sleeping, sanitary, and storage facilities. [101, 2006] (SIG-HOU)

3.3.84 Heat Alarm. A single or multiple station alarm responsive to heat. (SIG-IDS)

3.3.85 Heat Detector. See 3.3.43, Detector.

3.3.86 Hotel. A building or groups of buildings under the same management in which there are sleeping accommodations for more than 16 persons and primarily used by transients for lodging with or without meals. [101, 2006] (SIG-HOU)

3.3.87 Household Fire Alarm System. See 3.3.67, Fire Alarm System.

3.3.88 Hunt Group. A group of associated telephone lines within which an incoming call is automatically routed to an idle (not busy) telephone line for completion. (SIG-SSS)

3.3.89 Initiating Device. A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch. (SIG-IDS)

3.3.89.1 Analog Initiating Device (Sensor). An initiating device that transmits a signal indicating varying degrees of condition as contrasted with a conventional initiating device, which can only indicate an on-off condition. (SIG-IDS)



3.3.89.2 Automatic Extinguishing System Supervisory Device. A device that responds to abnormal conditions that could affect the proper operation of an automatic sprinkler system or other fire extinguishing system(s) or suppression system(s), including, but not limited to, control valves, pressure levels, liquid agent levels and temperatures, pump power and running, engine temperature and overspeed, and room temperature. (SIG-IDS)

3.3.89.3 Nonrestorable Initiating Device. A device in which the sensing element is designed to be destroyed in the process of operation. (SIG-IDS)

3.3.89.4 Restorable Initiating Device. A device in which the sensing element is not ordinarily destroyed in the process of operation, whose restoration can be manual or automatic. (SIG-IDS)

3.3.89.5 Supervisory Signal-Initiating Device. An initiating device such as a valve supervisory switch, water level indicator, or low air pressure switch on a dry-pipe sprinkler system in which the change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system; or a need for action in connection with guard tours, fire suppression systems or equipment, or maintenance features of related systems. (SIG-IDS)

3.3.90 Initiating Device Circuit. A circuit to which automatic or manual initiating devices are connected where the signal received does not identify the individual device operated. (SIG-PRO)

3.3.91 Ionization Smoke Detection. See 3.3.181, Smoke Detection.

3.3.92 Leg Facility. The portion of a communications channel that connects not more than one protected premises to a primary or secondary trunk facility. The leg facility includes the portion of the signal transmission circuit from its point of connection with a trunk facility to the point where it is terminated within the protected premises at one or more transponders. (SIG-SSS)

3.3.93 Level Ceilings. See 3.3.22, Ceiling.

3.3.94 Life Safety Network. A type of combination system that transmits fire safety control data through gateways to other building system control units. (SIG-PRO)

3.3.95 Living Area. Any normally occupiable space in a residential occupancy, other than sleeping rooms or rooms that are intended for combination sleeping/living, bathrooms, toilet compartments, kitchens, closets, halls, storage or utility spaces, and similar areas. [101, 2006] (SIG-HOU)

3.3.96 Loading Capacity. The maximum number of discrete elements of fire alarm systems permitted to be used in a particular configuration. (SIG-SSS)

3.3.97 Lodging or Rooming House. A building or portion thereof that does not qualify as a one- or two-family dwelling, that provides sleeping accommodations for a total of 16 or fewer people on a transient or permanent basis, without personal care services, with or without meals, but without separate cooking facilities for individual occupants. [101, 2006] (SIG-HOU)

3.3.98 Loss of Power. The reduction of available voltage at the load below the point at which equipment can function as designed. (SIG-FUN)

3.3.99 Low-Power Radio Transmitter. Any device that communicates with associated control/receiving equipment by low-power radio signals. (SIG-PRO)

3.3.100 Maintenance. Work, including, but not limited to, repair, replacement, and service, performed to ensure that equipment operates properly. (SIG-TMS)

3.3.101 Manual Fire Alarm Box. See 3.3.63, Fire Alarm Box.

3.3.102* Mass Notification System. A system used to provide information and instructions to people, in a building, area site, or other space. (SIG-PRO)

3.3.103 Master Box. See 3.3.63, Fire Alarm Box.

3.3.104 Master Fire Alarm Control Unit. See 3.3.64, Fire Alarm Control Unit.

3.3.105 Multiple Station Alarm. A single station alarm capable of being interconnected to one or more additional alarms so that the actuation of one causes the appropriate alarm signal to operate in all interconnected alarms. (SIG-HOU)

3.3.106 Multiple Station Alarm Device. Two or more single station alarm devices that can be interconnected so that actuation of one causes all integral or separate audible alarms to operate; or one single station alarm device having connections to other detectors or to a manual fire alarm box. (SIG-HOU)

3.3.107 Multiplexing. A signaling method characterized by simultaneous or sequential transmission, or both, and reception of multiple signals on a signaling line circuit, a transmission channel, or a communications channel, including means for positively identifying each signal. (SIG-SSS)

3.3.108 Municipal Fire Alarm Box (Street Box). A publicly accessible fire alarm box. See 3.3.63, Fire Alarm Box.

3.3.109 Municipal Fire Alarm System. See 3.3.67, Fire Alarm System.

3.3.110 Noncontiguous Property. See 3.3.138, Property.

3.3.111* Nonrequired. A fire alarm system component or group of components that is installed at the option of the owner, and is not installed due to a building or fire code requirement. (SIG-FUN)

3.3.112 Nonrestorable Initiating Device. See 3.3.89, Initiating Device.

3.3.113 Notification Appliance. A fire alarm system component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs, or any combination thereof. (SIG-NAS)

3.3.113.1 Audible Notification Appliance. A notification appliance that alerts by the sense of hearing. (SIG-NAS)

3.3.113.1.1 Exit Marking Audible Notification Appliance. An audible notification appliance that marks building exits and areas of refuge by the sense of hearing for the purpose of evacuation or relocation. (SIG-NAS)

3.3.113.1.2 Textual Audible Notification Appliance. A notification appliance that conveys a stream of audible information. An example of a textual audible notification appliance is a speaker that reproduces a voice message. (SIG-NAS)

3.3.113.2 Tactile Notification Appliance. A notification appliance that alerts by the sense of touch or vibration. (SIG-NAS)

3.3.113.3 Visible Notification Appliance. A notification appliance that alerts by the sense of sight. (SIG-NAS)

3.3.113.3.1 Textual Visible Notification Appliance. A notification appliance that conveys a stream of visible information that displays an alphanumeric or pictorial message. Textual visible notification appliances provide temporary text, permanent text, or symbols. Textual visible notification appliances include, but are not limited to, annunciators, monitors, CRTs, displays, and printers. (SIG-NAS)

3.3.114 Notification Appliance Circuit. A circuit or path directly connected to a notification appliance(s). (SIG-PRO)

3.3.115 Notification Zone. See 3.3.218, Zone.

3.3.116 Nuisance Alarm. See 3.3.5, Alarm.

3.3.117 Octave. The bandwidth of a filter that comprises a frequency range of a factor of 2. (That is, $f_2 = 2f_1$ as defined in IEC 61260. For example, for an octave-band centered on 500 Hz, the lower frequency is 353 Hz, and the upper frequency is 707 Hz). (SIG-NAS)

3.3.117.1 One-Third Octave. The bandwidth of a filter that comprises a frequency range of a factor of $2^{1/3}$. (That is, $f_2 = 2^{1/3} f_1$ as defined in IEC 61260.) The octave filter can be subdivided into three $\frac{1}{3}$ octave-bands. (SIG-NAS)

3.3.118 Off-Hook. To make connection with the public-switched telephone network in preparation for dialing a telephone number. (SIG-SSS)

3.3.119 On-Hook. To disconnect from the public-switched telephone network. (SIG-SSS)

3.3.120 Open Area Detection (Protection). Protection of an area such as a room or space with detectors to provide early warning of fire. (SIG-IDS)

3.3.121 Operating Mode.

3.3.121.1 Private Operating Mode. Audible or visible signaling only to those persons directly concerned with the implementation and direction of emergency action initiation and procedure in the area protected by the fire alarm system. (SIG-NAS)

3.3.121.2 Public Operating Mode. Audible or visible signaling to occupants or inhabitants of the area protected by the fire alarm system. (SIG-NAS)

3.3.122 Operating System Software. The basic operating system software that can be altered only by the equipment manufacturer or its authorized representative. Operating system software is sometimes referred to as *firmware*, *BIOS*, or *executive program*. (SIG-FUN)

3.3.123* Ownership. Any property or building or its contents under legal control by the occupant, by contract, or by holding of a title or deed. (SIG-SSS)

3.3.124 Paging System. A system intended to page one or more persons by such means as voice over loudspeaker, coded audible signals or visible signals, or lamp annunciators. (SIG-PRO)

3.3.125 Parallel Telephone System. A telephone system in which an individually wired circuit is used for each fire alarm box. (SIG-SSS)

3.3.126 Path (Pathways). Any conductor, optic fiber, radio carrier, or other means for transmitting fire alarm system information between two or more locations. (SIG-FUN)

3.3.127 Permanent Visual Record (Recording). An immediately readable, not easily alterable, print, slash, or punch record of all occurrences of status change. (SIG-SSS)

3.3.128 Photoelectric Light Obscuration Smoke Detection. See 3.3.181, Smoke Detection.

3.3.129 Photoelectric Light-Scattering Smoke Detection. See 3.3.181, Smoke Detection.

3.3.130 Plant. One or more buildings under the same ownership or control on a single property. (SIG-SSS)

3.3.131 Positive Alarm Sequence. An automatic sequence that results in an alarm signal, even when manually delayed for investigation, unless the system is reset. (SIG-PRO)

3.3.132 Power Supply. A source of electrical operating power, including the circuits and terminations connecting it to the dependent system components. (SIG-FUN)

3.3.133 Primary Battery (Dry Cell). A nonrechargeable battery requiring periodic replacement. (SIG-FUN)

3.3.134 Primary Trunk Facility. That part of a transmission channel connecting all leg facilities to a supervising or subsidiary station. (SIG-SSS)

3.3.135 Prime Contractor. The one company contractually responsible for providing central station services to a subscriber as required by this Code. The prime contractor can be either a listed central station or a listed fire alarm service—local company. (SIG-SSS)

3.3.136 Private Operating Mode. See 3.3.121, Operating Mode.

3.3.137 Private Radio Signaling. A radio system under control of the proprietary supervising station. (SIG-SSS)

3.3.138 Property.

3.3.138.1 Contiguous Property. A single-owner or single-user protected premises on a continuous plot of ground, including any buildings thereon, that is not separated by a public thoroughfare, transportation right-of-way, property owned or used by others, or body of water not under the same ownership. (SIG-SSS)

3.3.138.2 Noncontiguous Property. An owner- or user-protected premises where two or more protected premises, controlled by the same owner or user, are separated by a public thoroughfare, body of water, transportation right-of-way, or property owned or used by others. (SIG-SSS)

3.3.139 Proprietary Supervising Station. See 3.3.194, Supervising Station.

3.3.140 Proprietary Supervising Station Fire Alarm System. See 3.3.67, Fire Alarm System.

3.3.141 Proprietary Supervising Station Service. See 3.3.195 Supervising Station Service.

3.3.142 Protected Premises. The physical location protected by a fire alarm system. (SIG-PRO)

3.3.143 Protected Premises (Local) Control Unit. See 3.3.64, Fire Alarm Control Unit.

3.3.144 Protected Premises (Local) Fire Alarm System. See 3.3.67, Fire Alarm System.

3.3.145 Public Fire Alarm Reporting System. See 3.3.67, Fire Alarm System.



3.3.146 Public Fire Service Communications Center. The building or portion of the building used to house the central operating part of the fire alarm system; usually the place where the necessary testing, switching, receiving, transmitting, and power supply devices are located. (SIG-PRS)

3.3.147 Public Operating Mode. See 3.3.121, Operating Mode.

3.3.148 Radio Alarm Repeater Station Receiver (RARSR). A system component that receives radio signals and resides at a repeater station that is located at a remote receiving location. (SIG-SSS)

3.3.149 Radio Alarm Supervising Station Receiver (RASSR). A system component that receives data and annunciates that data at the supervising station. (SIG-SSS)

3.3.150 Radio Alarm System (RAS). A system in which signals are transmitted from a radio alarm transmitter (RAT) located at a protected premises through a radio channel to two or more radio alarm repeater station receivers (RARSR) and that are annunciated by a radio alarm supervising station receiver (RASSR) located at the central station. (SIG-SSS)

3.3.151 Radio Alarm Transmitter (RAT). A system component at the protected premises to which initiating devices or groups of devices are connected that transmits signals indicating a status change of the initiating devices. (SIG-SSS)

3.3.152 Radio Channel. See 3.3.30, Channel.

3.3.153 Rate Compensation Detector. See 3.3.43, Detector.

3.3.154 Rate-of-Rise Detector. See 3.3.43, Detector.

3.3.155 Record Drawings. Drawings (as-built) that document the location of all devices, appliances, wiring sequences, wiring methods, and connections of the components of the fire alarm system as installed. (SIG-FUN)

3.3.156 Record of Completion. A document that acknowledges the features of installation, operation (performance), service, and equipment with representation by the property owner, system installer, system supplier, service organization, and the authority having jurisdiction. (SIG-FUN)

3.3.157 Relocation. The movement of occupants from a fire zone to a safe area within the same building. (SIG-PRO)

3.3.158 Remote Supervising Station. See 3.3.194, Supervising Station.

3.3.159 Remote Supervising Station Fire Alarm System. See 3.3.67, Fire Alarm System.

3.3.160 Remote Supervising Station Service. See 3.3.195, Supervising Station Service.

3.3.161 Repeater Station. The location of the equipment needed to relay signals between supervising stations, subsidiary stations, and protected premises. (SIG-SSS)

3.3.162 Reset. A control function that attempts to return a system or device to its normal, nonalarm state. (SIG-FUN)

3.3.163 Residential Board and Care Occupancy. A building or portion thereof that is used for lodging and boarding of four or more residents, not related by blood or marriage to the owners or operators, for the purpose of providing personal care services. [101, 2006] (SIG-HOU)

3.3.164 Residential Occupancy. An occupancy that provides sleeping accommodations for purposes other than health care or detention and correctional. [101, 2006] (SIG-HOU)

3.3.165 Restorable Initiating Device. See 3.3.89, Initiating Device.

3.3.166 Runner. A person other than the required number of operators on duty at central, supervising, or runner stations (or otherwise in contact with these stations) available for prompt dispatching, when necessary, to the protected premises. (SIG-SSS)

3.3.167 Runner Service. The service provided by a runner at the protected premises, including restoration, resetting, and silencing of all equipment transmitting fire alarm or supervisory or trouble signals to an off-premises location. (SIG-SSS)

3.3.168 Scanner. Equipment located at the telephone company wire center that monitors each local leg and relays status changes to the alarm center. Processors and associated equipment might also be included. (SIG-SSS)

3.3.169 Secondary Trunk Facility. That part of a transmission channel connecting two or more, but fewer than all, leg facilities to a primary trunk facility. (SIG-SSS)

3.3.170 Separate Sleeping Area. The area of a dwelling unit where the bedrooms or sleeping rooms are located. [720, 2005] (SIG-HOU)

3.3.171 Shapes of Ceilings. The shapes of ceilings can be classified as sloping or smooth. (SIG-IDS)

3.3.172 Signal. A status indication communicated by electrical or other means. (SIG-FUN)

3.3.172.1 Alarm Signal. A signal indicating an emergency condition or an alert that requires action. (SIG-FUN)

3.3.172.2 Delinquency Signal. A signal indicating the need for action in connection with the supervision of guards or system attendants. (SIG-PRO)

3.3.172.3 Evacuation Signal. A distinctive signal intended to be recognized by the occupants as requiring evacuation of the building. (SIG-PRO)

3.3.172.4 Fire Alarm Signal. A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, waterflow switch, or other device in which activation is indicative of the presence of a fire or fire signature. (SIG-FUN)

3.3.172.5 Guard's Tour Supervisory Signal. A supervisory signal monitoring the performance of guard patrols. (SIG-PRO)

3.3.172.6 Supervisory Signal. A signal indicating the need for action in connection with the supervision of guard tours, the fire suppression systems or equipment, or the maintenance features of related systems. (SIG-FUN)

3.3.172.7 Trouble Signal. A signal initiated by a system or device indicative of a fault in a monitored circuit, system, or component. (SIG-FUN)

3.3.173 Signaling Line Circuit. A circuit path between any combination of addressable appliances or devices, circuit interfaces, control units, or transmitters over which multiple system input signals or output signals or both are carried. (SIG-PRO)

3.3.174 Signaling Line Circuit Interface. A system component that connects a signaling line circuit to any combination of

initiating devices, initiating device circuits, notification appliances, notification appliance circuits, system control outputs, and other signaling line circuits. (SIG-PRO)

3.3.175 Signal Transmission Sequence. A DACT that obtains dial tone, dials the number(s) of the DACR, obtains verification that the DACR is ready to receive signals, transmits the signals, and receives acknowledgment that the DACR has accepted that signal before disconnecting (going on-hook). (SIG-SSS)

3.3.176 Single Station Alarm. A detector comprising an assembly that incorporates a sensor, control components, and an alarm notification appliance in one unit operated from a power source either located in the unit or obtained at the point of installation. (SIG-HOU)

3.3.177 Single Station Alarm Device. An assembly that incorporates the detector, the 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. (SIG-HOU)

3.3.178 Site-Specific Software. Software that defines the specific operation and configuration of a particular system. Typically, it defines the type and quantity of hardware modules, customized labels, and specific operating features of a system. (SIG-TMS)

3.3.179 Sloping Ceiling. See 3.3.22, Ceiling.

3.3.180 Smoke Alarm. A single or multiple station alarm responsive to smoke. (SIG-HOU)

3.3.181 Smoke Detection.

3.3.181.1 Cloud Chamber Smoke Detection. The principle of using an air sample drawn from the protected area into a high-humidity chamber combined with a lowering of chamber pressure to create an environment in which the resultant moisture in the air condenses on any smoke particles present, forming a cloud. The cloud density is measured by a photoelectric principle. The density signal is processed and used to convey an alarm condition when it meets preset criteria. (SIG-IDS)

3.3.181.2* Ionization Smoke Detection. The principle of using a small amount of radioactive material to ionize the air between two differentially charged electrodes to sense the presence of smoke particles. Smoke particles entering the ionization volume decrease the conductance of the air by reducing ion mobility. The reduced conductance signal is processed and used to convey an alarm condition when it meets preset criteria. (SIG-IDS)

3.3.181.3* Photoelectric Light Obscuration Smoke Detection. The principle of using a light source and a photosensitive sensor onto which the principal portion of the source emissions is focused. When smoke particles enter the light path, some of the light is scattered and some is absorbed, thereby reducing the light reaching the receiving sensor. The light reduction signal is processed and used to convey an alarm condition when it meets preset criteria. (SIG-IDS)

3.3.181.4* Photoelectric Light-Scattering Smoke Detection. The principle of using a light source and a photosensitive sensor arranged so that the rays from the light source do not normally fall onto the photosensitive sensor. When smoke particles enter the light path, some of the light is scattered by reflection and refraction onto the sensor. The light signal is processed and used to convey an alarm condition when it meets preset criteria. (SIG-IDS)

3.3.181.5* Video Image Smoke Detection (VISD). The principle of using automatic analysis of real-time video images to detect the presence of smoke. (SIG-IDS)

3.3.182 Smoke Detector. See 3.3.43, Detector.

3.3.183 Smooth Ceiling. See 3.3.24, Ceiling Surfaces.

3.3.184 Solid Joist Construction. See 3.3.24, Ceiling Surfaces.

3.3.185 Spacing. A horizontally measured dimension related to the allowable coverage of fire detectors. (SIG-IDS)

3.3.186* Spark. A moving particle of solid material that emits radiant energy due either to its temperature or the process of combustion on its surface. [654, 2006] (SIG-IDS)

3.3.187 Spark/Ember Detector. See 3.3.43, Detector.

3.3.188 Spark/Ember Detector Sensitivity. The number of watts (or the fraction of a watt) of radiant power from a point source radiator, applied as a unit step signal at the wavelength of maximum detector sensitivity, necessary to produce an alarm signal from the detector within the specified response time. (SIG-IDS)

3.3.189 Spot-Type Detector. See 3.3.43, Detector.

3.3.190 Story. The portion of a building located between the upper surface of a floor and the upper surface of the floor or roof next above. [101, 2006] (SIG-FUN)

3.3.191 Stratification. The phenomenon where the upward movement of smoke and gases ceases due to the loss of buoyancy. (SIG-IDS)

3.3.192 Subscriber. The recipient of a contractual supervising station signal service(s). In case of multiple, noncontiguous properties having single ownership, the term refers to each protected premises or its local management. (SIG-SSS)

3.3.193 Subsidiary Station. A subsidiary station is a normally unattended location that is remote from the supervising station and is linked by a communications channel(s) to the supervising station. Interconnection of signals on one or more transmission channels from protected premises with a communications channel(s) to the supervising station is performed at this location. (SIG-SSS)

3.3.194 Supervising Station. A facility that receives signals from protected premises fire alarm systems and at which personnel are in attendance at all times to respond to these signals. (SIG-SSS)

3.3.194.1 Central Supervising Station. A supervising station that is listed for central station service and that also commonly provides less stringent supervising station services such as remote supervising services. (SIG-SSS)

3.3.194.2 Proprietary Supervising Station. A supervising station under the same ownership as the protected premises fire alarm system(s) that it supervises (monitors) and to which alarm, supervisory, or trouble signals are received and where personnel are in attendance at all times to supervise operation and investigate signals. (SIG-SSS)

3.3.194.3 Remote Supervising Station. A supervising station to which alarm, supervisory, or trouble signals or any combination of those signals emanating from protected premises fire alarm systems are received and where personnel are in attendance at all times to respond. (SIG-SSS)



3.3.195 Supervising Station Service.

3.3.195.1 Central Station Service. The use of a system or a group of systems including the protected premises fire alarm system(s) in which the operations of circuits and devices are signaled to, recorded in, and supervised from a listed central station that has competent and experienced operators who, upon receipt of a signal, take such action as required by this Code. Related activities at the protected premises, such as equipment installation, inspection, testing, maintenance, and runner service, are the responsibility of the central station or a listed fire alarm service local company. Central station service is controlled and operated by a person, firm, or corporation whose business is the furnishing of such contracted services or whose properties are the protected premises. (SIG-SSS)

3.3.195.2 Proprietary Supervising Station Service. The use of a system or a group of systems including the protected premises fire alarm system(s) in which the operations of circuits and devices are signaled to, recorded in, and supervised from a supervising station under the same ownership as the protected premises that has competent and experienced operators who, upon receipt of a signal, take such action as required by this Code. Related activities at the protected premises, such as equipment installation, inspection, testing, maintenance, and runner service, are the responsibility of the owner. Proprietary supervising station service is controlled and operated by the entity whose properties are the protected premises. (SIG-SSS)

3.3.195.3 Remote Supervising Station Service. The use of a system including the protected premises fire alarm system(s) in which the operations of circuits and devices are signaled to, recorded in, and supervised from a supervising station that has competent and experienced operators who, upon receipt of a signal, take such action as required by this Code. Related activities at the protected premises, such as equipment installation, inspection, testing, and maintenance, are the responsibility of the owner. (SIG-SSS)

3.3.196 Supervisory Service. The service required to monitor performance of guard tours and the operative condition of fixed suppression systems or other systems for the protection of life and property. (SIG-PRO)

3.3.197 Supervisory Signal. See 3.3.172, Signal.

3.3.198 Supervisory Signal-Initiating Device. See 3.3.89, Initiating Device.

3.3.199 Supplementary. As used in this Code, *supplementary* refers to equipment or operations not required by this Code and designated as such by the authority having jurisdiction. (SIG-FUN)

3.3.200 Switched Telephone Network. An assembly of communications facilities and central office equipment operated jointly by authorized service providers that provides the general public with the ability to establish transmission channels via discrete dialing. (SIG-SSS)

3.3.200.1 Public Switched Telephone Network. An assembly of communications facilities and central office equipment operated jointly by authorized common carriers that provides the general public with the ability to establish communications channels via discrete dialing codes. (SIG-SSS)

3.3.201 System Unit. The active subassemblies at the supervising station used for signal receiving, processing, display, or recording of status change signals; a failure of one of these subassemblies causes the loss of a number of alarm signals by that unit. (SIG-SSS)

3.3.202 Tactile Notification Appliance. See 3.3.113, Notification Appliance.

3.3.203 Textual Audible Notification Appliance. See 3.3.113, Notification Appliance.

3.3.204 Textual Visual Notification Appliance. See 3.3.113, Notification Appliance.

3.3.205 Transmission Channel. See 3.3.30, Channel.

3.3.206 Transmitter. A system component that provides an interface between signaling line circuits, initiating device circuits, or control units and the transmission channel. (SIG-SSS)

3.3.207 Transponder. A multiplex alarm transmission system functional assembly located at the protected premises. (SIG-SSS)

3.3.208 Trouble Signal. See 3.3.172, Signal.

3.3.209* Video Image Flame Detection (VIFD). The principle of using automatic analysis of real-time video images to detect the presence of flame. (SIG-IDS)

3.3.210 Visible Notification Appliance. See 3.3.113, Notification Appliance.

3.3.211* Voice Intelligibility. Audible voice information that is distinguishable and understandable. (SIG-NAS)

3.3.212 WATS (Wide Area Telephone Service). Telephone company service allowing reduced costs for certain telephone call arrangements. In-WATS or 800-number service calls can be placed from anywhere in the continental United States to the called party at no cost on to the calling party. Out-WATS is a service whereby, for a flat-rate charge, dependent on the total duration of all such calls, a subscriber can make an unlimited number of calls within a prescribed area from a particular telephone terminal without the registration of individual call charges. (SIG-SSS)

3.3.213* Wavelength. The distance between the peaks of a sinusoidal wave. All radiant energy can be described as a wave having a wavelength. Wavelength serves as the unit of measure for distinguishing between different parts of the spectrum. Wavelengths are measured in microns (μm), nanometers (nm), or angstroms ($\text{\AA}$). (SIG-IDS)

3.3.214 Wide Area Signaling. Signaling intended to provide alerting or information to exterior open spaces, such as campuses, neighborhood streets, a city, a town, or a community. (SIG-NAS)

3.3.215 Wireless Control Unit. See 3.3.39, Control Unit.

3.3.216 Wireless Protection System. A system or a part of a system that can transmit and receive signals without the aid of interconnection wiring. It can consist of either a wireless control unit or a wireless repeater. (SIG-PRO)

3.3.217 Wireless Repeater. A component used to relay signals among wireless devices, appliances, and control units. (SIG-PRO)

3.3.218 Zone. A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent, or an area in which a form of control can be executed. (SIG-FUN)

3.3.218.1* Evacuation Signaling Zone. A discrete area of a building, bounded by smoke or fire barriers, from which occupants are intended to relocate or evacuate. (SIG-PRO)

3.3.218.2 Notification Zone. An area covered by notification appliances that are activated simultaneously. (SIG-PRO)

Chapter 4 Fundamentals of Fire Alarm Systems

4.1 Application.

4.1.1 The basic functions of a complete fire alarm system shall comply with the requirements of this chapter.

4.1.2 The requirements of this chapter shall apply to fire alarm systems, equipment, and components addressed in Chapter 5 through Chapter 10.

4.2 Purpose. The purpose of fire alarm systems shall be primarily to provide notification of fire alarm, supervisory, and trouble conditions; to alert the occupants; to summon aid; and to control fire safety functions.

4.3 Equipment and Personnel.

4.3.1 Equipment. Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used. Fire alarm system components shall be installed, tested, and maintained in accordance with the manufacturer's published instructions and this Code.

4.3.2 System Designer.

4.3.2.1 Fire alarm system plans and specifications shall be developed in accordance with this Code by persons who are experienced in the proper design, application, installation, and testing of fire alarm systems.

4.3.2.2 The system designer shall be identified on the system design documents. Acceptable evidence of qualifications or certification shall be provided when requested by the authority having jurisdiction. Qualified personnel shall include, but not be limited to, one or more of the following:

- (1) Personnel who are factory trained and certified for fire alarm system design of the specific type and brand of system being designed
- (2)*Personnel who are certified by a nationally recognized fire alarm certification organization acceptable to the authority having jurisdiction
- (3) Personnel who are registered, licensed, or certified by a state or local authority

4.3.3 System Installer. Installation personnel shall be qualified or shall be supervised by persons who are qualified in the installation, inspection, and testing of fire alarm systems. Evidence of qualifications or certification shall be provided when requested by the authority having jurisdiction. Qualified personnel shall include, but not be limited to, one or more of the following:

- (1) Personnel who are factory trained and certified for fire alarm system installation of the specific type and brand of system being installed

- (2)*Personnel who are certified by a nationally recognized fire alarm certification organization acceptable to the authority having jurisdiction
- (3) Personnel who are registered, licensed, or certified by a state or local authority

4.4 System Fundamentals.

4.4.1 Power Supplies.

4.4.1.1 Scope. The provisions of this section shall apply to power supplies used for both protected premises fire alarm systems described in Chapter 6 and to supervising station facilities and equipment described in Chapter 8.

4.4.1.2 Code Conformance. All power supplies shall be installed in conformity with the requirements of NFPA 70, *National Electrical Code*, for such equipment and with the requirements indicated in this subsection.

4.4.1.3 Power Supply Sources.

4.4.1.3.1 At least two independent and reliable power supplies shall be provided, one primary and one secondary, each of which shall be of adequate capacity for the application.

4.4.1.3.2 Monitoring the integrity of power supplies shall be in accordance with 4.4.7.3.

4.4.1.4 Primary Power Supply.

4.4.1.4.1 Dedicated Branch Circuit. A dedicated branch circuit of one of the following shall supply primary power:

- (1) Commercial light and power
- (2) An engine-driven generator or equivalent in accordance with 4.4.1.9.2, where a person specifically trained in its operation is on duty at all times
- (3) An engine-driven generator or equivalent arranged for cogeneration with commercial light and power in accordance with 4.4.1.9.2, where a person specifically trained in its operation is on duty at all times

4.4.1.4.2 Mechanical Protection.

4.4.1.4.2.1 The dedicated branch circuit(s) and connections shall be mechanically protected.

4.4.1.4.2.2 Circuit disconnecting means shall have a red marking, shall be accessible only to authorized personnel, and shall be identified as "FIRE ALARM CIRCUIT."

4.4.1.4.2.3 The location of the circuit disconnecting means shall be permanently identified at the fire alarm control unit.

4.4.1.4.3 Overcurrent Protection. An overcurrent protective device of suitable current-carrying capacity that is capable of interrupting the maximum short-circuit current to which it can be subject shall be provided in each ungrounded conductor.

4.4.1.4.4 Circuit Breakers and Engine Stops. Circuit breakers or engine stops shall not be installed in such a manner as to cut off the power for lighting or for operating elevators.

4.4.1.5 Secondary Power Supply.

4.4.1.5.1* Secondary Power Supply for Protected Premises Fire Alarm Systems. The secondary power supply shall consist of one of the following:

- (1) A storage battery dedicated to the fire alarm system arranged in accordance with 4.4.1.8
- (2) An automatic starting, engine-driven generator serving the dedicated branch circuit specified in 4.4.1.4.1 and arranged in accordance with 4.4.1.9.3.1 and storage batteries dedicated to the fire alarm system with 4 hours of capacity arranged in accordance with 4.4.1.8



4.4.1.5.2 Secondary Power Supply for Supervising Station Facilities.

4.4.1.5.2.1 The secondary power supply shall consist of one of the following:

- (1) Storage batteries dedicated to the supervising station equipment arranged in accordance with 4.4.1.8
- (2) A dedicated branch circuit of an automatic-starting, engine-driven generator arranged in accordance with 4.4.1.9.3.2(A) and storage batteries dedicated to the supervising station equipment with 4 hours of capacity arranged in accordance with 4.4.1.8
- (3) A dedicated branch circuit of multiple engine-driven generators, at least one of which is arranged for automatic starting in accordance with 4.4.1.9.3.2(A)

4.4.1.5.2.2 Where 4.4.1.5.2.1(3) is used, 4.4.1.5.2.2(A) through 4.4.1.5.2.2(C) shall apply.

(A) Each generator shall be capable of supplying the energy required.

(B) Generators that are started manually shall be arranged in accordance with 4.4.1.9.3.2(B).

(C) When manual-start generators are employed, a person trained in the procedure of starting the generator shall be on duty at all times.

4.4.1.5.3* Capacity.

4.4.1.5.3.1 Unless otherwise permitted or required by 4.4.1.5.3.1(A) or 4.4.1.5.3.1(B), the secondary power supply shall have sufficient capacity to operate the fire alarm system under quiescent load (system operating in a nonalarm condition) for a minimum of 24 hours and, at the end of that period, shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes.

(A) The secondary power supply for emergency voice/alarm communications service shall be capable of operating the system under quiescent load for a minimum of 24 hours and then shall be capable of operating the system during a fire or other emergency condition for a period of 15 minutes at maximum connected load.

(B) The secondary power supply capacity for supervising station facilities and equipment shall be capable of supporting operations for a minimum of 24 hours.

4.4.1.5.3.2 The secondary power supply capacity required shall include all power supply loads that are not automatically disconnected upon the transfer to secondary power supply.

4.4.1.5.4 **Secondary Power Operation.** Operation on secondary power shall not affect the required performance of a fire alarm system or supervising station facility. The system shall produce the same alarm, supervisory, and trouble signals and indications, excluding the alternating current (ac) power indicator, when operating from the secondary power source as are produced when the unit is operating from the primary power source.

Exception: Audio amplifier monitoring shall comply with 4.4.7.2.1.

4.4.1.6* Continuity of Power Supplies.

4.4.1.6.1 The secondary power supply shall automatically provide power to the protected premises fire alarm system

within 10 seconds, whenever the primary power supply fails to provide the minimum voltage required for proper operation.

4.4.1.6.2 The secondary power supply shall automatically provide power to the supervising station facility and equipment within 60 seconds whenever the primary power supply fails to provide the minimum voltage required for proper operation.

4.4.1.6.3 Required signals shall not be lost, interrupted, or delayed by more than 10 seconds as a result of the primary power failure.

4.4.1.6.3.1 Storage batteries dedicated to the fire alarm system or an uninterruptible power supply (UPS) arranged in accordance with the provisions of NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, shall be permitted to supplement the secondary power supply to ensure required operation during the transfer period.

4.4.1.6.3.2 Where a UPS is employed in 4.4.1.6.3.1, a positive means for disconnecting the input and output of the UPS system while maintaining continuity of power supply to the load shall be provided.

4.4.1.7 Power Supply for Remotely Located Control Equipment.

4.4.1.7.1 Additional power supplies, where provided for control units, circuit interfaces, or other equipment essential to system operation, and located remotely from the main control unit, shall be comprised of a primary and secondary power supply that shall meet the same requirements as those of 4.4.1.1 through 4.4.1.6 and 4.4.7.3.

4.4.1.7.2 The location of any remotely located power supply shall be identified at the master control unit as well as on the record drawings. Identification on the control unit display shall be acceptable.

4.4.1.8* Storage Batteries.

4.4.1.8.1* **Marking.** Batteries shall be permanently marked with the month and year of manufacture, using the month/year format.

4.4.1.8.2 **Location.** Storage batteries shall be located so that the fire alarm equipment, including overcurrent devices, are not adversely affected by battery gases and shall conform to the requirements of NFPA 70, *National Electrical Code*, Article 480.

4.4.1.8.2.1 Cells shall be suitably insulated against grounds and crosses and shall be mounted securely in such a manner so as not to be subject to mechanical injury.

4.4.1.8.2.2 Racks shall be suitably protected against deterioration.

4.4.1.8.2.3 If not located in or adjacent to the fire alarm control unit, the batteries and their charger location shall be permanently identified at the fire alarm control unit.

4.4.1.8.3 Battery Charging.

4.4.1.8.3.1 Adequate facilities shall be provided to automatically maintain the battery fully charged under all conditions of normal operation.

4.4.1.8.3.2 Adequate facilities shall be provided to recharge batteries within 48 hours after fully charged batteries have been subject to a single discharge cycle as specified in 4.4.1.5.3.

4.4.1.8.3.3 Upon attaining a fully charged condition, the charge rate shall not be so excessive as to result in battery damage.

4.4.1.8.3.4* Batteries shall be either trickle- or float-charged.

4.4.1.8.3.5 Supervising stations shall maintain spare parts or units available, which shall be used to restore failed charging capacity prior to the consumption of one-half of the capacity of the batteries for the supervising station equipment.

4.4.1.8.4 Overcurrent Protection.

4.4.1.8.4.1 The batteries shall be protected against excessive load current by overcurrent devices.

4.4.1.8.4.2 The batteries shall be protected from excessive charging current by overcurrent devices or by automatic current-limiting design of the charging source.

4.4.1.8.5 Metering. The charging equipment shall provide either integral meters or readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.

4.4.1.8.6 Charger Supervision. Supervision means appropriate for the batteries and charger employed shall be provided to detect a failure of battery charging and initiate a trouble signal in accordance with 4.4.3.5.

4.4.1.9 Engine-Driven Generators.

4.4.1.9.1 Application and Installation. The application and installation of engine-driven generators shall be as specified in 4.4.1.9.2 through 4.4.1.9.7.

4.4.1.9.2 Primary Power Supply. Engine-driven generators arranged as the primary supply shall be designed and installed in an approved manner.

4.4.1.9.3 Secondary Power Supplies.

4.4.1.9.3.1 Protected Premises.

(A) Engine-driven generators used to provide secondary power for a protected premises fire alarm system shall comply with NFPA 110, *Standard for Emergency and Standby Power Systems*, Chapter 4, requirements for a Type 10, Class 24, Level 1 System. Installation shall be in accordance with NFPA 70, *National Electrical Code*, Article 700.

(B) Where survivability of circuits is required by Chapter 6, equal protection shall be provided for power supply circuits.

4.4.1.9.3.2 Supervising Station.

(A) Automatic-starting, engine-driven generators used to provide secondary power for a supervising station shall comply with NFPA 110, *Standard for Emergency and Standby Power Systems*, Chapter 4, requirements for a Type 60, Class 24, Level 2 system. Installation shall be in accordance with NFPA 70, *National Electrical Code*, Article 701.

(B) Manual-starting, engine-driven generators used to provide secondary power for a supervising station shall comply with NFPA 110, *Standard for Emergency and Standby Power Systems*, Chapter 4, requirements for a Type M, Class 24, Level 2 system. Installation shall be in accordance with NFPA 70, *National Electrical Code*, Article 702.

4.4.1.9.4 Performance, Operation, Testing, and Maintenance. The requirements for performance, operation, testing, and maintenance of engine-driven generators shall conform to the

applicable provisions of NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.9.5 Capacity. The unit shall be of a capacity that is sufficient to operate the system under the maximum normal load conditions in addition to all other demands placed upon the unit.

4.4.1.9.6 Fuel. Unless otherwise required or permitted in 4.4.1.9.6.1 through 4.4.1.9.6.3, fuel shall be available in storage sufficient for 6 months of testing plus the capacity specified in 4.4.1.5.

4.4.1.9.6.1 For public fire alarm reporting systems, the requirements of Chapter 9 shall apply.

4.4.1.9.6.2 If a reliable source of supply is available at any time on a 2-hour notice, it shall be permitted to have fuel in storage sufficient for 12 hours of operation at full load.

4.4.1.9.6.3 Fuel systems using natural or manufactured gas supplied through reliable utility mains shall not be required to have fuel storage tanks unless located in seismic risk zone 3 or greater as defined in ANSI A-58.1, *Building Code Requirements for Minimum Design Loads in Buildings and Other Structures*.

4.4.1.9.7 Battery and Charger. A separate storage battery and separate automatic charger shall be provided for starting the engine-driven generator and shall not be used for any other purpose.

4.4.2 Compatibility. All detection devices that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be listed for use with the control unit.

4.4.3 System Functions.

4.4.3.1* Alarm Signals. A coded alarm signal shall consist of not less than three complete rounds of the number transmitted. Each round shall consist of not less than three impulses.

4.4.3.2 Supervisory Signals.

4.4.3.2.1 Coded Supervisory Signal. A coded supervisory signal shall be permitted to consist of two rounds of the number transmitted to indicate a supervisory off-normal condition, and one round of the number transmitted to indicate the restoration of the supervisory condition to normal.

4.4.3.2.2 Combined Coded Alarm and Supervisory Signal Circuits. Where both coded sprinkler supervisory signals and coded fire or waterflow alarm signals are transmitted over the same signaling line circuit, provision shall be made to obtain either alarm signal precedence or sufficient repetition of the alarm signal to prevent the loss of an alarm signal.

4.4.3.2.3 Self-Restoring Supervisory Signal Indication. Visible and audible indication of self-restoring supervisory signals and visible indication of their restoration to normal shall be automatically indicated within 90 seconds at the following locations:

- (1) Fire alarm control unit for local fire alarm systems
- (2) Building fire command center for emergency voice/alarm communications systems
- (3) Supervising station location for systems installed in compliance with Chapter 8

4.4.3.2.4 Latching Supervisory Signal Indication. Visible and audible indication of latching supervisory signals shall be indicated within 90 seconds at the locations specified in 4.4.3.2.3.



Restoration of latching supervisory signals shall be indicated within 90 seconds at the same locations, after manual reset of the control unit, when the initiating device is normal.

4.4.3.3 Distinctive Signals. Fire alarms, supervisory signals, and trouble signals shall be distinctively and descriptively annunciated.

4.4.3.4 Fire Safety Function Status Indicators.

4.4.3.4.1 All controls provided specifically for the purpose of manually overriding any automatic fire safety function shall provide visible indication of the status of the associated control circuits.

4.4.3.4.2* Where status indicators are provided for emergency equipment or fire safety functions, they shall be arranged to reflect the actual status of the associated equipment or function.

4.4.3.5 Trouble Signals.

4.4.3.5.1 Trouble signals and their restoration to normal shall be indicated within 200 seconds at the locations identified in 4.4.3.5.6 or 4.4.3.5.7. Indication of primary power failure trouble signals transmitted to a supervising station shall be delayed in accordance with 4.4.7.3.3.

4.4.3.5.2 Trouble signals required to indicate at the protected premises shall be indicated by distinctive audible signals, which shall be distinctive from alarm signals.

4.4.3.5.3 If an intermittent signal is used, it shall sound at least once every 10 seconds, with a minimum duration of 1/2 second.

4.4.3.5.4 An audible trouble signal shall be permitted to be common to several supervised circuits.

4.4.3.5.5 The trouble signal(s) shall be located in an area where it is likely to be heard.

4.4.3.5.6 Visible and audible trouble signals and visible indication of their restoration to normal shall be indicated at the following locations:

- (1) Fire alarm control unit for protected premises alarm systems
- (2) Building fire command center for emergency voice/alarm communications systems
- (3) Central station or remote station location for systems installed in compliance with Chapter 8

4.4.3.5.7 Trouble signals and their restoration to normal shall be visibly and audibly indicated at the proprietary supervising station for systems installed in compliance with Chapter 8.

4.4.3.5.8 Audible Trouble Signal Silencing Means.

4.4.3.5.8.1 A means for silencing the trouble notification appliance(s) shall be permitted only if it complies with 4.4.3.5.8.1(A) through 4.4.3.5.8.1(D).

(A) The means shall be key-operated, located within a locked enclosure, or arranged to provide equivalent protection against unauthorized use.

(B) The means shall transfer the trouble indication to a suitably identified lamp or other acceptable visible indicator.

(C) The visible indication in 4.4.3.5.8.1(B) shall persist until the trouble condition has been corrected.

(D) The audible trouble signal shall sound when the silencing means is in its silence position and no trouble exists.

4.4.3.5.8.2 If an audible trouble notification appliance is also used to indicate a supervisory condition, as permitted in 4.4.3.6.2(2), a trouble signal silencing switch shall not prevent subsequent sounding of supervisory signals.

4.4.3.5.8.3* An audible trouble signal that has been silenced at the protected premises shall comply with 4.4.3.5.8.3(A) through 4.4.3.5.8.3(C).

(A) The audible trouble signal shall automatically re-sound every 24 hours or less until fault conditions are restored to normal.

(B) The audible trouble signal shall sound until it is manually silenced or acknowledged.

(C) The re-sounded trouble signal shall also be automatically retransmitted to any supervising station to which the original trouble signal was transmitted.

4.4.3.5.8.4* If permitted by the authority having jurisdiction, the requirement for a 24-hour re-sound of an audible trouble signal shall be permitted to occur only at a supervising station that meets the requirements of Chapter 8 and not at the protected premises.

4.4.3.6 Distinctive Signals.

4.4.3.6.1 Audible alarm notification appliances for a fire alarm system shall produce signals that are distinctive from other similar appliances used for other purposes in the same area.

4.4.3.6.2 The distinction among signals shall be as follows:

- (1) Fire alarm signals shall be distinctive in sound from other signals, shall comply with the requirements of 6.8.6.5.1, and their sound shall not be used for any other purpose.
- (2)*Supervisory signals shall be distinctive in sound from other signals, and their sound shall not be used for any other purpose.

Exception: A supervisory signal sound shall be permitted to be used to indicate a trouble condition. If the same sound is used for both supervisory signals and trouble signals, the distinction between signals shall be by other appropriate means such as visible annunciation.

- (3) Fire alarm, supervisory, and trouble signals shall take precedence, in that respective order of priority, over all other signals.

Exception: Signals from hold-up alarms or other life-threatening signals shall be permitted to take precedence over supervisory and trouble signals if acceptable to the authority having jurisdiction.

4.4.3.7* Alarm Signal Deactivation.

4.4.3.7.1 A means for turning off activated alarm notification appliance(s) shall be permitted only if it complies with 4.4.3.7.3 through 4.4.3.7.6.

4.4.3.7.2 When an alarm signal deactivation means is actuated, both audible and visible notification appliances shall be simultaneously deactivated.

4.4.3.7.3 The means shall be key-operated, located within a locked cabinet, or arranged to provide equivalent protection against unauthorized use.

4.4.3.7.4 The means shall provide a visible zone alarm indication or the equivalent as specified in 4.4.6.1.

4.4.3.7.5 Subsequent actuation of initiating devices on other initiating device circuits or subsequent actuation of addressable initiating devices on signaling line circuits shall cause the notification appliances to reactivate.

Exception: If permitted by the authority having jurisdiction, subsequent actuation of another addressable initiating device of the same type in the same room or space shall not be required to cause the notification appliance(s) to reactivate.

4.4.3.7.6 A means that is left in the “off” position when there is no alarm shall operate an audible trouble signal until the means is restored to normal.

4.4.3.8 Supervisory Signal Silencing. A means for silencing a supervisory signal notification appliance(s) shall be permitted only if it complies with 4.4.3.8.1 through 4.4.3.8.3.

4.4.3.8.1 The means shall be key-operated, located within a locked enclosure, or arranged to provide equivalent protection against unauthorized use.

4.4.3.8.2 The means shall transfer the supervisory indication to a lamp or other visible indicator, and subsequent supervisory signals in other zones shall cause the supervisory notification appliance(s) to re-sound.

4.4.3.8.3 A means that is left in the “silence” position where there is no supervisory off-normal signal shall operate a visible signal silence indicator and cause the trouble signal to sound until the silencing means is restored to normal position.

4.4.4 Performance and Limitations.

4.4.4.1 Voltage, Temperature, and Humidity Variation. Equipment shall be designed so that it is capable of performing its intended functions under the following conditions:

- (1) *At 85 percent and at 110 percent of the nameplate primary (main) and secondary (standby) input voltage(s)
- (2) At ambient temperatures of 0°C (32°F) and 49°C (120°F)
- (3) At a relative humidity of 85 percent and an ambient temperature of 30°C (86°F)

4.4.4.2 Installation and Design.

4.4.4.2.1* All systems shall be installed in accordance with the specifications and standards approved by the authority having jurisdiction.

4.4.4.2.2 Devices and appliances shall be located and mounted so that accidental operation or failure is not caused by vibration or jarring.

4.4.4.2.3 All apparatus requiring rewinding or resetting to maintain normal operation shall be restored to normal as promptly as possible after each alarm and kept in normal condition for operation.

4.4.4.2.4 Equipment shall be installed in locations where conditions do not exceed the voltage, temperature, and humidity limits specified in 4.4.4.1.

Exception: Equipment specifically listed for use in locations where conditions can exceed the upper and lower limits specified in 4.4.4.1 shall be permitted.

4.4.4.3 Transient Protection. To reduce the possibility of damage by induced transients, circuits and equipment shall be properly protected in accordance with the requirements of NFPA 70, *National Electrical Code*, Article 800.

4.4.4.4* Wiring. The installation of all wiring, cable, and equipment shall be in accordance with NFPA 70, *National Electrical Code*, and specifically with Articles 760, 770, and 800, where applicable. Optical fiber cables shall be protected against mechanical injury in accordance with Article 760.

4.4.4.5 Grounding. All systems shall test free of grounds.

Exception: Parts of circuits or equipment that are intentionally and permanently grounded to provide ground-fault detection, noise suppression, emergency ground signaling, and circuit protection grounding shall be permitted.

4.4.4.6 Initiating Devices.

4.4.4.6.1 Initiating devices of the manual or automatic type shall be selected and installed so as to minimize nuisance alarms.

4.4.4.6.2 Fire alarm boxes of the manually operated type shall comply with Section 5.13 and 6.8.5.2.1.

4.4.5* Protection of Fire Alarm System. In areas that are not continuously occupied, automatic smoke detection shall be provided at the location of each fire alarm control unit(s), notification appliance circuit power extenders, and supervising station transmitting equipment to provide notification of fire at that location.

Exception No. 1: Where ambient conditions prohibit installation of automatic smoke detection, automatic heat detection shall be permitted.

Exception No. 2: Fully sprinklered buildings shall not require protection in accordance with 4.4.5.

4.4.6 Annunciation and Annunciation Zoning.

4.4.6.1 Alarm Annunciation. Where required, the location of an operated initiating device shall be annunciated by visible means. Visible annunciation shall be by an indicator lamp, alphanumeric display, printout, or other approved means. The visible annunciation of the location of operated initiating devices shall not be canceled by the means used to deactivate alarm notification appliances.

4.4.6.2 Supervisory and Trouble Annunciation. Where required, supervisory and/or trouble annunciation shall be annunciated by visible means. Visible annunciation shall be by an indicator lamp, alphanumeric display, printout, or other means. The visible annunciation of supervisory and/or trouble conditions shall not be canceled by the means used to deactivate supervisory or trouble notification appliances.

4.4.6.3* Annunciator Access and Location. All required annunciation means shall be readily accessible to responding personnel and shall be located as required by the authority having jurisdiction to facilitate an efficient response to the fire situation.

4.4.6.4 Alarm Annunciation Display. Visible annunciators shall be capable of displaying all zones in alarm. If all zones in alarm are not displayed simultaneously, the zone of origin shall be displayed and there shall be an indication that other zones are in alarm.

4.4.6.5 Fire Command Center. Annunciation at the fire command center shall be by means of audible and visible indicators.

4.4.6.6* Annunciation Zoning.

4.4.6.6.1 For the purpose of alarm annunciation, each floor of the building shall be considered as a separate zone. If a



floor is subdivided by fire or smoke barriers and the fire plan for the protected premises allows relocation of occupants from the zone of origin to another zone on the same floor, each zone on the floor shall be annunciated separately for purposes of alarm location.

4.4.6.6.2 Where the system serves more than one building, each building shall be annunciated separately.

4.4.7 Monitoring Integrity.

4.4.7.1* Monitoring Integrity of Installation Conductors and Other Signaling Channels. Unless otherwise permitted or required by 4.4.7.1.1 through 4.4.7.1.13, all means of interconnecting equipment, devices, and appliances and wiring connections shall be monitored for the integrity of the interconnecting conductors or equivalent path so that the occurrence of a single open or a single ground-fault condition in the installation conductors or other signaling channels and their restoration to normal shall be automatically indicated within 200 seconds.

4.4.7.1.1 Monitoring for integrity shall not be required for styles of initiating device circuits, signaling line circuits, and notification appliance circuits tabulated in Table 6.5, Table 6.6.1, and Table 6.7 that do not have an "X" under "Trouble" for the abnormal condition indicated.

4.4.7.1.2 Shorts between conductors shall not be required to be monitored for integrity, unless required by 4.4.7.1.17 and 4.4.7.2.2.

4.4.7.1.3 Monitoring for integrity shall not be required for a noninterfering shunt circuit, provided that a fault circuit condition on the shunt circuit wiring results only in the loss of the noninterfering feature of operation.

4.4.7.1.4 Monitoring for integrity shall not be required for connections to and between supplementary system components, provided that single open, ground, or short-circuit conditions of the supplementary equipment or interconnecting means, or both, do not affect the required operation of the fire alarm system.

4.4.7.1.5 Monitoring for integrity shall not be required for the circuit of an alarm notification appliance installed in the same room with the central control equipment, provided that the notification appliance circuit conductors are installed in conduit or are equivalently protected against mechanical injury.

4.4.7.1.6 Monitoring for integrity shall not be required for a trouble signal circuit.

4.4.7.1.7* Monitoring for integrity shall not be required for the interconnection between listed equipment within a common enclosure.

4.4.7.1.8 Monitoring for integrity shall not be required for the interconnection between enclosures containing control equipment located within 6 m (20 ft) of each other where the conductors are installed in conduit or equivalently protected against mechanical injury.

4.4.7.1.9 Monitoring for integrity shall not be required for the conductors for ground detection where a single ground does not prevent the required normal operation of the system.

4.4.7.1.10 Monitoring for integrity shall not be required for central station circuits serving notification appliances within a central station.

4.4.7.1.11 Monitoring for integrity shall not be required for pneumatic rate-of-rise systems of the continuous line type in

which the wiring terminals of such devices are connected in multiple across electrically supervised circuits.

4.4.7.1.12 Monitoring for integrity shall not be required for the interconnecting wiring of a stationary computer and the computer's keyboard, video monitor, mouse-type device, or touch screen, as long as the interconnecting wiring does not exceed 2.4 m (8 ft) in length; is a listed computer/data processing cable as permitted by NFPA 70, *National Electrical Code*; and failure of cable does not cause the failure of the required system functions not initiated from the keyboard, mouse, or touch screen.

4.4.7.1.13 Monitoring for integrity of the installation conductors for a ground-fault condition shall not be required for the communications and transmission channels extending from a supervising station to a subsidiary station(s) or protected premises, or both, which comply with the requirements of Chapter 8 and are electrically isolated from the fire alarm system (or circuits) by a transmitter(s), provided that a single ground condition does not affect the required operation of the fire alarm system.

4.4.7.1.14 Interconnection means shall be arranged so that a single break or single ground fault does not cause an alarm signal.

4.4.7.1.15 Unacknowledged alarm signals shall not be interrupted if a fault on an initiating device circuit or a signaling line circuit occurs while there is an alarm condition on that circuit.

Exception: Circuits used to interconnect fire alarm control units.

4.4.7.1.16 An open, ground, or short-circuit fault on the installation conductors of one alarm notification appliance circuit shall not affect the operation of any other alarm notification circuit.

4.4.7.1.17 A wire-to-wire short-circuit fault on any alarm notification appliance circuit shall result in a trouble signal in accordance with 4.4.3.5, except as permitted by 4.4.7.1.4, 4.4.7.1.5, or 4.4.7.1.10.

4.4.7.2 Monitoring Integrity of Emergency Voice/Alarm Communications Systems.

4.4.7.2.1* Speaker Amplifier and Tone-Generating Equipment. If speakers are used to produce audible fire alarm signals, the required trouble signal for 4.4.7.2.1.1 through 4.4.7.2.1.3 shall be in accordance with 4.4.3.5.

4.4.7.2.1.1 When primary power is available, failure of any audio amplifier shall result in a trouble signal.

4.4.7.2.1.2 When an alarm is present and primary power is not available (i.e., system is operating from the secondary power source), failure of any audio amplifier shall result in a trouble signal.

4.4.7.2.1.3 Failure of any tone-generating equipment shall result in a trouble signal, unless the tone-generating and amplifying equipment are enclosed as integral parts and serve only a single, listed loudspeaker.

4.4.7.2.2 Two-Way Telephone Communications Circuits. Where a two-way telephone communications circuit is provided, its installation wires shall be monitored for open and short-circuit fault conditions that would cause the telephone communications circuit to become fully or partially inoperative.

Two-way telephone communications circuit fault conditions shall result in a trouble signal in accordance with 4.4.3.5.

4.4.7.3 Monitoring Integrity of Power Supplies.

4.4.7.3.1 Unless otherwise permitted or required by 4.4.7.3.1.1 through 4.4.7.3.1.4, all primary and secondary power supplies shall be monitored for the presence of voltage at the point of connection to the system. Failure of either supply shall result in a trouble signal in accordance with 4.4.3.5. Where the DACT is powered from a protected premises fire alarm system control unit, power failure indication shall be in accordance with this paragraph.

4.4.7.3.1.1 Monitoring shall not be required for a power supply for supplementary equipment.

4.4.7.3.1.2 Monitoring shall not be required for the neutral of a three-, four-, or five-wire ac or direct current (dc) supply source.

4.4.7.3.1.3 Monitoring shall not be required for the main power supply in a central station, provided the fault condition is otherwise indicated so as to be obvious to the operator on duty.

4.4.7.3.1.4 Monitoring shall not be required for the output of an engine-driven generator that is part of the secondary power supply, provided the generator is tested weekly in accordance with Chapter 10.

4.4.7.3.2* Power supply sources and electrical supervision for digital alarm communications systems shall be in accordance with 4.4.1 and 4.4.7.

4.4.7.3.3* Unless prohibited by the authority having jurisdiction, supervising station fire alarm systems shall be arranged to delay transmission of primary power failure signals for a period ranging from 60 to 180 minutes.

4.4.7.3.4 Power supervisory devices shall be arranged so as not to impair the receipt of fire alarm or supervisory signals.

4.5 Documentation.

4.5.1 Approval and Acceptance.

4.5.1.1* The authority having jurisdiction shall be notified prior to installation or alteration of equipment or wiring. At the authority having jurisdiction's request, complete information regarding the system or system alterations, including specifications, type of system or service, shop drawings, input/output matrix, battery calculations, and notification appliance circuit voltage drop calculations shall be submitted for approval.

4.5.1.2 Before requesting final approval of the installation, if required by the authority having jurisdiction, the installing contractor shall furnish a written statement stating that the system has been installed in accordance with approved plans and tested in accordance with the manufacturer's published instructions and the appropriate NFPA requirements.

4.5.1.3* The record of completion form, Figure 4.5.2.1, shall be permitted to be a part of the written statement required in 4.5.1.2. When more than one contractor has been responsible for the installation, each contractor shall complete the portions of the form for which that contractor had responsibility.

4.5.1.4 The record of completion form, Figure 4.5.2.1, shall be permitted to be a part of the documents that support the requirements of 4.5.2.4.

4.5.2 Completion Documents.

4.5.2.1* Preparation. The preparation of a record of completion, Figure 4.5.2.1, shall be the responsibility of the qualified and experienced person described in 4.3.3 and shall be in accordance with 4.5.2.1.1 through 4.5.2.1.3.

4.5.2.1.1 Parts 1 through 11 shall be completed after the system is installed and the installation wiring has been checked. Parts 12 and 13 shall be completed after the operational acceptance tests have been completed.

4.5.2.1.2 A preliminary copy of the record of completion shall be given to the system owner and, if requested, to other authorities having jurisdiction after completion of the installation wiring tests. A final copy shall be provided after completion of the operational acceptance tests.

4.5.2.1.3 One copy of the record of completion, updated to reflect all system additions or modifications and maintained in a current condition at all times, shall be stored at the fire alarm control unit or other location approved by the authority having jurisdiction.

4.5.2.2 Revision. All fire alarm systems that are modified after the initial installation shall have the original record of completion revised to show all changes from the original information and shall include a revision date.

4.5.2.3 Documentation Required. Every system shall include the following documentation, which shall be delivered to the owner or the owner's representative upon final acceptance of the system:

- (1)*An owner's manual and manufacturer's published instructions covering all system equipment
- (2) Record drawings
- (3) For software-based systems, a record copy of the site-specific software

4.5.2.4* Verification of Compliant Installation. Where required, compliance of the completed installation with the requirements of this standard, as implemented via the referring code(s), specifications, and/or other criteria applicable to the specific installation, shall be certified by a qualified and impartial third-party organization acceptable to the authority having jurisdiction.

4.5.2.4.1 At a minimum, the verification shall ensure that the installed system includes all required components and functions, that those components and functions are installed and operate as required, that the system has been 100 percent acceptance tested in accordance with Chapter 10, and that all required documentation has been provided to the system owner. For supervising station systems, the verification shall also ascertain proper arrangement, transmission, and receipt of all signals required to be transmitted off-premises.

Exception: Where the installation is an extension, modification, or reconfiguration of an existing system, the verification shall be required for the new work only and reacceptance testing in accordance with Chapter 10 shall be acceptable.

4.5.2.4.2 Verification shall include confirmation that any required corrective actions have been completed.

4.5.3 Records.

4.5.3.1 A complete record of the tests and operations of each system shall be kept until the next test and for 1 year thereafter.



FIRE ALARM SYSTEM RECORD OF COMPLETION

To be completed by the system installation contractor at the time of system acceptance and approval.

1. PROTECTED PROPERTY INFORMATION

Name of property: _____

Address: _____

Description of property: _____

Occupancy type: _____

Name of property representative: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Authority having jurisdiction over this property: _____

Phone: _____ Fax: _____ E-mail: _____

2. FIRE ALARM SYSTEM INSTALLATION, SERVICE, AND TESTING INFORMATION

Installation contractor for this equipment: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Service organization for this equipment: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Location of as-built drawings: _____ Location of historical test reports: _____

Location of system operation and maintenance manuals: _____

A contract for test and inspection in accordance with NFPA standards is in effect as of _____

Contracted testing company: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Contract expires: _____ Contract number: _____ Frequency of routine inspections: _____

3. TYPE OF FIRE ALARM SYSTEM OR SERVICE

NFPA 72 Chapter Reference of System Type: _____

Name of organization receiving alarm signals with phone numbers (if applicable):

Alarm: _____ Phone: _____

Supervisory: _____ Phone: _____

Trouble: _____ Phone: _____

Entity to which alarms are retransmitted: _____ Phone: _____

Method of retransmission of alarms to that organization or location: _____

FIGURE 4.5.2.1 Record of Completion.

3. TYPE OF FIRE ALARM SYSTEM OR SERVICE (continued)

If Chapter 8, note the means of transmission from the protected premises to the central station:

☐ Digital alarm communicator ☐ McCulloh ☐ Multiplex ☐ 2-way radio ☐ 1-way radio ☐ N/A

If Chapter 9, note the type of connection: ☐ Local energy ☐ Shunt ☐ N/A

3.1 System Software

Operating system (executive) software revision level: _____

Site-specific software revision date: _____ Revision completed by: _____

4. SIGNALING LINE CIRCUITS

Characteristics of signaling line circuits connected to this system (see NFPA 72, Table 6.6.1):

Quantity: _____ Style: _____ Class: _____

5. ALARM-INITIATING DEVICES AND CIRCUITS

Characteristics of initiating device circuits connected to this system (see NFPA 72, Table 6.5):

Quantity: _____ Style: _____ Class: _____

5.1 Manual Initiating Devices**5.1.1 Manual Pull Stations**

Number of manual pull stations: _____

Type of devices: ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A

5.2 Automatic Initiating Devices**5.2.1 Area Smoke Detectors**

Number of smoke detectors: _____

Type of coverage: ☐ Complete area ☐ Partial area ☐ Nonrequired partial area ☐ N/A

Type of devices: ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A

Type of smoke detector sensing technology: ☐ Ionization ☐ Photoelectric

5.2.2 Duct Smoke Detectors

Number of duct smoke detectors: _____

Type of coverage: _____

Type of devices: ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A

Type of smoke detector sensing technology: ☐ Ionization ☐ Photoelectric

5.2.3 Heat Detectors

Number of heat detectors: _____

Type of coverage: ☐ Complete area ☐ Partial area ☐ Nonrequired partial area ☐ N/A

Type of devices: ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A

5.2.4 Sprinkler Waterflow Detectors

Number of waterflow detectors: _____

Type of devices ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A

5.2.5 Alarm Verification

Number of devices subject to alarm verification: _____

Alarm verification on this system is: ☐ Enabled ☐ Disabled ☐ Set for _____ seconds

FIGURE 4.5.2.1 *Continued*

6. SUPERVISORY SIGNAL-INITIATING DEVICES AND CIRCUITS**6.1 Sprinkler System**

Number of valve supervisory switches: _____

Type of devices: ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A**6.2 Fire Pump**Type of fire pump: ☐ Electric ☐ DieselType of fire pump supervisory devices: ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A

Fire Pump Functions Supervised

☐ Fire pump power ☐ Fire pump running ☐ Fire pump phase reversal ☐ Selector switch not in auto☐ Engine or control panel trouble ☐ Low fuel

Other: _____

6.3 Engine-Driven GeneratorType of generator supervisory devices: ☐ Addressable ☐ Conventional ☐ Coded ☐ Transmitter ☐ N/A☐ Engine or control panel trouble ☐ Generator running ☐ Selector switch not in auto ☐ Low fuel

Other: _____

7. ANNUNCIATORS**7.1 Annunciator 1** ☐ Local ☐ RemoteType: ☐ Addressable ☐ Directory ☐ Graphic ☐ N/A Location: _____**7.2 Annunciator 2** ☐ Local ☐ RemoteType: ☐ Addressable ☐ Directory ☐ Graphic ☐ N/A Location: _____**7.3 Annunciator 3** ☐ Local ☐ RemoteType: ☐ Addressable ☐ Directory ☐ Graphic ☐ N/A Location: _____**8. ALARM NOTIFICATION DEVICES AND CIRCUITS****8.1 Emergency Voice Alarm Service**

Number of single voice alarm channels: _____ Number of multiple voice alarm channels: _____

Number of speakers: _____ Number of speaker zones: _____

8.2 Telephone Jacks

Number of telephone jacks installed: _____ Number of telephone handsets stored on site: _____

Type of telephone system installed: ☐ Electrically powered ☐ Sound powered ☐ N/A**8.3 Nonvoice Audible System***Characteristics of notification device circuits connected to this system (see NFPA 72, Table 6.5):*

Quantity: _____ Style: _____ Class: _____

FIGURE 4.5.2.1 *Continued*

8. ALARM NOTIFICATION DEVICES AND CIRCUITS (continued)**8.4 Types and Quantities of Nonvoice Notification Appliances Installed**

Bells: _____ With visual device: _____ Horns: _____ With visual device: _____
 Chimes: _____ With visual device: _____ Bells: _____ With visual device: _____
 Visual devices without audible devices: _____ Other (describe): _____

9. EMERGENCY CONTROL FUNCTIONS ACTIVATED

- ☐ Hold-open door releasing devices ☐ Smoke management or smoke control
☐ Door unlocking ☐ Elevator recall ☐ Other

10. SYSTEM POWER SUPPLY**10.1 Primary Power**

Nominal voltage _____ Amps _____
 Overcurrent protection: Type _____ Amps _____
 Location (of primary supply panelboard): _____
 Disconnecting means location: _____

10.2 Secondary Power

Location: _____ Type: _____ Nominal voltage: _____ Current rating: _____
 Number of standby batteries: _____ Amp hour rating: _____
 Location of emergency generator: _____
 Location of fuel storage: _____
 Calculated capacity of secondary power to drive the system
 In standby mode: _____ In alarm mode: _____

11. RECORD OF SYSTEM INSTALLATION

Fill out after all installation is complete and wiring has been checked for opens, shorts, ground faults, and improper branching, but before conducting operational acceptance tests.

The system has been installed in accordance with the following NFPA standards: (Note any or all that apply.)

- ☐ NFPA 72 ☐ NFPA 70, *National Electrical Code*, Article 760
☐ Manufacturer's published instructions ☐ Other (please specify): _____
 System deviations from referenced NFPA standards: _____

Signed: _____ Printed name: _____ Date: _____
 Organization: _____ Title: _____ Phone: _____

12. RECORD OF SYSTEM OPERATION

All operational features and functions of this system were tested by or in the presence of the signer shown below, on the date shown below, and were found to be operating properly in accordance with the requirements of:

- ☐ NFPA 72 ☐ NFPA 70, *National Electrical Code*, Article 760
☐ Manufacturer's published instructions ☐ Other (please specify): _____
☐ Documentation in accordance with Inspection and Testing Form (Figure 10.6.2.3) is attached

Signed: _____ Printed name: _____ Date: _____
 Organization: _____ Title: _____ Phone: _____

FIGURE 4.5.2.1 *Continued*

13. CERTIFICATIONS AND APPROVALS**13.1 System Installation Contractor**

This system as specified herein has been installed and tested according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

13.2 System Service Contractor

This system as specified herein has been installed and tested according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

13.3 Central Station

This system as specified herein will be monitored according to all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

13.4 Property Representative

I accept this system as having been installed and tested to its specifications and all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

13.5 Authority Having Jurisdiction

I have witnessed a satisfactory acceptance test of this system and find it to be installed and operating properly in accordance with its approved plans and specifications, its approved sequence of operations, and with all NFPA standards cited herein.

Signed: _____ Printed name: _____ Date: _____

Organization: _____ Title: _____ Phone: _____

FIGURE 4.5.2.1 *Continued*

4.5.3.2 The record shall be available for examination and, if required, reported to the authority having jurisdiction. Archiving of records by any means shall be permitted if hard copies of the records can be provided promptly when requested.

4.5.3.3 If off-premises monitoring is provided, records of all signals, tests, and operations recorded at the supervising station shall be maintained for not less than 1 year.

4.6* Impairments.

4.6.1 The system owner or their designated representative shall be notified when a fire alarm system or part thereof is impaired. Impairments to systems shall include out-of-service events.

4.6.2 A record shall be maintained by the system owner or designated representative for a period of 1 year from the date the impairment is corrected.

4.6.3* Where required, mitigating measures acceptable to the authority having jurisdiction shall be implemented for the period that the system is impaired.

4.6.4 The system owner or owner's designated representative shall be notified when an impairment period is completed or discontinued.

4.7 Mass Notification Systems. See Annex E.

Chapter 5 Initiating Devices

5.1 Application.

5.1.1 The performance, selection, use, and location of automatic fire detection devices, sprinkler waterflow detectors, manually activated fire alarm stations, and supervisory signal-initiating devices (including guard tour reporting used to ensure timely warning for the purposes of life safety and the protection of a building, space, structure, area, or object) shall comply with the minimum requirements of this chapter.

5.1.2 The requirements of Chapter 4 and Chapter 6 shall also apply unless they are in conflict with this chapter.

5.1.3 The requirements of Chapter 10 shall apply.

5.1.4 The requirements of single- and multiple-station alarms and household fire alarm systems shall be determined in accordance with Chapter 11.

5.1.5 The material in this chapter shall be applied by persons knowledgeable in the application of fire detection and fire alarm systems and services.

5.1.6 The interconnection of initiating devices with control equipment configurations and power supplies, or with output systems responding to external actuation, shall be as detailed elsewhere in this Code or in other NFPA codes and standards.

5.2 Purpose. Automatic and manual initiating devices shall contribute to life safety, fire protection, and property conservation by providing a reliable means to signal other equipment arranged to monitor the initiating devices and to initiate a response to those signals.

5.3* Performance-Based Design.

5.3.1 Performance-based designs submitted to the authority having jurisdiction for review and approval shall include documentation, in an approved format, of each performance objective and applicable scenario, together with any calculations,

modeling, or other technical substantiation used in establishing the proposed design's fire and life safety performance.

5.3.2 The authority having jurisdiction shall determine whether such identified performance objectives are appropriate and have been met.

5.3.3 The authority having jurisdiction shall approve modifications to or variations from the approved design or design basis in advance.

5.4 General Requirements.

5.4.1 These requirements shall apply to all initiating devices.

5.4.2 Initiating devices shall not be installed in inaccessible areas.

5.4.3 Where subject to mechanical damage, an initiating device shall be protected. A mechanical guard used to protect a smoke, heat, or radiant energy-sensing detector shall be listed for use with the detector.

5.4.4 Initiating devices shall be supported independently of their attachment to the circuit conductors.

5.4.5 Initiating devices shall be installed in a manner that provides accessibility for periodic maintenance.

5.4.6 Initiating devices shall be installed in all areas, compartments, or locations where required by other NFPA codes and standards or as required by the authority having jurisdiction.

5.4.7* Duplicate terminals, leads, or connectors that provide for the connection of installation wiring shall be provided on each initiating device for the express purpose of connecting into the fire alarm system to monitor the integrity of the signaling and power wiring.

Exception: Initiating devices connected to a system that provides the required monitoring.

5.5 Requirements for Smoke and Heat Detectors.

5.5.1 Recessed Mounting. Unless tested and listed for recessed mounting, detectors shall not be recessed into the mounting surface.

5.5.2* Detector Coverage.

5.5.2.1 Total (Complete) Coverage. If required and unless otherwise modified by 5.5.2.1.1 through 5.5.2.1.5, total coverage shall include all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, and other subdivisions and accessible spaces as well as the inside of all closets, elevator shafts, enclosed stairways, dumbwaiter shafts, and chutes.

5.5.2.1.1 Where inaccessible areas contain combustible material, unless otherwise specified in 5.5.2.1.2, they shall be made accessible and shall be protected by a detector(s).

5.5.2.1.2 Detectors shall not be required in combustible blind spaces if any of the following conditions exist:

- (1) Where the ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck
- (2) Where the concealed space is entirely filled with a noncombustible insulation (In solid joist construction, the insulation shall be required to fill only the space from the ceiling to the bottom edge of the joist of the roof or floor deck.)



- (3) Where there are small concealed spaces over rooms, provided any space in question does not exceed 4.6 m² (50 ft²) in area
- (4) In spaces formed by sets of facing studs or solid joists in walls, floors, or ceilings where the distance between the facing studs or solid joists is less than 150 mm (6 in.)

5.5.2.1.3 Detectors shall not be required below open grid ceilings if all of the following conditions exist:

- (1) Openings of the grid are 6.4 mm (¼ in.) or larger in the least dimension.
- (2) Thickness of the material does not exceed the least dimension.
- (3) Openings constitute at least 70 percent of the area of the ceiling material.

5.5.2.1.4 Detectors shall not be required in concealed, accessible spaces above suspended ceilings that are used as a return air plenum meeting the requirements of NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, where equipped with smoke detection at each connection from the plenum to the central air-handling system.

5.5.2.1.5 Detectors shall not be required underneath open loading docks or platforms and their covers and for accessible under-floor spaces if all of the following conditions exist:

- (1) Space is not accessible for storage purposes or entrance of unauthorized persons and is protected against the accumulation of windborne debris.
- (2) Space contains no equipment such as steam pipes, electric wiring, shafting, or conveyors.
- (3) Floor over the space is tight.
- (4) No flammable liquids are processed, handled, or stored on the floor above.

5.5.2.2* Partial or Selective Coverage. Where codes, standards, laws, or authorities having jurisdiction require the protection of selected areas only, the specified areas shall be protected in accordance with this Code.

5.5.2.3* Nonrequired Coverage.

5.5.2.3.1 Detection installed for reasons of achieving specific fire safety objectives, but not required by any laws, codes, or standards, shall meet all of the requirements of this Code, with the exception of prescriptive spacing criteria of 5.6.5 and 5.7.3.2.3.

5.5.2.3.2 Where nonrequired detectors are installed for achieving specific fire safety objectives, additional detectors not necessary to achieve the objectives shall not be required.

5.6 Heat-Sensing Fire Detectors.

5.6.1 General.

5.6.1.1* The heat detection design documentation shall state the required performance objective of the system.

5.6.1.2 Designs not in accordance with 5.6.1.3 shall be deemed prescriptive designs and shall be designed in accordance with the prescriptive requirements of this chapter.

5.6.1.3* Performance-based designs shall be executed in accordance with Section 5.3.

5.6.1.4* Spot-type heat detectors shall include in their installation instructions, technical data, and listing documentation the operating temperature and RTI (response time index) as determined by the organization listing the device.

The requirement for RTI documentation shall have an effective date of July 1, 2008.

5.6.2 Temperature Classification.

5.6.2.1 Color Coding.

5.6.2.1.1 Heat-sensing fire detectors of the fixed-temperature or rate-compensated, spot-type shall be classified as to the temperature of operation and marked with a color code in accordance with Table 5.6.2.1.1.

Exception: Heat-sensing fire detectors where the alarm threshold is field adjustable and that are marked with the temperature range.

Table 5.6.2.1.1 Temperature Classification for Heat-Sensing Fire Detectors

Temperature Classification	Temperature Rating Range		Maximum Ceiling Temperature		Color Code
	°C	°F	°C	°F	
Low*	39–57	100–134	28	80	Uncolored
Ordinary	58–79	135–174	47	115	Uncolored
Intermediate	80–121	175–249	69	155	White
High	122–162	250–324	111	230	Blue
Extra high	163–204	325–399	152	305	Red
Very extra high	205–259	400–499	194	380	Green
Ultra high	260–302	500–575	249	480	Orange

*Intended only for installation in controlled ambient areas. Units shall be marked to indicate maximum ambient installation temperature.

5.6.2.1.2 If the overall color of a heat-sensing fire detector is the same as the color code marking required for that detector, one of the following arrangements, applied in a contrasting color and visible after installation, shall be employed:

- (1) Ring on the surface of the detector
- (2) Temperature rating in numerals at least 9.5 mm (⅜ in.) high

5.6.2.2* Integral Heat Sensors on Combination and Multi-Sensor Detectors. A heat-sensing detector integrally mounted on a smoke detector shall be listed for not less than 15 m (50 ft) spacing.

5.6.2.3 Marking. Heat-sensing fire detectors shall be marked with their listed operating temperature. Spot-type heat detectors shall also be marked with their RTI (response time index). The RTI marking requirements shall have an effective date of July 1, 2008.

5.6.3 Location.

5.6.3.1* Unless otherwise modified by 5.6.3.1.1 or 5.6.3.1.2, spot-type heat-sensing fire detectors shall be located on the ceiling not less than 100 mm (4 in.) from the sidewall or on the sidewalls between 100 mm and 300 mm (4 in. and 12 in.) from the ceiling.

5.6.3.1.1 In the case of solid joist construction, detectors shall be mounted at the bottom of the joists.

5.6.3.1.2 In the case of beam construction where beams are less than 300 mm (12 in.) in depth and less than 2.4 m (8 ft)

on center, detectors shall be permitted to be installed on the bottom of beams.

5.6.3.2 Unless otherwise modified by 5.6.3.2.1 through 5.6.3.2.3, line-type heat detectors shall be located on the ceiling or on the sidewalls not more than 500 mm (20 in.) from the ceiling.

5.6.3.2.1 In the case of solid joist construction, detectors shall be mounted at the bottom of the joists.

5.6.3.2.2 In the case of beam construction where beams are less than 300 mm (12 in.) in depth and less than 2.4 m (8 ft) on center, detectors shall be permitted to be installed on the bottom of beams.

5.6.3.2.3 Where a line-type detector is used in an application other than open area protection, the manufacturer's published instructions shall be followed.

5.6.4* Temperature. Detectors having fixed-temperature or rate-compensated elements shall be selected in accordance with Table 5.6.2.1.1 for the maximum expected ambient ceiling temperature. The temperature rating of the detector shall be at least 11°C (20°F) above the maximum expected temperature at the ceiling.

5.6.5* Spacing.

5.6.5.1* Smooth Ceiling Spacing.

5.6.5.1.1 One of the following requirements shall apply:

- (1) The distance between detectors shall not exceed their listed spacing, and there shall be detectors within a distance of one-half the listed spacing, measured at right angles from all walls or partitions extending upward to within the top 15 percent of the ceiling height.
- (2) All points on the ceiling shall have a detector within a distance equal to 0.7 times the listed spacing (0.7S).

5.6.5.1.2* For irregularly shaped areas, the spacing between detectors shall be permitted to be greater than the listed spacing, provided the maximum spacing from a detector to the farthest point of a sidewall or corner within its zone of protection is not greater than 0.7 times the listed spacing.

5.6.5.2* Solid Joist Construction. The spacing of heat detectors, where measured at right angles to the solid joists, shall not exceed 50 percent of the smooth ceiling spacing permitted under 5.6.5.1.1 and 5.6.5.1.2.

5.6.5.3* Beam Construction.

5.6.5.3.1 A ceiling shall be treated as a smooth ceiling if the beams project no more than 100 mm (4 in.) below the ceiling.

5.6.5.3.2 Where the beams project more than 100 mm (4 in.) below the ceiling, the spacing of spot-type heat detectors at right angles to the direction of beam travel shall be not more than two-thirds of the smooth ceiling spacing permitted under 5.6.5.1.1 and 5.6.5.1.2.

5.6.5.3.3 Where the beams project more than 460 mm (18 in.) below the ceiling and are more than 2.4 m (8 ft) on center, each bay formed by the beams shall be treated as a separate area.

5.6.5.4 Sloping Ceilings.

5.6.5.4.1* Peaked. A row of detectors shall first be spaced and located at or within 900 mm (3 ft) of the peak of the ceiling, measured horizontally. The number and spacing of additional

detectors, if any, shall be based on the horizontal projection of the ceiling in accordance with the type of ceiling construction.

5.6.5.4.2* Shed. Sloping ceilings shall have a row of detectors located on the ceiling within 900 mm (3 ft) of the high side of the ceiling measured horizontally, spaced in accordance with the type of ceiling construction. The remaining detectors, if any, shall be located in the remaining area on the basis of the horizontal projection of the ceiling.

5.6.5.4.3 Roof Slope Less Than 30 Degrees. For a roof slope of less than 30 degrees, all detectors shall be spaced using the height at the peak. For a roof slope of greater than 30 degrees, the average slope height shall be used for all detectors other than those located in the peak.

5.6.5.5 High Ceilings.

5.6.5.5.1* On ceilings 3 m to 9.1 m (10 ft to 30 ft) high, heat detector linear spacing shall be reduced in accordance with Table 5.6.5.5.1 prior to any additional reductions for beams, joists, or slope, where applicable.

Exception: Table 5.6.5.5.1 shall not apply to the following detectors, which rely on the integration effect:

- (1) Line-type electrical conductivity detectors (see 3.3.43.10)
- (2) Pneumatic rate-of-rise tubing heat detectors (see 3.3.43.14)

In these cases, the manufacturer's published instructions shall be followed for appropriate alarm point and spacing.

Table 5.6.5.5.1 Heat Detector Spacing Reduction Based on Ceiling Height

Ceiling Height Above		Up to and Including		Multiply Listed Spacing by
m	ft	m	ft	
0	0	3.05	10	1.00
3.05	10	3.66	12	0.91
3.66	12	4.27	14	0.84
4.27	14	4.88	16	0.77
4.88	16	5.49	18	0.71
5.49	18	6.10	20	0.64
6.10	20	6.71	22	0.58
6.71	22	7.32	24	0.52
7.32	24	7.93	26	0.46
7.93	26	8.54	28	0.40
8.54	28	9.14	30	0.34

5.6.5.5.2* The minimum spacing of heat detectors shall not be required to be less than 0.4 times the height of the ceiling.

5.6.5.6 Alternative Design Methods. Annex B shall be permitted to be used as one alternative design method for determining detector spacing.

5.7 Smoke-Sensing Fire Detectors.

5.7.1 General.

5.7.1.1* The smoke detection design documentation shall state the required performance objective of the system.

5.7.1.2* Designs not in accordance with 5.7.1.3 shall be deemed prescriptive designs and shall be designed in accordance with the prescriptive requirements of this chapter.



5.7.1.3* Performance-based designs shall be executed in accordance with Section 5.3.

5.7.1.4 The prescriptive requirements in this section shall be applied only where detectors are installed in ordinary indoor locations.

5.7.1.5 Where smoke detectors are being installed to control the spread of smoke, they shall be installed in accordance with the requirements of Section 5.16.

5.7.1.6 Smoke detectors shall be installed in all areas where required by applicable laws, codes, or standards.

5.7.1.7 The selection and placement of smoke detectors shall take into account both the performance characteristics of the detector and the areas into which the detectors are to be installed to prevent nuisance alarms or improper operation after installation.

5.7.1.8* Unless specifically designed and listed for the expected conditions, smoke detectors shall not be installed if any of the following ambient conditions exist:

- (1) Temperature below 0°C (32°F)
- (2) Temperature above 38°C (100°F)
- (3) Relative humidity above 93 percent
- (4) Air velocity greater than 1.5 m/sec (300 ft/min)

5.7.1.9* The location of smoke detectors shall be based on an evaluation of potential ambient sources of smoke, moisture, dust, or fumes, and electrical or mechanical influences to minimize nuisance alarms.

5.7.1.10* The effect of stratification below the ceiling shall be taken into account. The guidelines in Annex B shall be permitted to be used.

5.7.1.11 Detectors shall not be installed until after the construction cleanup of all trades is complete and final.

Exception: Where required by the authority having jurisdiction for protection during construction. Detectors that have been installed during construction and found to have a sensitivity outside the listed and marked sensitivity range shall be cleaned or replaced in accordance with Chapter 10 at completion of construction.

5.7.2* Sensitivity.

5.7.2.1* Smoke detectors shall be marked with their nominal production sensitivity and tolerance (percent per foot obscuration), as required by the listing.

5.7.2.2 Smoke detectors that have provision for field adjustment of sensitivity shall have an adjustment range of not less than 0.6 percent per foot obscuration.

5.7.2.3 If the means of adjustment of sensitivity is on the detector, a method shall be provided to restore the detector to its factory calibration.

5.7.2.4 Detectors that have provision for program-controlled adjustment of sensitivity shall be permitted to be marked with their programmable sensitivity range only.

5.7.3 Location and Spacing.

5.7.3.1* General.

5.7.3.1.1 The location and spacing of smoke detectors shall be based upon the anticipated smoke flows due to the plume and ceiling jet produced by the anticipated fire as well as any pre-existing ambient air flows that could exist in the protected compartment.

5.7.3.1.2 The design shall account for the contribution of the following factors in predicting detector response to the anticipated fires to which the system is intended to respond:

- (1) Ceiling shape and surface
- (2) Ceiling height
- (3) Configuration of contents in the protected area
- (4) Combustion characteristics and probable equivalence ratio of the anticipated fires involving the fuel loads within the protected area
- (5) Compartment ventilation
- (6) Ambient temperature, pressure, altitude, humidity, and atmosphere

5.7.3.1.3 If the intent is to protect against a specific hazard, the detector(s) shall be permitted to be installed closer to the hazard in a position where the detector can intercept the smoke.

5.7.3.2* Spot-Type Smoke Detectors.

5.7.3.2.1* Spot-type smoke detectors shall be located on the ceiling not less than 100 mm (4 in.) from a sidewall to the near edge or, if on a sidewall, between 100 mm and 300 mm (4 in. and 12 in.) down from the ceiling to the top of the detector.

5.7.3.2.2* To minimize dust contamination, smoke detectors, where installed under raised floors, shall be mounted only in an orientation for which they have been listed.

5.7.3.2.3 On smooth ceilings, spacing for spot-type smoke detectors shall be in accordance with 5.7.3.2.3.1 through 5.7.3.2.3.5.

5.7.3.2.3.1* In the absence of specific performance-based design criteria, smoke detectors shall be permitted to be located using 9.1 m (30 ft) spacing.

The text of 5.7.3.2.3.1 has been revised by a tentative interim amendment (TIA). See page 1.

5.7.3.2.3.2 In all cases, the manufacturer's published instructions shall be followed.

5.7.3.2.3.3 Other spacing shall be permitted to be used depending on ceiling height, different conditions, or response requirements.

5.7.3.2.3.4 For the detection of flaming fires, the guidelines in Annex B shall be permitted to be used.

5.7.3.2.3.5* For smooth ceilings, all points on the ceiling shall have a detector within a distance equal to 0.7 times the selected spacing.

5.7.3.2.4* For solid joist and beam construction, spacing for spot-type smoke detectors shall be in accordance with 5.7.3.2.4.1 through 5.7.3.2.4.5.

5.7.3.2.4.1 Solid joists shall be considered equivalent to beams for smoke detector spacing guidelines.

5.7.3.2.4.2 For level ceilings the following shall apply:

- (1) For ceilings with beam depths of less than 10 percent of the ceiling height ($0.1 H$), smooth ceiling spacing shall be permitted.
- (2) For ceilings with beam depths equal to or greater than 10 percent of the ceiling height ($0.1 H$) and beam spacing equal to or greater than 40 percent of the ceiling height ($0.4 H$), spot-type detectors shall be located on the ceiling in each beam pocket.

(3)*For waffle or pan-type ceilings with beams or solid joists no greater than 600 mm (24 in.) deep and no greater than 3.66 m (12 ft) center-to-center spacing, the following shall be permitted:

- (a) Smooth ceiling spacing including those provisions permitted for irregular areas in 5.6.5.1.2, substituting "selected spacing" for "listed spacing"
- (b) Location of spot-type smoke detectors on ceilings or on the bottom of beams

(4)*For corridors 4.5 m (15 ft) in width or less having ceiling beams or solid joists perpendicular to the corridor length, the following shall be permitted:

- (a) Smooth ceiling spacing including those provisions permitted for irregular areas in 5.6.5.1.2, substituting "selected spacing" for "listed spacing"
- (b) Location of spot-type smoke detectors on ceilings, sidewalls, or the bottom of beams or solid joists

(5) For rooms of 84 m² (900 ft²) area or less, only one smoke detector shall be required.

5.7.3.2.4.3* For sloped ceilings with beams running parallel to (up) the slope, spacing shall comply with the following:

- (1) The spacing for level beamed ceilings shall be used.
- (2) The ceiling height shall be taken as the average height over slope.
- (3) For slopes greater than 10 degrees, the detectors located at one-half the spacing from the low end shall not be required.
- (4) Spacings shall be measured along a horizontal projection of the ceilings.

5.7.3.2.4.4 For sloped ceilings with beams running perpendicular to (across) the slope, spacing shall comply with the following:

- (1) The spacing for level beamed ceilings shall be used.
- (2) The ceiling height shall be taken as the average height over slope.

5.7.3.2.4.5 For sloped ceilings with solid joists, the detectors shall be located on the bottom of the joist.

5.7.3.3 Air Sampling-Type Smoke Detector.

5.7.3.3.1 Each sampling port of an air sampling-type smoke detector shall be treated as a spot-type detector for the purpose of location and spacing.

5.7.3.3.2 Maximum air sample transport time from the farthest sampling port to the detector shall not exceed 120 seconds.

5.7.3.3.3* Sampling pipe networks shall be designed on the basis of, and shall be supported by, sound fluid dynamic principles to ensure required performance.

5.7.3.3.4 Sampling pipe network design details shall include calculations showing the flow characteristics of the pipe network and each sample port.

5.7.3.3.5 Air-sampling detectors shall give a trouble signal if the airflow is outside the manufacturer's specified range.

5.7.3.3.6* The sampling ports and in-line filter, if used, shall be kept clear in accordance with the manufacturer's published instructions.

5.7.3.3.7 Air-sampling network piping and fittings shall be airtight and permanently fixed.

5.7.3.3.8 Sampling system piping shall be conspicuously identified as "SMOKE DETECTOR SAMPLING TUBE — DO NOT DISTURB," as follows:

- (1) At changes in direction or branches of piping
- (2) At each side of penetrations of walls, floors, or other barriers
- (3) At intervals on piping that provide visibility within the space, but no greater than 6 m (20 ft)

5.7.3.4* Projected Beam-Type Smoke Detectors.

5.7.3.4.1 Projected beam-type smoke detectors shall be located in accordance with the manufacturer's published instructions.

5.7.3.4.2 The effects of stratification shall be evaluated when locating the detectors.

5.7.3.4.3 The beam length shall not exceed the maximum permitted by the equipment listing.

5.7.3.4.4 If mirrors are used with projected beams, the mirrors shall be installed in accordance with the manufacturer's published instructions.

5.7.3.4.5 A projected beam-type smoke detector shall be considered equivalent to a row of spot-type smoke detectors for level and sloping ceiling applications.

5.7.3.4.6 Projected beam-type detectors and mirrors shall be mounted on stable surfaces to prevent false or erratic operation due to movement.

5.7.3.4.7 The beam shall be designed so that small angular movements of the light source or receiver do not prevent operation due to smoke and do not cause nuisance alarms.

5.7.3.4.8* The light path of projected beam-type detectors shall be kept clear of opaque obstacles at all times.

5.7.3.5* Peaked. Detectors shall first be spaced and located within 900 mm (3 ft) of the peak, measured horizontally. The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.

5.7.3.6* Shed. Detectors shall first be spaced and located within 900 mm (3 ft) of the high side of the ceiling, measured horizontally. The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.

5.7.3.7 Raised Floors and Suspended Ceilings. Spaces beneath raised floors and above suspended ceilings shall be treated as separate rooms for smoke detector spacing purposes. Detectors installed beneath raised floors or above suspended ceilings, or both, including raised floors and suspended ceilings used for environmental air, shall not be used in lieu of providing detection within the room.

5.7.3.7.1 For raised floors the following shall apply:

- (1) Detectors installed beneath raised floors shall be spaced in accordance with 5.7.3.1, 5.7.3.1.3, and 5.7.3.2.2.
- (2) Where the area beneath the raised floor is also used for environmental air, detector spacing shall also conform to 5.7.4.1 and 5.7.4.2.

5.7.3.7.2 For suspended ceilings the following shall apply:

- (1) Detector spacing above suspended ceilings shall conform to the requirements of 5.7.3 for the ceiling configuration.



- (2) Where detectors are installed in ceilings used for environmental air, detector spacing shall also conform to 5.7.4.1 and 5.7.4.2.

5.7.3.8* Partitions. Where partitions extend to within 15 percent of the ceiling height, the spaces separated by the partitions shall be considered as separate rooms.

5.7.4 Heating, Ventilating, and Air Conditioning (HVAC).

5.7.4.1* In spaces served by air-handling systems, detectors shall not be located where airflow prevents operation of the detectors.

5.7.4.2 Detectors installed in plenums shall comply with 5.7.4.2.1 and 5.7.4.2.2.

5.7.4.2.1 In under-floor spaces and above-ceiling spaces that are used as HVAC plenums, detectors shall be listed for the anticipated environment as required by 5.7.1.8. Detector spacings and locations shall be selected on the basis of anticipated airflow patterns and fire type.

5.7.4.2.2* Detectors placed in environmental air ducts or plenums shall not be used as a substitute for open area detectors. Where detectors are used for the control of smoke spread, the requirements of Section 5.16 shall apply. Where open area protection is required, 5.7.3 shall apply.

5.7.5 Special Considerations.

5.7.5.1 Spot-Type Detectors.

5.7.5.1.1 Combination and multi-sensor smoke detectors that have a fixed-temperature element as part of the unit shall be selected in accordance with Table 5.6.2.1.1 for the maximum ceiling temperature expected in service.

5.7.5.1.2* Holes in the back of a detector shall be covered by a gasket, sealant, or equivalent means, and the detector shall be mounted so that airflow from inside or around the housing does not prevent the entry of smoke during a fire or test condition.

5.7.5.2* High-Rack Storage. The location and spacing of smoke detectors for high-rack storage shall address the commodity, quantity, and configuration of the rack storage.

5.7.5.3 High Air Movement Areas.

5.7.5.3.1 General. The purpose and scope of 5.7.5.3 shall be to provide location and spacing guidance for smoke detectors intended for early warning of fire in high air movement areas.

Exception: Detectors provided for the control of smoke spread are covered by the requirements of Section 5.16.

5.7.5.3.2 Location. Smoke detectors shall not be located directly in the airstream of supply registers.

5.7.5.3.3* Spacing. Smoke detector spacing shall be in accordance with Table 5.7.5.3.3 and Figure 5.7.5.3.3.

Exception: Air-sampling or projected beam smoke detectors installed in accordance with the manufacturer's published instructions.

5.7.5.3.4 HVAC Mechanical Rooms. Where HVAC mechanical rooms are used as an air plenum for return air, the spacings of smoke detectors shall not be required to be reduced based on the number of air changes.

5.7.6 Video Image Smoke Detection.

5.7.6.1 Video image smoke detection systems and all of the components thereof, including hardware and software, shall be listed for the purpose of smoke detection.

Table 5.7.5.3.3 Smoke Detector Spacing Based on Air Movement

Minutes per Air Change	Air Changes per Hour	Spacing per Detector	
		m ²	ft ²
1	60	11.61	125
2	30	23.23	250
3	20	34.84	375
4	15	46.45	500
5	12	58.06	625
6	10	69.68	750
7	8.6	81.29	875
8	7.5	83.61	900
9	6.7	83.61	900
10	6	83.61	900

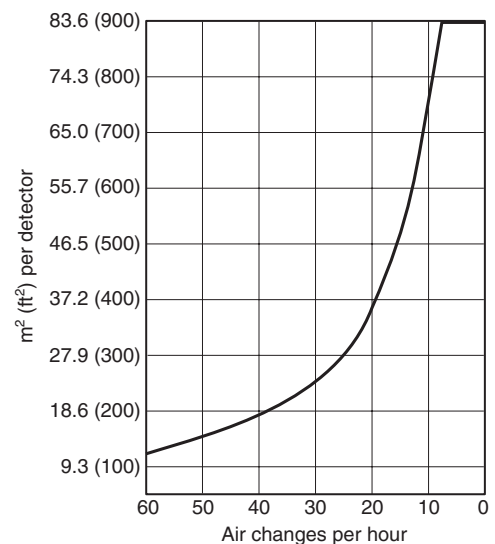


FIGURE 5.7.5.3.3 High Air Movement Areas (Not to be Used for Under-Floor or Above-Ceiling Spaces).

5.7.6.2 Video image smoke detection systems shall comply with all of the applicable requirements of Chapters 1, 4, 5, 6, and 10 of this Code.

5.7.6.2.1 Systems shall be designed in accordance with the performance-based design requirements of Section 5.3.

5.7.6.2.2 The location and spacing of video image smoke detectors shall comply with the requirements of 5.10.5.

5.7.6.3* Video signals generated by cameras that are components of video image smoke detection systems shall be permitted to be transmitted to other systems for other uses only through output connections provided specifically for that purpose by the video system manufacturer.

5.7.6.4* All component controls and software shall be protected from unauthorized changes. All changes to the software or component settings shall be tested in accordance with Chapter 10.

5.8 Radiant Energy–Sensing Fire Detectors.

5.8.1* General.

5.8.1.1 The radiant energy detection design documentation shall state the required performance objective of the system.

5.8.1.2 The purpose and scope of Section 5.8 shall be to provide requirements for the selection, location, and spacing of fire detectors that sense the radiant energy produced by burning substances. These detectors shall be categorized as flame detectors and spark/ember detectors.

5.8.2* Fire Characteristics and Detector Selection.

5.8.2.1* The type and quantity of radiant energy–sensing fire detectors shall be determined on the basis of the performance characteristics of the detector and an analysis of the hazard, including the burning characteristics of the fuel, the fire growth rate, the environment, the ambient conditions, and the capabilities of the extinguishing media and equipment.

5.8.2.2* The selection of the radiant energy–sensing detectors shall be based on the following:

- (1) Matching of the spectral response of the detector to the spectral emissions of the fire or fires to be detected
- (2) Minimizing the possibility of spurious nuisance alarms from non-fire sources inherent to the hazard area

5.8.3 Spacing Considerations.

5.8.3.1 General Rules.

5.8.3.1.1* Radiant energy–sensing fire detectors shall be employed consistent with the listing or approval and the inverse square law, which defines the fire size versus distance curve for the detector.

5.8.3.1.2 Detector quantity shall be based on the detectors being positioned so that no point requiring detection in the hazard area is obstructed or outside the field of view of at least one detector.

5.8.3.2 Spacing Considerations for Flame Detectors.

5.8.3.2.1* The location and spacing of detectors shall be the result of an engineering evaluation that includes the following:

- (1) Size of the fire that is to be detected
- (2) Fuel involved
- (3) Sensitivity of the detector
- (4) Field of view of the detector
- (5) Distance between the fire and the detector
- (6) Radiant energy absorption of the atmosphere
- (7) Presence of extraneous sources of radiant emissions
- (8) Purpose of the detection system
- (9) Response time required

5.8.3.2.2 The system design shall specify the size of the flaming fire of given fuel that is to be detected.

5.8.3.2.3* In applications where the fire to be detected could occur in an area not on the optical axis of the detector, the distance shall be reduced or detectors shall be added to compensate for the angular displacement of the fire in accordance with the manufacturer's published instructions.

5.8.3.2.4* In applications in which the fire to be detected is of a fuel that differs from the test fuel used in the process of listing or approval, the distance between the detector and the

fire shall be adjusted consistent with the fuel specificity of the detector as established by the manufacturer.

5.8.3.2.5 Because flame detectors are line-of-sight devices, their ability to respond to the required area of fire in the zone that is to be protected shall not be compromised by the presence of intervening structural members or other opaque objects or materials.

5.8.3.2.6* Provisions shall be made to sustain detector window clarity in applications where airborne particulates and aerosols coat the detector window between maintenance intervals and affect sensitivity.

5.8.3.3 Spacing Considerations for Spark/Ember Detectors.

5.8.3.3.1* The location and spacing of detectors shall be the result of an engineering evaluation that includes the following:

- (1) Size of the spark or ember that is to be detected
- (2) Fuel involved
- (3) Sensitivity of the detector
- (4) Field of view of the detector
- (5) Distance between the fire and the detector
- (6) Radiant energy absorption of the atmosphere
- (7) Presence of extraneous sources of radiant emissions
- (8) Purpose of the detection systems
- (9) Response time required

5.8.3.3.2* The system design shall specify the size of the spark or ember of the given fuel that the detection system is to detect.

5.8.3.3.3 Spark detectors shall be positioned so that all points within the cross section of the conveyance duct, conveyor, or chute where the detectors are located are within the field of view (*as defined in 3.3.62*) of at least one detector.

5.8.3.3.4* The location and spacing of the detectors shall be adjusted using the inverse square law, modified for the atmospheric absorption and the absorption of nonburning fuel suspended in the air in accordance with the manufacturer's published instructions.

5.8.3.3.5* In applications where the sparks to be detected could occur in an area not on the optical axis of the detector, the distance shall be reduced or detectors shall be added to compensate for the angular displacement of the fire in accordance with the manufacturer's published instructions.

5.8.3.3.6* Provisions shall be made to sustain the detector window clarity in applications where airborne particulates and aerosols coat the detector window and affect sensitivity.

5.8.4 Other Considerations.

5.8.4.1 Radiant energy–sensing detectors shall be protected either by design or installation to ensure that optical performance is not compromised.

5.8.4.2 If necessary, radiant energy–sensing detectors shall be shielded or otherwise arranged to prevent action from unwanted radiant energy.

5.8.4.3 Where used in outdoor applications, radiant energy–sensing detectors shall be shielded or otherwise arranged in a fashion to prevent diminishing sensitivity by conditions such as rain or snow and yet allow a clear field of vision of the hazard area.



5.8.4.4 A radiant energy-sensing fire detector shall not be installed in a location where the ambient conditions are known to exceed the extremes for which the detector has been listed.

5.8.5 Video Image Flame Detection.

5.8.5.1 Video image flame detection systems and all of the components thereof, including hardware and software, shall be listed for the purpose of flame detection.

5.8.5.2 Video image flame detection systems shall comply with all of the applicable requirements of Chapters 1, 4, 5, 6, and 10 of this Code.

5.8.5.3* Video signals generated by cameras that are components of video image flame detection systems shall be permitted to be transmitted to other systems for other uses only through output connections provided specifically for that purpose by the video system manufacturer.

5.8.5.4* All component controls and software shall be protected from unauthorized changes. All changes to the software or component settings shall be tested in accordance with Chapter 10.

5.9 Combination, Multi-Criteria, and Multi-Sensor Detectors.

5.9.1 General. Section 5.9 provides requirements for the selection, location, and spacing of combination, multi-criteria, and multi-sensor detectors.

5.9.2 Combination Detectors.

5.9.2.1 A combination detector shall be listed for each sensor.

5.9.2.2 The device listings shall determine the locations and spacing criteria in accordance with Chapter 5.

5.9.3 Multi-Criteria Detectors.

5.9.3.1 A multi-criteria detector shall be listed for the primary function of the device.

5.9.3.2 Because of the device-specific, software-driven solution of multi-criteria detectors to reduce unwanted alarms and improve detector response to a nonspecific fire source, location and spacing criteria included with the detector installation instructions shall be followed.

5.9.4 Multi-Sensor Detectors.

5.9.4.1 A multi-sensor detector shall be listed for each sensor.

5.9.4.2 Because of the device-specific, software-driven solution of multi-sensor detectors to reduce unwanted alarms and improve detector response to a nonspecific fire source, location and spacing criteria included with the detector installation instructions shall be followed.

5.10 Other Fire Detectors.

5.10.1 Detectors that operate on principles different from those covered by Section 5.6, Section 5.7, and Section 5.8 shall be classified as "other fire detectors." Such detectors shall be installed in all areas where they are required either by other NFPA codes and standards or by the authority having jurisdiction.

5.10.2* "Other fire detectors" shall operate where subjected to the abnormal concentration of combustion effects that occur during a fire, such as water vapor, ionized molecules, or other phenomena for which they are designed.

5.10.3 Detection layout shall be based upon the size and intensity of fire to provide the necessary quantity of required products and related thermal lift, circulation, or diffusion for operation.

5.10.4 Room sizes and contours, airflow patterns, obstructions, and other characteristics of the protected hazard shall be taken into account.

5.10.5 Location and spacing of detectors shall comply with 5.10.5.1 through 5.10.5.3.

5.10.5.1 The location and spacing of detectors shall be based on the principle of operation and an engineering survey of the conditions anticipated in service. The manufacturer's published instructions shall be consulted for recommended detector uses and locations.

5.10.5.2 Detectors shall not be spaced beyond their listed or approved maximums. Closer spacing shall be used where the structural or other characteristics of the protected hazard warrant.

5.10.5.3 The location and sensitivity of the detectors shall be the result of an engineering evaluation that includes the following:

- (1) Structural features, size, and shape of the rooms and bays
- (2) Occupancy and uses of the area
- (3) Ceiling height
- (4) Ceiling shape, surface, and obstructions
- (5) Ventilation
- (6) Ambient environment
- (7) Burning characteristics of the combustible materials present
- (8) Configuration of the contents in the area to be protected

5.11 Sprinkler Waterflow Alarm-Initiating Devices.

5.11.1* The provisions of Section 5.11 shall apply to devices that initiate an alarm indicating a flow of water in a sprinkler system.

5.11.2* Activation of the initiating device shall occur within 90 seconds of waterflow at the alarm-initiating device when flow occurs that is equal to or greater than that from a single sprinkler of the smallest orifice size installed in the system.

5.11.3 Movement of water due to waste, surges, or variable pressure shall not initiate an alarm signal.

5.12* Detection of the Operation of Other Automatic Extinguishing Systems. The operation of fire extinguishing systems or suppression systems shall initiate an alarm signal by alarm-initiating devices installed in accordance with their individual listings.

5.13 Manually Actuated Alarm-Initiating Devices.

5.13.1 Manual fire alarm boxes shall be used only for fire alarm initiating purposes.

5.13.2 Combination manual fire alarm boxes and guard's signaling stations shall be permitted.

5.13.3 Each manual fire alarm box shall be securely mounted.

5.13.4 The operable part of each manual fire alarm box shall be not less than 1.1 m (3½ ft) and not more than 1.37 m (4½ ft) above floor level.

5.13.5* Manual fire alarm boxes shall be installed so that they are conspicuous, unobstructed, and accessible.

5.13.6 Manual fire alarm boxes shall be located within 1.5 m (5 ft) of the exit doorway opening at each exit on each floor.

5.13.7 Manual fire alarm boxes shall be mounted on both sides of grouped openings over 12.2 m (40 ft) in width, and within 1.5 m (5 ft) of each side of the opening.

5.13.8* Additional manual fire alarm boxes shall be provided so that the travel distance to the nearest fire alarm box will not be in excess of 61 m (200 ft) measured horizontally on the same floor.

5.14 Fire Extinguisher Monitoring Device. A fire extinguisher monitoring device shall indicate those conditions for a specific fire extinguisher required by NFPA 10, *Standard for Portable Fire Extinguishers*, to a fire alarm control unit or other control unit.

5.15 Supervisory Signal-Initiating Devices.

5.15.1 Control Valve Supervisory Signal-Initiating Device.

5.15.1.1 Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position (off-normal) and the other indicating restoration of the valve to its normal position.

5.15.1.2 The off-normal signal shall be initiated during the first two revolutions of the hand wheel or during one-fifth of the travel distance of the valve control apparatus from its normal position.

5.15.1.3 The off-normal signal shall not be restored at any valve position except normal.

5.15.1.4 An initiating device for supervising the position of a control valve shall not interfere with the operation of the valve, obstruct the view of its indicator, or prevent access for valve maintenance.

5.15.2 Pressure Supervisory Signal-Initiating Device.

5.15.2.1 Two separate and distinct signals shall be initiated: one indicating that the required pressure has increased or decreased (off-normal) and the other indicating restoration of the pressure to its normal value.

5.15.2.2 The following requirements shall apply to pressure supervisory signal-initiating devices:

- (1) A pressure tank supervisory signal-initiating device for a pressurized limited water supply, such as a pressure tank, shall indicate both high- and low-pressure conditions. The off-normal signal shall be initiated when the required pressure increases or decreases by 70 kPa (10 psi).
- (2) A pressure supervisory signal-initiating device for a dry-pipe sprinkler system shall indicate both high- and low-pressure conditions. The off-normal signal shall be initiated when the pressure increases or decreases by 70 kPa (10 psi).
- (3) A steam pressure supervisory signal-initiating device shall indicate a low-pressure condition. The off-normal signal shall be initiated prior to the pressure falling below 110 percent of the minimum operating pressure of the steam-operated equipment supplied.
- (4) An initiating device for supervising the pressure of sources other than those specified in 5.15.2.2(1) through 5.15.2.2(3) shall be provided as required by the authority having jurisdiction.

5.15.3 Water Level Supervisory Signal-Initiating Device.

5.15.3.1 Two separate and distinct signals shall be initiated: one indicating that the required water level has been lowered or raised (off-normal) and the other indicating restoration.

5.15.3.2 A pressure tank signal-initiating device shall indicate both high- and low-water level conditions. The off-normal signal shall be initiated when the water level falls 76 mm (3 in.) or rises 76 mm (3 in.).

5.15.3.3 A supervisory signal-initiating device for other than pressure tanks shall initiate a low-water level signal when the water level falls 300 mm (12 in.).

5.15.4 Water Temperature Supervisory Signal-Initiating Device.

A temperature supervisory device for a water storage container exposed to freezing conditions shall initiate two separate and distinctive signals. One signal shall indicate a decrease in water temperature to 4.4°C (40°F) and the other shall indicate its restoration to above 4.4°C (40°F).

5.15.5 Room Temperature Supervisory Signal-Initiating Device.

A room temperature supervisory device shall indicate a decrease in room temperature to 4.4°C (40°F) and its restoration to above 4.4°C (40°F).

5.16* Smoke Detectors for Control of Smoke Spread.

5.16.1* Classifications. Smoke detectors installed and used to prevent smoke spread by initiating control of fans, dampers, doors, and other equipment shall be classified in the following manner:

- (1) Area detectors that are installed in the related smoke compartments
- (2) Detectors that are installed in the air duct systems
- (3) Video image smoke detection that is installed in related smoke compartments

5.16.2* Limitations.

5.16.2.1 Detectors that are installed in the air duct system in accordance with 5.16.1(2) shall not be used as a substitute for open area protection.

5.16.2.2 Where open area protection is required, 5.7.3 shall apply.

5.16.3* Purposes.

5.16.3.1 To prevent the recirculation of dangerous quantities of smoke, a detector approved for air duct use shall be installed on the supply side of air-handling systems as required by NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, and 5.16.4.2.1.

5.16.3.2 If smoke detectors are used to initiate selectively the operation of equipment to control smoke spread, the requirements of 5.16.4.2.2 shall apply.

5.16.3.3 If detectors are used to initiate the operation of smoke doors, the requirements of 5.16.6 shall apply.

5.16.3.4 If duct detectors are used to initiate the operation of smoke dampers within ducts, the requirements of 5.16.5 shall apply.

5.16.4 Application.

5.16.4.1 Area Smoke Detectors within Smoke Compartments.

Area smoke detectors within smoke compartments shall be permitted to be used to control the spread of smoke by initiating operation of doors, dampers, and other equipment.



5.16.4.2* Smoke Detection for the Air Duct System.

5.16.4.2.1 Supply Air System. Where the detection of smoke in the supply air system is required by other NFPA standards, a detector(s) listed for the air velocity present and that is located in the supply air duct downstream of both the fan and the filters shall be installed.

Exception: Additional smoke detectors shall not be required to be installed in ducts where the air duct system passes through other smoke compartments not served by the duct.

5.16.4.2.2* Return Air System. Unless otherwise modified by 5.16.4.2.2.1 or 5.16.4.2.2.2, if the detection of smoke in the return air system is required by other NFPA standards, a detector(s) listed for the air velocity present shall be located where the air leaves each smoke compartment, or in the duct system before the air enters the return air system common to more than one smoke compartment.

5.16.4.2.2.1 Additional smoke detectors shall not be required to be installed in ducts where the air duct system passes through other smoke compartments not served by the duct.

5.16.4.2.2.2 Where total coverage smoke detection is installed in all areas of the smoke compartment served by the return air system, installation of air duct detectors in the return air system shall not be required, provided their function is accomplished by the design of the area detection system.

5.16.5 Location and Installation of Detectors in Air Duct Systems.

5.16.5.1 Detectors shall be listed for the purpose for which they are being used.

5.16.5.2* Air duct detectors shall be installed in such a way as to obtain a representative sample of the airstream. This installation shall be permitted to be achieved by any of the following methods:

- (1) Rigid mounting within the duct
- (2) Rigid mounting to the wall of the duct with the sensing element protruding into the duct
- (3) Installation outside the duct with rigidly mounted sampling tubes protruding into the duct
- (4) Installation through the duct with projected light beam

5.16.5.3 Detectors shall be mounted in accordance with the manufacturer's published instructions and shall be accessible for cleaning by providing access doors or control units in accordance with NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

5.16.5.4 The location of all detectors in air duct systems shall be permanently and clearly identified and recorded.

5.16.5.5 Detectors mounted outside of a duct that employs sampling tubes for transporting smoke from inside the duct to the detector shall be designed and installed to allow verification of airflow from the duct to the detector.

5.16.5.6 Detectors shall be listed for operation over the complete range of air velocities, temperature, and humidity expected at the detector when the air-handling system is operating.

5.16.5.7 All penetrations of a return air duct in the vicinity of detectors installed on or in an air duct shall be sealed to prevent entrance of outside air and possible dilution or redirection of smoke within the duct.

5.16.5.8 Where in-duct smoke detectors are installed in concealed locations more than 3 m (10 ft) above the finished floor or in arrangements where the detector's alarm or supervisory indicator is not visible to responding personnel, the detectors shall be provided with remote alarm or supervisory indication in a location acceptable to the authority having jurisdiction.

5.16.5.9 Where required by 5.16.5.8 and unless the specific detector alarm or supervisory signal is indicated at the control unit, remote alarm or supervisory indicators shall be installed in an accessible location and shall be clearly labeled to indicate both their function and the air-handling unit(s) associated with each detector.

5.16.6 Smoke Detectors for Door Release Service.

5.16.6.1 Smoke detectors that are part of an open area protection system covering the room, corridor, or enclosed space on each side of the smoke door and that are located and spaced as required by 5.7.3 shall be permitted to accomplish smoke door release service.

5.16.6.2 Smoke detectors that are used exclusively for smoke door release service shall be located and spaced as required by 5.16.6.

5.16.6.3 Where smoke door release is accomplished directly from the smoke detector(s), the detector(s) shall be listed for releasing service.

5.16.6.4 Smoke detectors shall be of the photoelectric, ionization, or other approved type.

5.16.6.5 The number of detectors required shall be determined in accordance with 5.16.6.5.1 through 5.16.6.5.4.

5.16.6.5.1 If doors are to be closed in response to smoke flowing in either direction, the requirements of 5.16.6.5.1.1 through 5.16.6.5.1.4 shall apply.

5.16.6.5.1.1 If the depth of wall section above the door is 610 mm (24 in.) or less, one ceiling-mounted smoke detector shall be required on one side of the doorway only, or two wall-mounted detectors shall be required, one on each side of the doorway. Figure 5.16.6.5.1.1, part A or B, shall apply.

5.16.6.5.1.2 If the depth of wall section above the door is greater than 610 mm (24 in.) on one side only, one ceiling-mounted smoke detector shall be required on the higher side of the doorway only, or one wall-mounted detector shall be required on both sides of the doorway. Figure 5.16.6.5.1.1, part D, shall apply.

5.16.6.5.1.3* If the depth of wall section above the door is greater than 610 mm (24 in.) on both sides, two ceiling-mounted or wall-mounted detectors shall be required, one on each side of the doorway. Figure 5.16.6.5.1.1, part F, shall apply.

5.16.6.5.1.4 If a detector is specifically listed for door frame mounting or if a listed combination or integral detector-door closer assembly is used, only one detector shall be required if installed in the manner recommended by the manufacturer's published instructions. Figure 5.16.6.5.1.1, parts A, C, and E, shall apply.

5.16.6.5.2 If door release is intended to prevent smoke transmission from one space to another in one direction only, detectors located in the space to which smoke is to be confined, regardless of the depth of wall section above the door, shall be in accordance with 5.16.6.6. Alternatively, a smoke detector conforming with 5.16.6.5.1.4 shall be permitted to be used.