**Chapter 17 Initiating Devices**

17.1 Application

17.1.1\*

The performance, selection, use, and location of automatic or manual initiating devices shall comply with the minimum requirements of this chapter.

17.1.2\*

This chapter establishes the minimum installation criteria for initiating devices required by other governing laws, codes, standards, or sections of this document. This chapter does not, by itself, require the installation of initiating devices.

17.1.3

The requirements of Chapters 7, 10, 12, 21, 23, and 24 shall also apply unless they are in conflict with this chapter.

17.1.4

The requirements of Chapter 14 shall apply.

17.1.5

The requirements of single- and multiple-station alarms and household fire alarm systems shall be determined in accordance with Chapter 29.

17.1.6

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

17.1.7

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 governing laws, codes, or standards.

17.2 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.

17.3\* Performance-Based Design

17.3.1

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.

17.3.2

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

17.3.3

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

17.4 General Requirements

17.4.1

The requirements of 17.4.2 through 17.4.7 shall apply to all initiating devices.

17.4.2 Mechanical Protection

17.4.2.1

Initiating devices subject to mechanical damage shall be protected.

17.4.2.2

If guards or covers are employed, they shall be listed for use with the initiating device.

17.4.2.3\*

The protection shall not prevent the initiating device from achieving the objectives of the system by adversely affecting the use, operation, or performance of the initiating device.

17.4.3

Initiating devices shall be installed in a manner that provides accessibility for periodic inspection, testing, and maintenance.

17.4.4

Initiating devices shall be installed in all areas, compartments, or locations where required by other governing laws, codes, or standards.

17.4.5\*

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 unless the initiating devices are connected to a system that provides the required monitoring.

17.4.6

Where detectors are installed in concealed locations more than 10 ft (3.0 m) 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.

17.4.6.1\*

If a remote alarm indicator is provided, the location of the detector and the area protected by the detector shall be prominently indicated at the remote alarm indicator by a permanently attached placard or by other approved means.

17.4.6.2

Remote alarm or supervisory indicators shall be installed in an accessible location and shall be clearly labeled to indicate both their function and any device or equipment associated with each detector.

17.4.6.3

Detectors installed in concealed locations where the specific detector alarm or supervisory signal is indicated at the control unit (and on the drawings with its specific location and functions) shall not be required to be provided with remote alarm indicators as specified in 17.4.6.

17.4.7\*

If the intent is to initiate action when smoke/fire threatens a specific object or space, the detector shall be permitted to be installed in close proximity to that object or space.

17.5 Requirements for Smoke and Heat Detectors

17.5.1 Recessed Mounting

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

17.5.2\* Partitions

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

17.5.3\* Detector Coverage

17.5.3.1\* Total (Complete) Coverage

Where required by other governing laws, codes, or standards, and unless otherwise modified by 17.5.3.1.1 through 17.5.3.1.5, total coverage of a building or a portion thereof, shall include all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, and other subdivisions and accessible spaces.

17.5.3.1.1

Where inaccessible areas are constructed of or contain combustible material, unless otherwise specified in 17.5.3.1.2, they shall be made accessible and shall be protected by a detector(s).

17.5.3.1.2

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

Where the ceiling is attached directly to the underside of the supporting beams of a combustible roof or floor deck.

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.)

Where there are small concealed spaces over rooms, provided that any space in question does not exceed 50 ft2 (4.6 m2) in area.

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 6 in. (150 mm).

17.5.3.1.3

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

Openings of the grid are 1/4 in. (6.4 mm) or larger in the least dimension.

Thickness of the material does not exceed the least dimension.

Openings constitute at least 70 percent of the area of the ceiling material.

17.5.3.1.4\*

Where concealed accessible spaces above suspended ceilings are used as a return air plenum meeting the requirements of NFPA 90A detection shall be provided in one of the following means:

Smoke detection shall be provided in accordance with 17.7.4.2, or

Smoke detection shall be provided at each connection from the return air plenum to the central air-handling system.

17.5.3.1.5

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

Space is not accessible for storage purposes or entrance of unauthorized persons and is protected against the accumulation of windborne debris.

Space contains no equipment such as steam pipes, electric wiring, shafting, or conveyors.

Floor over the space is tight.

No flammable liquids are processed, handled, or stored on the floor above.

17.5.3.2\* Partial or Selective Coverage

Where other governing laws, codes, or standards require the protection of selected areas only, the specified areas shall be protected in accordance with this Code.

17.5.3.3\* Nonrequired Coverage

17.5.3.3.1

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 the prescriptive spacing criteria of Chapter 17.

17.5.3.3.2

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

17.6 Heat-Sensing Fire Detectors

17.6.1 General

17.6.1.1\*

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

17.6.1.2

Designs not in accordance with 17.6.1.3 shall be deemed prescriptive designs and shall be designed in accordance with the prescriptive requirements of this chapter.

17.6.1.3\*

Performance-based designs shall be executed in accordance with Section 17.3.

17.6.1.4

Heat sensing fire detectors shall be listed in accordance with applicable standards such as ANSI/UL 521, Standard for Heat Detectors for Fire Protective Signaling Systems.

17.6.1.5\*

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

17.6.2 Temperature

17.6.2.1 Classification

Heat-sensing fire detectors of the fixed-temperature or rate-compensated, spot type shall be classified as to the temperature of operation in accordance with Table 17.6.2.1.

Table 17.6.2.1 Temperature Classification and Color Code for Heat-Sensing Fire Detectors

Temperature Classification Temperature Rating Range Maximum Ceiling Temperature Color Code

°F °C °F °C

Low 100-134 38-56 80 28 Uncolored

Ordinary 135-174 57-79 115 47 Uncolored

Intermediate 175-249 80-121 155 69 White

High 250-324 122-162 230 111 Blue

Extra high 325-399 163-204 305 152 Red

Very extra high 400-499 205-259 380 194 Green

Ultra high 500-575 260-302 480 249 Orange

17.6.2.2 Marking

17.6.2.2.1 Color Coding

17.6.2.2.1.1

Heat-sensing fire detectors of the fixed-temperature or rate-compensated, spot type shall be marked with a color code in accordance with Table 17.6.2.1.

17.6.2.2.1.2

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:

Ring on the surface of the detector

Temperature rating in numerals at least 3/8 in. (9.5 mm) high

17.6.2.2.2 Operating Temperature

17.6.2.2.2.1

Heat-sensing fire detectors shall be marked with their listed operating temperature.

17.6.2.2.2.2

Heat-sensing fire detectors where the alarm threshold is field adjustable shall be marked with the temperature range.

17.6.2.2.2.3

Spot-type heat detectors shall also be marked with their RTI.

17.6.2.3\* Ambient Ceiling Temperature

17.6.2.3.1

Detectors having fixed-temperature or rate-compensated elements shall be selected in accordance with Table 17.6.2.1 for the maximum expected ambient ceiling temperature.

17.6.2.3.2

The temperature rating of the detector shall be at least 20°F (11°C) above the maximum expected temperature at the ceiling.

17.6.3 Location and Spacing

17.6.3.1 Smooth Ceiling

17.6.3.1.1\* Spacing

One of the following requirements shall apply:

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.

All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the listed spacing (0.7S).

17.6.3.1.2 Irregular Areas

For irregularly shaped areas, the spacing between detectors shall be permitted to be greater than the listed spacing, provided that 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.

17.6.3.1.3 Location

17.6.3.1.3.1\*

Unless otherwise modified by 17.6.3.2.2, 17.6.3.3.2, or 17.6.3.7, spot-type heat-sensing fire detectors shall be located on the ceiling not less than 4 in. (100 mm) from the sidewall or on the sidewalls between 4 in. and 12 in. (100 mm and 300 mm) from the ceiling.

17.6.3.1.3.2

Unless otherwise modified by 17.6.3.2.2, 17.6.3.3.2, or 17.6.3.7, line-type heat detectors shall be located on the ceiling or on the sidewalls not more than 20 in. (510 mm) from the ceiling.

17.6.3.2\* Solid Joist Construction

17.6.3.2.1 Spacing

The design spacing of heat detectors, where measured at right angles to the solid joists, shall not exceed 50 percent of the listed spacing.

17.6.3.2.2 Location

Detectors shall be mounted at the bottom of the joists.

17.6.3.3\* Beam Construction

17.6.3.3.1 Spacing

17.6.3.3.1.1

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

17.6.3.3.1.2

Where the beams project more than 4 in. (100 mm) 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 listed spacing.

17.6.3.3.1.3

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

17.6.3.3.2 Location

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

17.6.3.4\* Sloping Ceilings (Peaked and Shed)

17.6.3.4.1 Spacing

17.6.3.4.1.1 Ceiling Slope Less Than 30 Degrees

For a ceiling slope of less than 30 degrees, all detectors shall be spaced using the height at the peak.

17.6.3.4.1.2 Ceiling Slopes of 30 Degrees or Greater

All detectors, other than those located in the peak, shall be spaced using the average slope height or the height of the peak.

17.6.3.4.1.3

Spacing shall be measured along a horizontal projection of the ceiling in accordance with the type of ceiling construction.

17.6.3.4.2 Location

17.6.3.4.2.1

A row of detectors shall first be located at or within 36 in. (910 mm) of the peak of the ceiling.

17.6.3.4.2.2

Additional detectors shall be located as determined in 17.6.3.4.1.

17.6.3.5 High Ceilings

17.6.3.5.1\*

Unless otherwise modified by 17.6.3.5.2, on ceilings 10 ft to 30 ft (3.0 m to 9.1 m) high, heat detector spacing shall be reduced in accordance with Table 17.6.3.5.1 prior to any additional reductions for beams, joists, or slope, where applicable.

Table 17.6.3.5.1 Heat Detector Spacing Reduction Based on Ceiling Height

Ceiling Height Greater than (>) Up to and Including Multiply Listed Spacing by

ft m ft m

0 0 10 3.0 1.00

10 3.0 12 3.7 0.91

12 3.7 14 4.3 0.84

14 4.3 16 4.9 0.77

16 4.9 18 5.5 0.71

18 5.5 20 6.1 0.64

20 6.1 22 6.7 0.58

22 6.7 24 7.3 0.52

24 7.3 26 7.9 0.46

26 7.9 28 8.5 0.40

28 8.5 30 9.1 0.34

17.6.3.5.2

For line-type electrical conductivity detectors (see 3.3.70.11) and pneumatic rate-of-rise tubing heat detectors (see 3.3.70.15), which rely on the integration effect, the derating required by Table 17.6.3.5.1 shall not apply, and the manufacturer's published instructions shall be followed for appropriate alarm point and spacing.

17.6.3.5.3\* Spacing Minimum

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

17.6.3.6\* 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 50 ft (15.2 m) spacing.

17.6.3.7 Other Applications

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

17.6.3.8 Alternative Design Methods

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

17.7 Smoke-Sensing Fire Detectors

17.7.1 General

17.7.1.1\*

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

17.7.1.2\*

Designs not in accordance with 17.7.1.3 shall be deemed prescriptive designs and shall be designed in accordance with the prescriptive requirements of this chapter.

17.7.1.3\*

Performance-based designs shall be executed in accordance with Section 17.3.

17.7.1.4

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

17.7.1.5

Where smoke detectors are being installed to control the spread of smoke, they shall be installed in accordance with the requirements of 17.7.5.

17.7.1.6

Smoke detectors shall be installed in all areas where required by other governing laws, codes, or standards or by other parts of this Code.

17.7.1.7

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 and unintentional alarms or improper operation after installation.

17.7.1.8\*

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

Temperature below 32°F (0°C)

Temperature above 100°F (38°C)

Relative humidity above 93 percent

Air velocity greater than 300 ft/min (1.5 m/sec)

17.7.1.9\*

Smoke detectors installed in ducts and other locations with air velocities greater than 300 ft/min (1.5 m/sec) shall be listed for the velocity conditions anticipated and installed in accordance with the manufacturer's published instructions.

17.7.1.10\*

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.

17.7.1.11\*

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

17.7.1.12\* Protection During Construction

17.7.1.12.1

Where detectors are installed for signal initiation during construction, they shall be cleaned and verified to be operating in accordance with the listed sensitivity, or they shall be replaced prior to the final acceptance test of the system.

17.7.1.12.2

Where detectors are installed but not operational during construction, they shall be protected from construction debris, dust, dirt, and damage in accordance with the manufacturer's recommendations and verified to be operating in accordance with the listed sensitivity, or they shall be replaced prior to the final acceptance test of the system.

17.7.1.12.3

Where detection is not required during construction, detectors shall not be installed until after all other construction trades have completed cleanup.

17.7.2\* Sensitivity

17.7.2.1\*

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

17.7.2.2

Spot-type smoke detectors that have provision for field adjustment of sensitivity via a mechanical means shall have an adjustment range of not less than 0.6 percent per foot (1.95 percent per meter) obscuration.

17.7.2.3

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

17.7.2.4

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

17.7.3 Location and Spacing

17.7.3.1\* General

17.7.3.1.1

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 airflows that could exist in the protected compartment.

17.7.3.1.2

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:

Ceiling shape and surface

Ceiling height

Configuration of contents in the protected area

Combustion characteristics and probable equivalence ratio of the anticipated fires involving the fuel loads within the protected area

Compartment ventilation

Ambient temperature, pressure, altitude, humidity, and atmosphere

17.7.3.1.3

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.

17.7.3.2\* Spot-Type Smoke Detectors

17.7.3.2.1\*

Spot-type smoke detectors shall be located on the ceiling or, if on a sidewall, between the ceiling and 12 in. (300 mm) down from the ceiling to the top of the detector.

17.7.3.2.2\*

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

17.7.3.2.3

On smooth ceilings, spacing for spot-type smoke detectors shall be in accordance with 17.7.3.2.3.1 through 17.7.3.2.3.4.

17.7.3.2.3.1\*

In the absence of specific performance-based design criteria, one of the following requirements shall apply:

The distance between smoke detectors shall not exceed a nominal spacing of 30 ft (9.1 m) and there shall be detectors within a distance of one-half the nominal spacing, measured at right angles from all walls or partitions extending upward to within the top 15 percent of the ceiling height.

\*All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the nominal 30 ft (9.1 m) spacing (0.7S).

17.7.3.2.3.2

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

17.7.3.2.3.3

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

17.7.3.2.3.4

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

17.7.3.2.4\*

For solid joist and beam construction, spacing for spot-type smoke detectors shall be in accordance with 17.7.3.2.4.1 through 17.7.3.2.4.6.

17.7.3.2.4.1

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

17.7.3.2.4.2

For level ceilings, the following shall apply:

For ceilings with beam depths of less than 10 percent of the ceiling height (0.1 H), the following shall apply:

Smooth ceiling spacing shall be permitted.

Spot-type smoke detectors shall be permitted to be located on ceilings or on the bottom of beams.

For ceilings with beam depths equal to or greater than 10 percent of the ceiling height (0.1 H), the following shall apply:

Where beam spacing is 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.

Where beam spacing is less than 40 percent of the ceiling height (0.4 H), the following shall be permitted for spot detectors:

Smooth ceiling spacing in the direction parallel to the beams and at one-half smooth ceiling spacing in the direction perpendicular to the beams

Location of detectors either on the ceiling or on the bottom of the beams

\*For beam pockets formed by intersecting beams, including waffle or pan-type ceilings, the following shall apply:

For beam depths less than 10 percent of the ceiling height (0.1 H), spacing shall be in accordance with 17.7.3.2.4.2(1).

For beam depths greater than or equal to 10 percent of the ceiling height (0.1 H), spacing shall be in accordance with 17.7.3.2.4.2(2).

\*For corridors 15 ft (4.6 m) in width or less having ceiling beams or solid joists perpendicular to the corridor length, the following shall apply:

Smooth ceiling spacing shall be permitted.

Location of spot-type smoke detectors shall be permitted on ceilings, sidewalls, or the bottom of beams or solid joists.

For rooms of 900 ft2 (84 m2) or less, the following shall apply:

Use of smooth ceiling spacing shall be permitted.

Location of spot-type smoke detectors shall be permitted on ceilings or on the bottom of beams.

17.7.3.2.4.3\*

For sloping ceilings with beams running parallel up slope, the following shall apply:

Spot-type detector(s) shall be located on the ceiling within beam pocket(s)

The ceiling height shall be taken as the average height over slope.

Spacing shall be measured along a horizontal projection of the ceiling.

Smooth ceiling spacing shall be permitted within beam pocket(s) parallel to the beams.

For beam depths less than or equal to 10 percent of the ceiling height (0.1 H), spot-type detectors shall be located with smooth ceiling spacing perpendicular to the beams.

For beam depths greater than 10 percent of the ceiling height (0.1 H), the following shall apply for spacing perpendicular to the beams:

For beam spacing greater than or equal to 40 percent of the ceiling height (0.4 H), spot-type detectors shall be located in each beam pocket.

For beam spacing less than 40 percent of the ceiling height (0.4 H), spot-type detectors shall not be required in every beam pocket but shall be spaced not greater than 50 percent of smooth ceiling spacing.

17.7.3.2.4.4\*

For sloping ceilings with beams running perpendicular across slope, the following shall apply:

Spot-type detector(s) shall be located at the bottom of the beams.

The ceiling height shall be taken as the average height over slope.

Spacing shall be measured along a horizontal projection of the ceiling.

Smooth ceiling spacing shall be permitted within beam pocket(s).

For beam depths less than or equal to 10 percent of the ceiling height (0.1 H), spot-type detectors shall be located with smooth ceiling spacing.

For beam depths greater than 10 percent of the ceiling height (0.1 H), spot-type detectors shall not be required to be located closer than (0.4 H) and shall not exceed 50 percent of smooth ceiling spacing.

17.7.3.2.4.5\*

For sloped ceilings with beam pockets formed by intersecting beams, the following shall apply:

Spot-type detector(s) shall be located at the bottom of the beams.

The ceiling height shall be taken as the average height over slope.

Spacing shall be measured along a horizontal projection of the ceiling.

For beam depths less than or equal to 10 percent of the ceiling height (0.1 H), spot-type detectors shall be spaced with not more than three beams between detectors and shall not exceed smooth ceiling spacing.

For beam depths greater than 10 percent of the ceiling height (0.1 H), spot-type detectors shall be spaced with not more than two beams between detectors, but shall not be required to be spaced closer than (0.4 H), and shall not exceed 50 percent of smooth ceiling spacing.

17.7.3.2.4.6

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

17.7.3.3\* Peaked

17.7.3.3.1

Detectors shall first be spaced and located within 36 in. (910 mm) of the peak, measured horizontally.

17.7.3.3.2

The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.

17.7.3.4\* Shed

17.7.3.4.1

Detectors shall first be spaced and located within 36 in. (910 mm) of the high side of the ceiling, measured horizontally.

17.7.3.4.2

The number and spacing of additional detectors, if any, shall be based on the horizontal projection of the ceiling.

17.7.3.5 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.

17.7.3.5.1

For raised floors, the following shall apply:

Detectors installed beneath raised floors shall be spaced in accordance with 17.7.3.1,17.7.3.1.3, and 17.7.3.2.2.

Where the area beneath the raised floor is also used for environmental air, detector spacing shall also conform to 17.7.4.1 and 17.7.4.2.

17.7.3.5.2

For suspended ceilings, the following shall apply:

Detector spacing above suspended ceilings shall conform to the requirements of 17.7.3 for the ceiling configuration.

Where detectors are installed in ceilings used for environmental air, detector spacing shall also conform to 17.7.4.1, 17.7.4.2, and 17.7.4.4.

17.7.3.6 Air Sampling-Type Smoke Detector

17.7.3.6.1 General

17.7.3.6.1.1\*

In the absence of specific performance-based design criteria, each sampling port of an air sampling-type smoke detector shall be treated as a spot-type smoke detector for the purpose of location and spacing in accordance with 17.7.3.

17.7.3.6.1.2

Air sampling-type smoke detectors shall produce trouble signals if the airflow is outside the manufacturer's specified range.

17.7.3.6.1.3

If provided, atmospheric contaminant filtration shall be listed for use with the detector and installed and maintained in accordance with the air sampling-type smoke detector manufacturer's published instructions.

17.7.3.6.2 Pipe Network

17.7.3.6.2.1

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

17.7.3.6.2.2

Sampling pipe networks shall be designed on the basis of, and shall be supported by, computer-based fluid dynamics design calculations to ensure required performance.

17.7.3.6.2.3

The sampling pipe network design calculations shall include pressure, volumetric flow, and alarm sensitivity at each sampling port.

17.7.3.6.2.4

Software applications for the design of pipe networks shall be listed for use with the manufacturer's equipment.

17.7.3.6.2.5

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

At changes in direction or branches of piping

At each side of penetrations of walls, floors, or other barriers

At intervals on piping that provide visibility within the space, but no greater than 20 ft (6.1 m)

17.7.3.6.2.6\*

Sampling ports shall be identified as such.

17.7.3.6.2.7\*

If provided, test ports at the end (most remote location) of a pipe run installed in the pipe network solely for the purpose of validating consistency in performance (also referred to as benchmark test points) shall be included in the design calculations and allowed, but not required, to comply with the requirements of 17.7.3.6.2.

17.7.3.6.2.8

If the piping and fittings are painted, the painting shall be performed in accordance with the air sampling-type smoke detector manufacturer's published instructions.

17.7.3.6.2.9\*

Pipe network materials, sizing, and installation shall be in accordance with the manufacturer's published requirements and suitable for use in the environment in which they are installed.

17.7.3.6.2.10

Where used, capillary tubing shall be sized and affixed in accordance with the manufacturer's published instructions and computer-based design calculations.

17.7.3.6.3 Installation and Spacing

17.7.3.6.3.1\*

Air sampling pipe network fittings shall be installed air-tight and permanently affixed.

17.7.3.6.3.2

Sampled air shall be exhausted to a lessor or equal pressure zone. The pressure differential between the sampled air and detector exhaust shall not exceed the manufacturer's published instructions.

17.7.3.6.3.3\*

Supports for sampling pipe shall be in accordance with the air sampling-type smoke detector manufacturer's published instructions.

17.7.3.6.4 Special Applications

17.7.3.6.4.1 Air Duct Applications

(A)

The air sampling system shall be listed for air duct applications and shall be installed in accordance with the manufacturer's published instructions.

(B)

The inlet and exhaust sections of pipe that are installed inside the air duct shall be air-tight and shall exhaust the sampled air in accordance with the manufacturer's published instructions.

17.7.3.6.4.2\* Electrical Cabinet Applications

For protection of cabinets containing electrical equipment, the air sampling ports shall be located in the main airflow at the exhaust vents, downstream of the airflow distribution path, or in accordance with the manufacturer's published instructions.

17.7.3.7\* Projected Beam-Type Smoke Detectors

17.7.3.7.1

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

17.7.3.7.2

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

17.7.3.7.3

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

17.7.3.7.4

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

17.7.3.7.5

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

17.7.3.7.6

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

17.7.3.7.7

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 or unintentional alarms.

17.7.3.7.8\*

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

17.7.4 Heating, Ventilating, and Air-Conditioning (HVAC)

17.7.4.1\*

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

17.7.4.2

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 17.7.1.8.

17.7.4.3

Detector spacings and locations shall be selected on the basis of anticipated airflow patterns and fire type.

17.7.4.4\*

Detectors placed in environmental air ducts or plenums shall not be used as a substitute for open area detectors.

17.7.4.4.1

Where detectors are used for the control of smoke spread, the requirements of 17.7.5 shall apply.

17.7.4.4.2

Where open area protection is required, 17.7.3 shall apply.

17.7.4.5

Detectors placed in environmental air ducts or plenums shall be permitted to be either supervisory or alarm initiating devices.

17.7.5\* Smoke Detectors for Control of Smoke Spread

17.7.5.1\* 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:

Area detectors that are installed in the related smoke compartments

Detectors that are installed in the air duct systems

Video image smoke detection that is installed in related smoke compartments

17.7.5.2\* Limitations

17.7.5.2.1

Detectors that are installed in the air duct system in accordance with 17.7.5.1(2) shall not be used as a substitute for open area protection.

17.7.5.2.2

Where open area protection is required, 17.7.3 shall apply.

17.7.5.3\* Purposes

17.7.5.3.1

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 and 17.7.5.4.2.1.

17.7.5.3.2

If smoke detectors are used to initiate selectively the operation of equipment to control smoke spread, the requirements of 17.7.5.4.2.2 shall apply.

17.7.5.3.3

If detectors are used to initiate the operation of smoke doors, the requirements of 17.7.5.6 shall apply.

17.7.5.3.4

If duct detectors are used to initiate the operation of smoke dampers within ducts, the requirements of 17.7.5.5 shall apply.

17.7.5.4 Application

17.7.5.4.1 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.

17.7.5.4.2\* Smoke Detection for Air Duct System

17.7.5.4.2.1 Supply Air System

(A)

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 shall be installed in the supply air duct downstream of both the fan and the filters.

(B)

Where the air duct system passes through other smoke compartments not served by the duct, additional smoke detectors shall not be required to be installed.

17.7.5.4.2.2\* Return Air System

Unless otherwise modified by 17.7.5.4.2.2(A) or 17.7.5.4.2.2(B), 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.

(A)

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.

(B)

Where total coverage smoke detection is installed in accordance with 17.5.3.1 in all areas of the smoke compartment served by the return air system, installation of additional detector(s) listed for the air velocity present where the air leaves each smoke compartment, or in the duct system before the air enters in the return air system shall not be required, provided that their function is accomplished by the design of the total coverage smoke detection system.

17.7.5.5 Location and Installation of Detectors in Air Duct Systems

17.7.5.5.1

Detectors shall be listed for the purpose for which they are being used.

17.7.5.5.2\*

Air duct detectors shall be installed in such a way as to obtain a representative sample of the airstream.

17.7.5.5.3

This installation shall be permitted to be achieved by any of the following methods:

Rigid mounting within the duct

Rigid mounting to the wall of the duct with the sensing element protruding into the duct

Installation outside the duct with rigidly mounted sampling tubes protruding into the duct

Installation through the duct with projected light beam

17.7.5.5.4

Detectors shall be mounted in accordance with the manufacturer's published instructions and shall be accessible for cleaning by providing access doors or panels in accordance with NFPA 90A.

17.7.5.5.5

The location of all detectors in air duct systems shall be permanently and clearly identified and recorded.

17.7.5.5.6

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.

17.7.5.5.7

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.

17.7.5.5.8

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.

17.7.5.6 Smoke Detectors for Door Release Service

17.7.5.6.1

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 17.7.3 shall be permitted to accomplish smoke door release service.

17.7.5.6.2

Smoke detectors that are used exclusively for smoke door release service shall be located and spaced as required by 17.7.5.6.

17.7.5.6.3

Where smoke door release is accomplished directly from the smoke detector(s), the detector(s) shall be listed for releasing service.

17.7.5.6.4

Smoke detectors shall be of the photoelectric, ionization, or other approved type.

17.7.5.6.5

The number of detectors required shall be determined in accordance with 17.7.5.6.5.1 through 17.7.5.6.5.4.

17.7.5.6.5.1

If doors are to be closed in response to smoke flowing in either direction, the requirements of 17.7.5.6.5.1(A) through 17.7.5.6.5.1(D) shall apply.

(A)

If the depth of wall section above the door is 24 in. (610 mm) 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 17.7.5.6.5.1(A), part A or B, shall apply.

FIGURE 17.7.5.6.5.1(A) Detector Location Requirements for Wall Sections.

(B)

If the depth of wall section above the door is greater than 24 in. (610 mm) 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 17.7.5.6.5.1(A), part D, shall apply.

(C)\*

If the depth of wall section above the door is greater than 24 in. (610 mm) on both sides, two ceiling-mounted or wall-mounted detectors shall be required, one on each side of the doorway. Figure 17.7.5.6.5.1(A), part F, shall apply.

(D)

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 17.7.5.6.5.1(A), parts A, C, and E, shall apply.

17.7.5.6.5.2

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 17.7.5.6.6. Alternatively, a smoke detector conforming with 17.7.5.6.5.1(D) shall be permitted to be used.

17.7.5.6.5.3

If there are multiple doorways, additional ceiling-mounted detectors shall be required as specified in 17.7.5.6.5.3(A) through 17.7.5.6.5.3(C).

(A)

If the separation between doorways exceeds 24 in. (610 mm), each doorway shall be treated separately. Figure 17.7.5.6.5.3(A), part E, shall apply.

FIGURE 17.7.5.6.5.3(A) Detector Location Requirements for Single and Double Doors.

(B)

Each group of three or more doorway openings shall be treated separately. Figure 17.7.5.6.5.3(B) shall apply.

FIGURE 17.7.5.6.5.3(B) Detector(s) Location ±24 in. (610 mm) Requirements for Group Doorways.

(C)

(Each group of doorway openings that exceeds 20 ft (6.1 m) in width, measured at its overall extremes, shall be treated separately. Figure 17.7.5.6.5.3(C) shall apply.

FIGURE 17.7.5.6.5.3(C) Detector(s) Location ±24 in. (610 mm) Requirements for Group Doorways over 20 ft (6.1 m) in Width.

17.7.5.6.5.4

If there are multiple doorways and listed door frame-mounted detectors, or if listed combination or integral detector-door closer assemblies are used, there shall be one detector for each single or double doorway.

17.7.5.6.6

The locations of detectors shall be determined in accordance with 17.7.5.6.6.1 and 17.7.5.6.6.2.

17.7.5.6.6.1

If ceiling-mounted smoke detectors are to be installed on a smooth ceiling for a single or double doorway, they shall be located as follows [Figure 17.7.5.6.5.3(A) shall apply]:

On the centerline of the doorway

No more than 5 ft (1.5 m), measured along the ceiling and perpendicular to the doorway [Figure 17.7.5.6.5.1(A) shall apply.]

No closer than shown in Figure 17.7.5.6.5.1(A), parts B, D, and F

17.7.5.6.6.2

If ceiling-mounted detectors are to be installed in conditions other than those outlined in 17.7.5.6.6.1, an engineering evaluation shall be made.

17.7.6 Special Considerations

17.7.6.1 Spot-Type Detectors

17.7.6.1.1

Combination and multi-sensor smoke detectors that have a fixed-temperature element as part of the unit shall be selected in accordance with Table 17.6.2.1 for the maximum ceiling temperature expected in service.

17.7.6.1.2\*

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.

17.7.6.2\* 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.

17.7.6.3 High Air Movement Areas

17.7.6.3.1\* General

The purpose and scope of 17.7.6.3 shall be to provide location and spacing guidance for smoke detectors intended for early warning of fire in high air movement areas.

17.7.6.3.2 Location

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

17.7.6.3.3\* Spacing

17.7.6.3.3.1

Smoke detector spacing shall be reduced where the airflow in a defined space exceeds 8 minutes per air change (total space volume) (equal to 7.5 air changes per hour).

17.7.6.3.3.2

Where spacing must be adjusted for airflow, spot-type smoke detector spacing shall be adjusted in accordance with Table 17.7.6.3.3.2 or Figure 17.7.6.3.3.2 before making any other spacing adjustments required by this Code.

Table 17.7.6.3.3.2 Smoke Detector Spacing Based on Air Movement (Not to Be Used for Under-Floor or Above-Ceiling Spaces)

Minutes per Air Change Air Changes per Hour Spacing per Detector

ft2 m2

1 60 125 12

2 30 250 23

3 20 375 35

4 15 500 46

5 12 625 58

6 10 750 70

7 8.6 875 81

8 7.5 900 84

9 6.7 900 84

10 6 900 84

FIGURE 17.7.6.3.3.2 High Air Movement Areas (Not to Be Used for Under-Floor or Above-Ceiling Spaces).

17.7.6.3.3.3

Air sampling or projected beam smoke detectors shall be installed in accordance with the manufacturer's published instructions.

17.7.6.3.4 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.

17.7.7 Video Image Smoke Detection

17.7.7.1

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

17.7.7.2

Video image smoke detection systems shall comply with all of the applicable requirements of Chapters 1, 10, 14, 17, and 23 of this Code.

17.7.7.2.1

Systems shall be designed in accordance with the performance-based design requirements of Section 17.3.

17.7.7.2.2

The location and spacing of video image smoke detectors shall comply with the requirements of 17.11.5.

17.7.7.3\*

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.

17.7.7.4\*

All component controls and software shall be protected from unauthorized changes.

17.7.7.5

All changes to the software or component settings shall be tested in accordance with Chapter 14.

17.8 Radiant Energy-Sensing Fire Detectors

17.8.1\* General

17.8.1.1

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

17.8.1.2

The purpose and scope of Section 17.8 shall be to provide requirements for the selection, location, and spacing of fire detectors that sense the radiant energy produced by burning substances.

17.8.1.3

These detectors shall be categorized as flame detectors and spark/ember detectors.

17.8.2\* Fire Characteristics and Detector Selection

17.8.2.1\*

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.

17.8.2.2\*

The selection of the radiant energy-sensing detectors shall be based on the following:

Matching of the spectral response of the detector to the spectral emissions of the fire or fires to be detected

Minimizing the possibility of spurious nuisance alarms from non-fire sources inherent to the hazard area

17.8.3 Spacing Considerations

17.8.3.1 General Rules

17.8.3.1.1\*

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.

17.8.3.1.2

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.

17.8.3.2 Spacing Considerations for Flame Detectors

17.8.3.2.1\*

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

Size of the fire that is to be detected

Fuel involved

Sensitivity of the detector

Field of view of the detector

Distance between the fire and the detector

Radiant energy absorption of the atmosphere

Presence of extraneous sources of radiant emissions

Purpose of the detection system

Response time required

17.8.3.2.2

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

17.8.3.2.3\*

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.

17.8.3.2.4\*

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.

17.8.3.2.5

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.

17.8.3.2.6\*

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.

17.8.3.3 Spacing Considerations for Spark/Ember Detectors

17.8.3.3.1\*

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

Size of the spark or ember that is to be detected

Fuel involved

Sensitivity of the detector

Field of view of the detector

Distance between the fire and the detector

Radiant energy absorption of the atmosphere

Presence of extraneous sources of radiant emissions

Purpose of the detection systems

Response time required

17.8.3.3.2\*

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

17.8.3.3.3

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 3.3.106) of at least one detector.

17.8.3.3.4\*

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.

17.8.3.3.5\*

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.

17.8.3.3.6\*

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

17.8.4 Other Considerations

17.8.4.1

Radiant energy-sensing detectors shall be protected either by design or installation to ensure that optical performance is not compromised.

17.8.4.2

If necessary, radiant energy-sensing detectors shall be shielded or otherwise arranged to prevent action from unwanted radiant energy.

17.8.4.3

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.

17.8.4.4

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.

17.8.5 Video Image Flame Detection

17.8.5.1

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

17.8.5.2

Video image flame detection systems shall comply with all of the applicable requirements of Chapters 1, 10, 14, 17, and 23 of this Code.

17.8.5.3\*

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.

17.8.5.4\*

All component controls and software shall be protected from unauthorized changes.

17.8.5.5

All changes to the software or component settings shall be tested in accordance with Chapter 14.

17.9 Combination, Multi-Criteria, and Multi-Sensor Detectors

17.9.1 General

The requirements for the selection, location, and spacing of combination, multi-criteria, and multi-sensor detectors shall comply with Section 17.9.

17.9.2 Combination Detectors

17.9.2.1

A combination detector shall be listed for each sensor.

17.9.2.2

The device listings shall determine the locations and spacing criteria in accordance with Chapter 17.

17.9.3 Multi-Criteria Detectors

17.9.3.1

A multi-criteria detector shall be listed for the primary function of the device.

17.9.3.2

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.

17.9.4 Multi-Sensor Detectors

17.9.4.1

A multi-sensor detector shall be listed for each sensor.

17.9.4.2

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.

17.10 Gas Detection

17.10.1 General

The purpose and scope of Section 17.10 shall be to provide requirements for the selection, installation, and operation of gas detectors other than carbon monoxide detectors.

17.10.2 Gas Characteristics and Detector Selection

17.10.2.1

Gas detection equipment shall be listed in accordance with applicable standards such as ANSI/UL 1484, Standard for Residential Gas Detectors, or ANSI/UL 2075, Standard for Gas and Vapor Detectors and Sensors, for the specific gas or vapor it is intended to detect.

17.10.2.2

Any gas detection systems installed on a fire alarm system shall comply with all the applicable requirements of Chapters 1, 10, 14, 17, and 23 of this Code.

17.10.2.3

The requirements of this Code shall not apply to gas detection systems used solely for process control.

17.10.2.4\*

The selection and placement of the gas detectors shall be based on an engineering evaluation.

17.11 Other Fire Detectors

17.11.1

Detectors that operate on principles different from those covered by Sections 17.6 through 17.8 shall be classified as other fire detectors.

17.11.1.1

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.

17.11.2\*

Other fire detectors shall operate where subjected to the abnormal concentration of combustion effects that occur during a fire.

17.11.3

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.

17.11.4

Room sizes and contours, airflow patterns, obstructions, and other characteristics of the protected hazard shall be taken into account.

17.11.5

Location and spacing of detectors shall comply with 17.11.5.1 through 17.11.5.3.

17.11.5.1

The location and spacing of detectors shall be based on the principle of operation and an engineering survey of the conditions anticipated in service.

17.11.5.1.1

The manufacturer's published instructions shall be consulted for recommended detector uses and locations.

17.11.5.2

Detectors shall not be spaced beyond their listed or approved maximums.

17.11.5.2.1

Closer spacing shall be used where the structural or other characteristics of the protected hazard warrant.

17.11.5.3

The location and sensitivity of the detectors shall be based on a documented engineering evaluation that includes the manufacturer's installation instructions and the following:

Structural features, size, and shape of the rooms and bays

Occupancy and uses of the area

Ceiling height

Ceiling shape, surface, and obstructions

Ventilation

Ambient environment

Burning characteristics of the combustible materials present

Configuration of the contents in the area to be protected

17.12 Carbon Monoxide Detectors

17.12.1\*

Where required by other governing laws, codes, or standards, carbon monoxide detectors shall be installed in accordance with the following:

\*On the ceiling in the same room as permanently installed fuel-burning appliances, and

\*Centrally located on every habitable level and in every HVAC zone of the building, and

Outside of each separate dwelling unit, guest room, and guest suite sleeping area within 21 ft (6.4 m) of any door to a sleeping room, with the distance measured along a path of travel, and

Other locations where required by applicable laws, codes, or standards, or

A performance-based design in accordance with Section 17.3

17.12.2

Carbon monoxide detectors shall meet the following requirements:

Carbon monoxide detectors shall be listed in accordance with applicable standards, such as ANSI/UL 2075, Gas and Vapor Detectors and Sensors.

Carbon monoxide detectors shall be set to respond to the sensitivity limits specified in ANSI/UL 2034, Standard for Single and Multiple Station Carbon Monoxide Alarms.

17.12.3

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

17.12.4

The location of carbon monoxide detectors shall be based on an evaluation of potential ambient sources and flows of carbon monoxide, moisture, temperature, dust, or fumes and of electrical or mechanical influences to minimize nuisance alarms.

17.12.5

The selection and placement of carbon monoxide 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 and unintentional alarms or improper operation after installation.

17.12.6

Unless specifically designed and listed for the expected conditions, carbon monoxide detectors shall not be installed where any of the following ambient conditions exist:

Temperature below 32°F (0°C)

Temperature above 100°F (38°C)

Relative humidity outside the range of 10 percent to 95 percent

17.12.7

Unless tested and listed for recessed mounting, carbon monoxide detectors shall not be recessed into the mounting surface.

17.12.8 Protection During Construction

17.12.8.1

Where detectors are installed for signal initiation during construction, they shall be replaced prior to the final commissioning of the system.

17.12.8.2

Where detection is not required during construction, detectors shall not be installed until after all other construction trades have completed cleanup.

17.12.9 Carbon Monoxide Detectors for Control of Carbon Monoxide Spread

17.12.9.1

System designers shall consider the spread of carbon monoxide through an occupancy through the HVAC system.

17.12.9.2

Interaction with smoke control systems, if such is provided, shall be coordinated.

17.13 Sprinkler Waterflow Alarm-Initiating Devices

17.13.1\*

The provisions of Section 17.13 shall apply to devices that initiate an alarm indicating a flow of water in a sprinkler system.

17.13.2\*

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.

17.13.3

Movement of water due to waste, surges, or variable pressure shall not initiate an alarm signal.

17.14\* Detection of 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.

17.15 Manually Actuated Alarm-Initiating Devices

17.15.1

Manually actuated alarm-initiating devices shall be listed in accordance with applicable standards such as ANSI/UL 38, Standard for Manual Signaling Boxes for Fire Alarm Systems.

17.15.2

Manually actuated alarm-initiating devices for initiating signals other than for fire alarm shall be permitted if the devices are differentiated from manual fire alarm boxes by a color other than red and labeling.

17.15.3

Combination manual fire alarm boxes and guard's signaling stations shall be permitted.

17.15.4

Manually actuated alarm-initiating devices shall be securely mounted.

17.15.5

Manually actuated alarm-initiating devices shall be mounted on a background of contrasting color.

17.15.6

The operable part of a manually actuated alarm-initiating device shall be not less than 42 in. (1.07 m) and not more than 48 in. (1.22 m) from the finished floor.

17.15.7

Manually actuated alarm-initiating devices shall be permitted to be single action or double action.

17.15.8\*

Listed protective covers shall be permitted to be installed over single- or double-action manually actuated alarm-initiating devices.

17.15.9

Manual fire alarm boxes shall comply with 17.15.9.1 through 17.15.9.6.

17.15.9.1

Manual fire alarm boxes shall be used only for fire alarm initiating purposes.

17.15.9.2

Manual fire alarm boxes shall be installed so that they are conspicuous, unobstructed, and accessible.

17.15.9.3\*

Unless installed in an environment that precludes the use of red paint or red plastic, manual fire alarm boxes shall be red in color.

17.15.9.4

Manual fire alarm boxes shall be located within 5 ft (1.5 m) of each exit doorway on each floor.

17.15.9.5\*

Additional manual fire alarm boxes shall be provided so that the travel distance to the nearest manual fire alarm box will not exceed 200 ft (61 m), measured horizontally on the same floor.

17.15.9.6

Manual fire alarm boxes shall be mounted on both sides of grouped openings over 40 ft (12.2 m) in width, and within 5 ft (1.5 m) of each side of the grouped opening.

17.16 Fire Extinguisher Electronic Monitoring Device

A fire extinguisher electronic monitoring device shall indicate those conditions for a specific fire extinguisher required by NFPA 10 to a fire alarm control unit or other control unit.

17.17 Supervisory Signal-Initiating Devices

17.17.1 Control Valve Supervisory Signal-Initiating Device

17.17.1.1

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.

17.17.1.2

The off-normal signal shall be initiated during the first two revolutions of the handwheel or during one-fifth of the travel distance of the valve control apparatus from its normal position.

17.17.1.3

The off-normal signal shall not be restored at any valve position except normal.

17.17.1.4

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.

17.17.2 Pressure Supervisory Signal-Initiating Device

17.17.2.1

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.

17.17.2.2

The requirements in 17.17.2.2.1 through 17.17.2.2.4 shall apply to pressure supervisory signal-initiating devices.

17.17.2.2.1 Pressure Tank

(A)

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.

(B)

The off-normal signal shall be initiated when the required pressure increases or decreases by 10 psi (70 kPa).

17.17.2.2.2\* Dry Pipe Sprinkler System

(A)

A pressure supervisory signal-initiating device for a dry-pipe sprinkler system shall indicate both high- and low-pressure conditions.

(B)

For dry pipe valves, the off-normal signal shall be initiated when the pressure increases or decreases by 10 psi (70 kPa).

(C)

For low air pressure dry pipe valves, the high- and low-pressure values shall be set in accordance with the manufacturer's installation instructions.

17.17.2.2.3 Steam Pressure

(A)

A steam pressure supervisory signal-initiating device shall indicate a low pressure condition.

(B)

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.

17.17.2.2.4 Other Sources

An initiating device for supervising the pressure of sources other than those specified in 17.17.2.2.1 through 17.17.2.2.3 shall be provided as required by the authority having jurisdiction.

17.17.3 Water Level Supervisory Signal-Initiating Device

17.17.3.1

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.

17.17.3.2

A pressure tank signal-initiating device shall indicate both high and low water level conditions.

17.17.3.2.1

The off-normal signal shall be initiated when the water level falls 3 in. (76 mm) or rises 3 in. (76 mm).

17.17.3.3

A supervisory signal-initiating device for other than pressure tanks shall initiate a low water level when the water level falls 12 in. (300 mm).

17.17.4 Water Temperature Supervisory Signal-Initiating Device

17.17.4.1

A temperature supervisory device for a water storage container exposed to freezing conditions shall initiate two separate and distinctive signals, as specified in 17.17.4.2.

17.17.4.2

One signal shall indicate a decrease in water temperature to 40°F (4.4°C), and the other shall indicate its restoration to above 40°F (4.4°C).

17.17.5 Room Temperature Supervisory Signal-Initiating Device

A room temperature supervisory device shall indicate a decrease in room temperature to 40°F (4.4°C) and its restoration to above 40°F (4.4°C).