NFPA 720

Standard for the Installation of Carbon Monoxide (CO) Warning Equipment in Dwelling Units

2005 Edition



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

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NFPA 720

Standard for the

Installation of Carbon Monoxide (CO) Warning Equipment in Dwelling Units

2005 Edition

This edition of NFPA 720, *Standard for the Installation of Carbon Monoxide (CO) Warning Equipment in Dwelling Units,* was prepared by the Technical Committee on Carbon Monoxide Detection and acted on by NFPA at its November Association Technical Meeting held November 13–17, 2004, in Miami Beach, FL. It was issued by the Standards Council on January 14, 2005, with an effective date of February 7, 2005, and supersedes all previous editions.

This edition of NFPA 720 was approved as an American National Standard on February 7, 2005.

Origin and Development of NFPA 720

With the increased concern over carbon monoxide (CO) hazards in residential applications, the National Fire Protection Association was petitioned to develop a document covering the installation of CO detectors and related equipment. In late 1993, the Technical Committee on Household Fire Warning Equipment was tasked to develop a document covering the installation and use of CO detectors. This document was originally prepared by the Technical Committee on Household Fire Warning Equipment but was returned to committee at the 1995 Annual Meeting. The NFPA Standards Council later approved the formation of the Technical Committee on Carbon Monoxide and Fuel Gas Detectors to further develop this document.

The 2003 edition reflected editorial revisions 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 document: "Administration," "Referenced Publications," and "Definitions." Two technical chapters follow the administrative chapters: "General Provisions" from Chapter 1 (in part) of the 1998 edition and "Household Carbon Monoxide Warning Equipment" from Chapter 2 of the 1998 edition. Editorial revisions also included breaking out paragraphs with multiple requirements into individually numbered paragraphs, minimizing the use of exceptions, and using consistent headings for sections and subsections. Changes also were made in some sections to provide language and terminology that was more consistent and user-friendly.

The 2003 edition also contained technical revisions, including the recommendation that printed instructions for carbon monoxide alarms and detectors include minimum and recommended distances from fuel-burning appliances.

As communities have begun to recognize the life-safety benefit of carbon monoxide warning equipment, requirements by local jurisdictions for the installation of this equipment have become more common and the need for an installation standard written in enforceable language has become evident. The 2005 edition of this document reflects this need as it has been transformed from a recommended practice to a standard. In addition, terms such as "family living unit" and "household" have been replaced where appropriate with the term "dwelling unit" to provide language consistent with standard terminology used in NFPA codes and standards.

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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 addressing the selection, installation, operation, and maintenance of carbon monoxide warning equipment.

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NFPA 720

Standard for the

Installation of Carbon Monoxide (CO) Warning Equipment in Dwelling Units

2005 Edition

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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 mandatory extracts are given in Chapter 2 and those for nonmandatory extracts are given in Annex C. 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 C.

Chapter 1 Administration

1.1* Scope.

1.1.1 This standard is primarily concerned with life safety, not with protection of property.

1.1.2* This standard covers the selection, application, installation, location, testing, and maintenance of carbon monoxide warning equipment within dwelling units that contain fuel-burning appliances or fireplaces, or have attached garages.

1.1.3 This standard contains requirements for the selection, installation, operation, and maintenance of equipment that detects concentrations of carbon monoxide that could pose a risk to the health of most occupants in dwelling units.

1.2* Purpose. The purpose of this standard is to provide a warning of the presence of carbon monoxide in sufficient time to allow occupants to either escape or take other appropriate action.

1.3 Application. The requirements of this standard apply to the installation of carbon monoxide warning equipment in dwelling units, including the following:

(1) Single- and multiple-station carbon monoxide alarms
(2) Carbon monoxide detectors and their related systems and components

1.4 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

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

1.4.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.4.3 All alarms or detectors and related equipment having materials or forms different from those detailed in this standard shall be examined and tested in accordance with applicable standards and, if found equivalent, shall be permitted to be approved.

1.5 Units and Formulas. The standard units used in this document are the International System (SI) of Units. Where presented, inch-pound units follow the SI units in parentheses.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard 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 70, *National Electrical Code®,* 2002 edition.
NFPA 72®, *National Fire Alarm Code®,* 2002 edition.
NFPA *101®*, *Life Safety Code®,* 2003 edition.
NFPA 5000®, *Building Construction and Safety Code®,* 2003 edition.

2.3 Other Publications.

2.3.1 UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 2034, *Standard for Single and Multiple Station Carbon Monoxide Alarms*, June 28, 2002.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. 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 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.

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3.2.4* 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.

3.2.5 Shall. Indicates a mandatory requirement.

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

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

3.3 General Definitions.

3.3.1 Alarm.

3.3.1.1 ***Carbon Monoxide Alarm.*** A single- or multiple-station alarm responsive to carbon monoxide.

3.3.1.2 ***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. [***72,*** 2002]

3.3.1.3 ***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. [***72,*** 2002]

3.3.2 Detector.

3.3.2.1 ***Carbon Monoxide Detector.*** A device suitable for connection to a circuit having a sensor that responds to carbon monoxide and does not contain an integral notification appliance.

3.3.2.2 ***Multiple-Purpose Detector.*** A detector that incorporates detection capabilities for more than one hazardous condition, such as fire, fuel gas, or carbon monoxide.

3.3.3 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. [***5000,*** 2003]

3.3.4 Fireplace. A hearth, fire chamber, or similarly prepared area and a chimney. [**211**, 2003]

3.3.5* Fuel-Burning Appliance. A device that burns solid, liquid, or gaseous fuel or a combination thereof.

3.3.6 Notification Appliance. An alarm system component such as a bell, horn, speaker, strobe, or printer that provides audible or visible output, or both.

3.3.7 Reliable Component. A component that is not expected to fail or be periodically replaced and that is not monitored.

3.3.8 Response Plan. The action to be taken in response to an alarm signal.

3.3.9* Separate Sleeping Area. The area of a dwelling unit where the bedrooms or sleeping rooms are located.

3.3.10 Signal.

3.3.10.1 ***Alarm Signal.*** A signal indicating a concentration of carbon monoxide at or above the alarm threshold that could pose a risk to the life safety of the occupants in the dwelling unit and that requires immediate action.

3.3.10.2 ***Trouble Signal.*** An indication distinct from the alarm signal that warns of a malfunction or failure.

3.3.11 System. One or more detectors that are interconnected with remotely located devices or components and that have the ability to function interdependently.

Chapter 4 General Provisions

4.1 Warning Functions.

4.1.1 The warning functions intended in this standard shall be performed by single- or multiple-station alarms or by detectors connected to a control unit and associated equipment, or any combination thereof.

4.1.2* Carbon monoxide warning equipment shall not be used in lieu of fire warning equipment required by *NFPA 72, National Fire Alarm Code*, NFPA *101, Life Safety Code*, or *NFPA 5000, Building Construction and Safety Code.*

4.2 Supplemental Functions. Supplemental functions, including the transmission of an alarm beyond the dwelling unit, shall be permitted and shall not interfere with the performance requirements of this standard.

4.3 Total System. Where the AHJ requires both the alarm transmission beyond the dwelling unit and the total system to comply with the applicable sections of *NFPA 72, National Fire Alarm Code*, the requirements of Section 5.1 and 5.4.2 of this document shall be followed.

4.4 Equipment. All alarms or detectors and related equipment to be installed in conformity with this standard shall be listed for the purpose for which they are used.

Chapter 5 Carbon Monoxide Warning Equipment

5.1 Required Protection.

5.1.1* Carbon Monoxide Alarm and Detectors.

5.1.1.1* A carbon monoxide alarm or detector shall be centrally located outside of each separate sleeping area in the immediate vicinity of the bedrooms.

5.1.1.2 Each alarm or detector shall be located on the wall, ceiling, or other location as specified in the installation instructions that accompany the unit.

5.1.2 Alarm Notification Appliances.

5.1.2.1 General. Each alarm or detector shall cause the operation of an alarm notification appliance that shall meet the performance requirements of 7.4.2 and 7.4.4 of *NFPA 72, National Fire Alarm Code.*

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5.1.2.2* Alarm Notification Appliances for the Hearing Impaired. When alarm notification appliances for the hearing impaired are provided, each initiating device shall cause the operation of a visible alarm signal in accordance with 5.3.3 or the operation of a listed tactile notification appliance.

5.2 Power Supplies.

5.2.1 General.

5.2.1.1 All power supplies shall have sufficient capacity to operate the alarm signal(s) for at least 12 continuous hours.

5.2.1.2 For electrically powered carbon monoxide warning equipment, the primary (main) power source shall be ac, unless otherwise permitted by the following:

(1) Detectors and alarms shall be permitted to be powered by a monitored dc circuit of a control unit when power for the control unit meets the requirements of Section 5.2 and the circuit remains operable upon loss of primary (main) ac power.
(2) A detector and a wireless transmitter that serves only that detector shall be permitted to be powered from a monitored battery primary (main) source where part of a listed, monitored, low-power radio (wireless) system.
(3) In existing construction, a monitored battery primary (main) power source, as described in 5.2.3, shall be permitted.

5.2.2 Primary Power Supply — AC.

5.2.2.1 An ac primary (main) power source shall be a commercial light and power supply or other dependable source.

5.2.2.2 A visible "power on" indicator shall be provided.

5.2.2.3 Primary (main) ac power shall be supplied from either a dedicated branch circuit or the unswitched portion of a branch circuit also used for power and lighting.

5.2.2.4 All electrical systems designed to be installed by other than a qualified electrician shall be powered from a source not in excess of 30 volts that meets the requirements for Class 2 circuits as defined in Article 725 of NFPA 70, *National Electrical Code*.

5.2.2.5 A restraining means shall be used at the plug-in of any cord-connected installation.

5.2.2.6 Operation of a switch (other than a circuit breaker) or a ground fault circuit interrupter shall not cause loss of primary (main) ac power.

5.2.2.7 The requirement of 5.2.2.6 shall not apply where a ground fault circuit interrupter serves all electrical circuits within the dwelling unit.

5.2.2.8 Neither loss nor restoration of primary (main) ac power shall cause an alarm signal exceeding 2 seconds.

5.2.2.9 Where a secondary (standby) battery is provided, the primary (main) ac power supply shall be of sufficient capacity to operate the system under all conditions of loading with any secondary (standby) battery disconnected or fully discharged.

5.2.3 Primary Power Supply — Monitored Battery. Carbon monoxide warning equipment shall be permitted to be powered by a battery, provided that the battery is monitored to ensure that the following conditions are met:

(1) All power requirements are met for at least 1 year of battery life, including monthly testing.
(2) A distinctive audible trouble signal sounds before the battery is incapable of operating the device(s) (from causes such as aging or terminal corrosion) for alarm purposes.
(3) Automatic transfer is provided from alarm to a trouble condition for a unit employing a lock-in alarm feature.
(4) The unit is capable of producing an alarm signal for at least 12 hours at the battery voltage at which a trouble signal is normally obtained, followed by not less than 7 days of trouble signal operation.
(5) After the initial 4 minutes of alarm, the 5-second "off" time of the alarm signal shall be permitted to be changed to 60 seconds ± 10 percent.
(6) The audible trouble signal is produced at least once every minute for 7 consecutive days.
(7) Acceptable replacement batteries are identified by the manufacturer's name and model number on the unit near the battery compartment.
(8) A visible indication is displayed when a primary battery is removed from the unit.
(9) Any unit that uses a non-rechargeable battery as a primary power supply that is capable of a 10-year or greater service life, including testing, and meets the requirements of 5.2.3 shall not require a replaceable battery.
(10) A visible "power on" indicator is provided.

5.2.4 Secondary (Standby) Power Supply.

5.2.4.1 When provided, a secondary (standby) power supply shall have sufficient capacity to power the unit for 8 hours, followed by not less than 12 hours of alarm, followed by not less than 7 consecutive days of trouble signals.

5.2.4.2 After the initial 4 minutes of alarm, the 5-second "off" time of the alarm signal shall be permitted to be changed to 60 seconds ± 10 percent.

5.2.4.3 Removal or disconnection of a battery used as a secondary (standby) power source shall cause an audible or visible trouble signal.

5.2.4.4 Permitted replacement batteries shall be identified by manufacturer's name and model number on the unit near the battery compartment.

5.2.4.5 Where required by law for disposal reasons, rechargeable batteries shall be removable.

5.2.4.6 An audible trouble signal shall sound before the battery is incapable of operating the device(s) (from causes such as aging, discharge, or terminal corrosion) for alarm purposes.

5.2.4.7 Automatic recharging shall be provided when a rechargeable battery is used as a secondary (standby) supply.

5.2.4.8 Where automatic recharging is provided, the battery shall be recharged within one of the following time periods:

(1) Within 4 hours where power is provided from a circuit that can be switched on or off by means other than a circuit breaker
(2) Within 48 hours where power is provided from a circuit that cannot be switched on or off by means other than a circuit breaker

5.3 Equipment Performance.

5.3.1 Carbon Monoxide Alarms and Detectors.

5.3.1.1* Each carbon monoxide alarm and detector shall be in compliance with ANSI/UL 2034, *Standard for Single and Multiple Station Carbon Monoxide Alarms*.

5.3.1.2 All signals produced from periodic testing of carbon monoxide alarms or detectors *(see 5.5.2)* shall be identical to the signal produced when the unit is in alarm.

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5.3.2 Audible Alarm Signals.

5.3.2.1 All alarm sounding appliances shall have a minimum rating of 85 dBA at 3 m (10 ft).

5.3.2.2 The audible alarm signal for carbon monoxide alarms shall be a single tone pattern consisting of four cycles of 100 milliseconds ± 10 percent "on" and 100 milliseconds ± 10 percent "off," followed by 5 seconds ± 10 percent "off."

5.3.2.3 After the initial 4 minutes of alarm, the 5-second "off" time shall be permitted to be changed to 60 seconds ± 10 percent.

5.3.2.4 The alarm signal shall be repeated in compliance with 5.3.2.2 and 5.3.2.3 until the alarm resets or the alarm signal is manually silenced.

5.3.3 Visible Alarm Signals.

5.3.3.1 Visible notification appliances used in sleeping rooms shall have a minimum rating of 110 candela and be mounted within 4.8 m (16 ft) of the pillow.

5.3.3.2 Visible notification appliances in other than sleeping rooms shall have a minimum rating of 15 candela.

5.3.4 Multiple-Purpose Alarms.

5.3.4.1 A fire alarm signal shall take precedence and be distinctively recognizable over any other signal, even when the non-fire signal is initiated first.

5.3.4.2 There shall be a means for distinguishing the carbon monoxide alarm signal from all other signals.

5.3.5 Interconnecting Initiating Devices.

5.3.5.1 Multiple-station alarms shall be permitted to be interconnected provided that the multiple-station alarm devices are compatible.

5.3.5.2 A single fault on the wiring connecting the alarms shall not prevent the independent operation of any of the interconnected alarms.

5.3.5.3 The test feature on any alarm device shall cause all interconnected alarms to activate the appropriate alarm signal.

5.3.6 Control Equipment.

5.3.6.1 Control equipment shall be automatically restored upon restoration of electrical power.

5.3.6.2 The control equipment shall be of a type that "locks in" on an alarm condition.

5.3.6.3 When a reset switch is provided, it shall be of a self-restoring type.

5.3.6.4 An alarm-silencing switch shall not be provided unless one of the following criteria applies:

(1) The silenced position is indicated by a distinctive signal.
(2) The switch is a momentary or self-restoring switch.

5.3.6.5 Each electrical carbon monoxide system shall have an integral test means to allow testing of the system operation.

5.3.7 Combination Systems.

5.3.7.1 Where common wiring is employed for a combination system, the equipment for other than a fire warning signaling system shall be permitted to be connected to the common wiring of the system provided that the following conditions are met:

(1) Short circuits, open circuits, or any other ground fault in equipment or interconnection between this equipment and the fire warning system does not interfere with the monitoring for integrity of the fire warning system.
(2) Short circuits, open circuits, or any other ground fault in this equipment or interconnection between this equipment and the fire warning system does not prevent alarm or trouble signal transmissions.

5.3.7.2 In a combination system, the operation shall be as follows:

(1) A fire alarm signal shall take precedence or be distinctively annunciated over any other signal, even when the non-fire or carbon monoxide signal is initiated first.
(2) Distinctive alarm signals shall be obtained between fire alarms and all other functions.
(3) The use of a common audible notification appliance shall be permitted if distinctive signals are obtained.

5.3.8 Interconnection to Fire Alarm or Combination Control Units.

5.3.8.1 Where carbon monoxide alarms or detectors are interconnected to fire alarm or combination control units, connections shall be via supervisory circuits only.

5.3.8.2 Operation of carbon monoxide alarms or detectors shall not cause fire alarm or combination control units to activate either protected premises or supervising station fire alarm signals.

5.3.8.3 Where carbon monoxide warning equipment is connected to a protected premises fire alarm system, receipt of signals shall initiate the signal required by 5.3.2 and 5.3.3.

5.3.9 Supervising Station Fire Alarm Systems.

5.3.9.1 Supervising station systems requiring transmission of signals to continually staffed locations providing supervising station services (e.g., central station service, proprietary stations, or remote stations) shall also comply with the applicable requirements of Chapter 8 of *NFPA 72, National Fire Alarm Code*.

5.3.9.2 Where carbon monoxide warning equipment is connected to supervising station fire alarm systems, receipt of alarm signals shall be distinctively indicated as "supervisory signal carbon monoxide" or other non-fire alarm signal designation acceptable to the AHJ.

5.3.9.3 Signals received by the supervising station shall be processed by the supervising station personnel in accordance with the following requirements:

(1) The personnel shall retransmit the supervisory signal to the public fire service communications center.
(2) The personnel shall notify the subscriber by the quickest available method.
(3) When the signal results from a pre-arranged test, the actions required by 5.3.9.3(1) and 5.3.9.3(2) shall not be required.

5.3.10 Low-Power Wireless Systems.

5.3.10.1 Carbon monoxide warning systems utilizing low-power wireless transmission of signals within the protected dwelling unit shall comply with the requirements of *NFPA 72, National Fire Alarm Code*.

5.3.10.2 Monitoring for placement in accordance with *NFPA 72, National Fire Alarm Code*, shall not be required.

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5.4 Installation.

5.4.1 General Provisions.

5.4.1.1 All carbon monoxide alarms or detectors shall be installed in accordance with the manufacturer's installation instructions.

5.4.1.2 All carbon monoxide alarms or detectors shall be located and mounted so that accidental operation will not be caused by jarring or vibration.

5.4.1.3 All carbon monoxide alarms or detectors shall be supported independently of their attachment to wires.

5.4.1.4 All carbon monoxide alarms or detectors shall be tested in accordance with the instructions provided by the supplier or installing contractor *(see 5.6.2 and 5.6.3)* to ensure operation after installation.

5.4.1.5 All carbon monoxide alarms or detectors shall be restored to their normal mode of operation after each alarm or test.

5.4.1.6 The supplier or installing contractor shall provide the owner with the instructions required in 5.6.3.

5.4.2 Multiple-Station Alarms.

5.4.2.1* Interconnection that causes the other multiple-station alarms or the appropriate notification signal of multiple-purpose alarms within an individual dwelling unit to produce an alarm signal shall be permitted.

5.4.2.2 Remote annunciation from single- and multiple-station alarms shall be permitted provided the devices comply with 5.1.2.1 and 5.3.4.

5.4.2.3 Remote annunciation shall be permitted provided the signal is identifiable for the hazard it annunciates.

5.5 Maintenance and Testing.

5.5.1 Maintenance. If batteries are used as a source of energy, they shall be replaced in accordance with the instructions provided by the manufacturer.

5.5.2 Testing. Alarms, systems, and all connected notification appliances shall be inspected and tested in accordance with the manufacturer's instructions at least once a month.

5.6 Markings and Instructions.

5.6.1 General. Carbon monoxide alarms or detectors shall be provided with the information specified in 5.6.2 and 5.6.3.

5.6.2 Markings. The following information shall be marked on the alarms and detectors and shall be provided in the instructions:

(1) Identification of the sensitivity level at which the unit is designed to sense carbon monoxide
(2) Statement that indicates the unit is not suitable as a fire detector
(3) Name and address of the manufacturer or listee
(4) Model number
(5) Mark or certification that the unit has been listed by a nationally recognized testing laboratory
(6) Electrical rating (if applicable)
(7) Explanation of signal indicators
(8) Warning that carbon monoxide is odorless, colorless, and tasteless
(9) Emergency actions to be taken
(10) Manufacturing date or date code
(11) Recommended replacement date

5.6.3 Instructions. The following information shall be included in the printed instructions provided with carbon monoxide alarms and detectors:

(1) Installation instructions
(2) Operating instructions
(3) Testing instructions
(4) Maintenance instructions
(5) Replacement and service instructions
(6) Statement indicating that smoke might not be present during a carbon monoxide alarm condition
(7)*Information on the actions to be taken in case of an alarm
(8) Minimum and recommended distances from fuel-burning appliances

Annex A Explanatory Material

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

A.1.1 This document does not attempt to cover all equipment, methods, and requirements that might be necessary or advantageous for the protection of lives from carbon monoxide exposure.

The effects of exposure to carbon monoxide vary significantly among different people. Infants, pregnant women, and people with physical conditions that limit their bodies' ability to use oxygen can be affected by low concentrations of carbon monoxide. These conditions include, but are not limited to, emphysema, asthma, and heart disease, all of which are usually indicated by a shortness of breath upon mild exercise.

People in need of warning about low levels of carbon monoxide should explore the use of specially calibrated units or other alternatives.

A.1.1.2 See NFPA 1192, *Standard on Recreational Vehicles*, for equipment for use in recreational vehicles.

A.1.2 Carbon monoxide alarms and detectors are intended to alarm at carbon monoxide levels below those that are known to cause a loss of ability to react to the dangers of carbon monoxide. Refer also to Table B.1 and Figure B.1.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

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A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.5 Fuel-Burning Appliance. Fuel-burning appliances include, but are not limited to, devices used for cooking, heating, lighting, or decorative purposes. Examples are wood stoves, portable space heaters, ranges, furnaces, water heaters, clothes dryers, gas refrigerators, and gas lamps.

A.3.3.9 Separate Sleeping Area. Bedrooms or sleeping rooms separated by other use areas, such as kitchens or living rooms, but not bathrooms, are considered as separate sleeping areas for the purposes of this standard.

A.4.1.2 Although carbon monoxide warning equipment might respond to gases produced by unwanted fires, it is not fire warning equipment.

A.5.1.1 Experience has shown that hazardous concentrations of carbon monoxide can accumulate in a residence, generally from improperly operating heating appliances, insufficient make-up air into the residence or space, or blocked chimneys or vents. However, there are many other potential sources of carbon monoxide within a home, including the following:

(1) Malfunctioning fossil fuel appliances
(2) Wood stoves
(3) Fireplaces
(4) Idling automobiles in attached garages
(5) Portable equipment such as gasoline-powered lawn and garden equipment
(6) Barbecues

Carbon monoxide is odorless, tasteless, and colorless; therefore, its presence is undetectable by smell, taste, or sight. Carbon monoxide alarms meeting the requirements of ANSI/UL 2034-2002, *Standard for Single and Multiple Station Carbon Monoxide Alarms,* and installed in accordance with this standard should provide a significant level of protection against fatal carbon monoxide exposure.

The installation of additional carbon monoxide alarms could result in a higher degree of protection. Adding alarms to rooms where fuel-burning appliances are located could provide earlier warning of carbon monoxide hazards caused by those sources. Additional alarms located in rooms normally closed off from the required alarms could increase the escape time, since the carbon monoxide concentration needed to force the carbon monoxide out of the closed rooms to the alarms would not be necessary. As a consequence, the installation of additional carbon monoxide alarms should be considered.

Carbon monoxide alarms or detectors are not substitutes for proper maintenance, inspection, and testing of fuel-burning equipment. Fuel-burning equipment and appliances should be used, maintained, tested, and inspected according to the manufacturers' instructions.

A.5.1.1.1 Where sleeping areas are separated and the audibility of the alarm or detector to occupants within each sleeping area could be seriously impaired, more than one unit could be needed.

At times, depending on conditions, the audibility of notification appliances could be seriously impaired when occupants are in the bedroom area. For instance, there might be a noisy window air conditioner or room humidifier generating an ambient noise level of 55 dBA or higher. The detection device alarms need to penetrate through the closed doors and be heard over the bedroom's noise levels with sufficient intensity to awaken sleeping occupants therein. Test data indicate that alarms with ratings of 85 dBA at 3 m (10 ft) that are installed outside the bedrooms can produce about 15 dBA over ambient noise levels of 55 dBA in the bedrooms. This sound pressure is likely to be sufficient to awaken the average sleeping person.

Alarms or detectors located remote from the bedroom area might not be loud enough to awaken the average person. In such cases, it is recommended that units be interconnected in such a way that the operation of the remotely located detector or alarm causes an alarm of sufficient intensity to penetrate the bedrooms. The interconnection can be accomplished by the following:

(1) Installation of a system
(2) Wiring together of multiple-station alarms
(3) Use of line carrier or radio frequency transmitters/receivers
(4) Adding supplemental notification appliances

A.5.1.2.2 Since hearing deficits are often not apparent, the responsibility for advising the appropriate person(s) of the existence of this deficit should be that of the hearing-impaired party.

A.5.3.1.1 ANSI/UL 2034, *Standard for Single and Multiple Station Carbon Monoxide Alarms,* includes a level below which the alarm should not respond.

A.5.4.2.1 Carbon monoxide alarms or detectors could be susceptible to unwanted alarm signals triggered by vapors from petroleum, alcohols, or aerosols. An alarm for such a condition might be anticipated and tolerated by the occupant of a dwelling unit through routine living experience. An alarm would not be acceptable if it also triggered detectors in other dwelling units or resulted in an alarm of detectors located in common-use areas. Unwanted alarms can occur, and inspection authorities should be aware of the ramifications that could result if the coverage is extended beyond the limits of a single dwelling unit.

A.5.6.3(7) Actions that should be considered include opening of windows and doors and evacuation. Also, the information should provide examples of organizations to be contacted for assistance.

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Annex B Dangers of Carbon Monoxide

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 Carbon Monoxide. Carbon monoxide is an odorless, tasteless, colorless gas produced by incomplete combustion. Solid, liquid, or gaseous fuels can each, under certain conditions, produce lethal concentrations in the home. *(See Table B.1 and Figure B.1.)*

The dangers of carbon monoxide exposure depend on a number of variables, such as the occupant's health, activity level, time of exposure, and initial carboxyhemoglobin (COHb) level. Due to these variables, Table B.1 and Figure B.1 are to be used as general guidelines and might not appear quantitatively consistent.

The following equation for determining the estimated percent of COHb in the blood is from "A proposal for evaluating human exposure to carbon monoxide contamination in military vehicles" by Steinberg and Nielson in the March 1977 publication AMCMS Code 672716.H700011 and "Considerations for the physiological variables that determine the blood carboxyhemoglobin concentration in man" by Coburn, Forster, and Kane in Volume 1965-44 of the *Journal of Clinical Investigation*:

$$\%\mathrm{COHb}_t = \%\mathrm{COHb}_0\left[e^{-(t/2398B)}\right] + 218\left[1 - e^{-(t/2398B)}\right] \times \left(0.0003 + \frac{\text{ppm CO}}{1316}\right)$$

where:

$\%\mathrm{COHb}_t$ = percentage of COHb at time t
$\%\mathrm{COHb}_0$ = percentage of COHb in the blood at time 0
t = time in minutes
B = 0.0404 (work effort)
ppm CO = parts per million carbon monoxide

Table B.1 Symptoms of Carbon Monoxide Exposure Based on Concentration

Concentration (ppm CO)	Symptoms
50	No adverse effects with 8 hours of exposure
200	Mild headache after 2–3 hours of exposure
400	Headache and nausea after 1–2 hours of exposure
800	Headache, nausea, and dizziness after 45 minutes of exposure; collapse and unconsciousness after 2 hours of exposure
1,000	Loss of consciousness after 1 hour of exposure
1,600	Headache, nausea, and dizziness after 20 minutes of exposure
3,200	Headache, nausea, and dizziness after 5–10 minutes of exposure; collapse and unconsciousness after 30 minutes of exposure
6,400	Headache and dizziness after 1–2 minutes of exposure; unconsciousness and danger of death after 10–15 minutes of exposure
12,800 (1.28% by volume)	Immediate physiological effects; unconsciousness and danger of death after 1–3 minutes of exposure

CAUTION: The values in Table B.1 are approximate values for healthy adults. Children, the elderly, and persons with preexisting physical conditions might be more susceptible to the effects of carbon monoxide exposure. Continued exposure after unconsciousness can cause death.

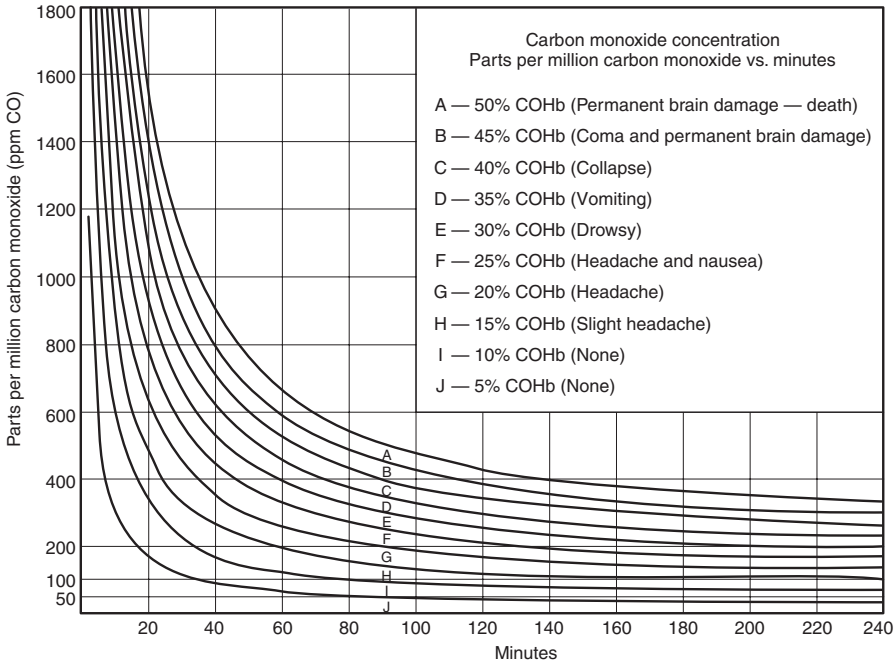

FIGURE B.1 Carbon Monoxide Concentration (ppm CO) Versus Time (Minutes).

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Annex C Informational References

C.1 Referenced Publications. The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not part of the requirements of this document unless also listed in Chapter 2.

C.1.1 NFPA Publication. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1192, *Standard on Recreational Vehicles*, 2005 edition.

C.1.2 Other Publications.

C.1.2.1 UL Publication. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062–2096.

ANSI/UL 2034, *Standard for Single and Multiple Station Carbon Monoxide Alarms*, June 28, 2002.

C.1.2.2 Other Publications.

Coburn, R. F., Forster, R. E., and Kane, P. G., "Considerations for the physiological variables that determine the blood carboxyhemoglobin concentration in man," *Journal of Clinical Investigation,* 1965-44, 1899–1910.

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

Steinberg and Nielson, "A proposal for evaluating human exposure to carbon monoxide contamination in military vehicles," AMCMS Code 672716.H700011, March, 1977.

C.2 Informational References. (Reserved)

C.3 References for Extracts. The following documents are listed here to provide reference information, including title and edition, for extracts given throughout the nonmandatory sections of this standard as indicated by a reference in brackets [ ] following a section or paragraph. These documents are not a part of the requirements of this document unless also listed in Chapter 2 for other reasons.

NFPA 72®, *National Fire Alarm Code®*, 2002 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, 2003 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2003 edition.

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Sequence of Events Leading to Publication of an NFPA Committee Document

Call goes out for proposals to amend existing document or for recommendations on new document.

▼

Committee meets to act on proposals, to develop its own proposals, and to prepare its report.

▼

Committee votes on proposals by letter ballot. If two-thirds approve, report goes forward. Lacking two-thirds approval, report returns to committee.

▼

Report — *Report on Proposals* (ROP) — is published for public review and comment.

▼

Committee meets to act on each public comment received.

▼

Committee votes on comments by letter ballot. If two-thirds approve, supplementary report goes forward. Lacking two-thirds approval, supplementary report returns to committee.

▼

Supplementary report — *Report on Comments* (ROC) — is published for public review.

▼

NFPA membership meets (Annual or Fall Meeting) and acts on committee report (ROP or ROC).

▼

Committee votes on any amendments to report approved at NFPA Annual or Fall Meeting.

▼

Appeals to Standards Council on Association action must be filed within 20 days of the NFPA Annual or Fall Meeting.

▼

Standards Council decides, based on all evidence, whether or not to issue standard or to take other action, including upholding any appeals.

Committee Membership Classifications

The following classifications apply to Technical Committee members and represent their principal interest in the activity of the committee.

M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.

U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.

I/M *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.

L *Labor:* A labor representative or employee concerned with safety in the workplace.

R/T *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.

E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.

I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.

C *Consumer:* A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.

SE *Special Expert:* A person not representing any of the previous classifications, but who has a special expertise in the scope of the standard or portion thereof.

NOTES:

1. "Standard" connotes code, standard, recommended practice, or guide.
2. A representative includes an employee.
3. While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of members or unique interests need representation in order to foster the best possible committee deliberations on any project. In this connection, the Standards Council may make such appointments as it seems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.
4. Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

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NFPA Technical Committee Document Proposal Form

Note: All proposals must be received by 5:00 p.m. EST/EDST on the published proposal closing date.

For further information on the standards-making process, please contact Codes and Standards Administration at 617-984-7249. For technical assistance, please call NFPA at 617-770-3000.

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Company _____
Address 9 Seattle St. **City** Seattle **State** WA **Zip** 02255
Please indicate organization represented (if any) Fire Marshals Assn. of North America

1. **a) NFPA Document Title** National Fire Alarm Code
   b) NFPA No. & Edition NFPA 72, 2002 ed. **c) Section/Paragraph** 4.4.7.1.1

2. **Proposal Recommends:** *(check one)* ☐ **new text** ☐ **revised text** ☒ **deleted text**

3. **Proposal.** *(Include proposed new or revised wording, or identification of wording to be deleted.)* Note: Proposed text should be in legislative format, that is, use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~). Delete exception.

4. **Statement of Problem and Substantiation for Proposal.** Note: State the problem that will be resolved by your recommendation. Give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication. A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

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