

**TO BE RESCINDED****4101:1-9-01 Fire protection systems.**

*[Comment: When a reference is made within this rule to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in rule 4101:1-35-01 of the Administrative Code. The application of the referenced standards shall be limited and as prescribed in section 102.5 of rule 4101:1-1-01 of the Administrative Code.]*

**SECTION 901  
GENERAL**

**901.1 Scope.** The provisions of this chapter shall specify where fire protection systems are required and shall apply to the design, installation and operation of fire protection systems.

**901.2 Fire protection systems.** Fire protection systems shall be installed, repaired, operated and maintained in accordance with this code and the *fire code*.

Any fire protection system for which an exception or reduction to the provisions of this code has been granted shall be considered to be a required system.

**Exception:** Any fire protection system or portion thereof not required by this code shall be permitted to be installed for partial or complete protection provided that such system meets the requirements of this code.

**901.2.1 Approval of fire protection systems.** *Prior to the start of fire protection system installation, alteration, repair, or removal, the owner or the owner's representative shall make application and obtain plan approval from the building official for the proposed work in accordance with Section 106 of the building code.*

**901.2.1.1 Input from the fire official.** *In jurisdictions where the local fire official has requested the opportunity to provide input into the fire protection system approval process conducted by the building official, the owner or the owner's representative is required to submit a copy of construction documents related the fire protection to the local fire official for review in accordance with Section 106.1.2(5). The building official shall evaluate the local fire official's comments and incorporate items of noncompliance with this code into the building department plan review*

*process as outlined in Section 107.6. In the absence of timely input from the fire official during the plan review process, the building official shall proceed as outlined in Section 107.5.1.*

**901.2.1.2 Coordination.** *When the building official or the fire official has indicated an intention to have personnel witness acceptance testing conducted in accordance with Section 901.5 or during the final inspection process, it is the responsibility of the owner or the owner's representative to provide advance notice of when the tests are scheduled to both the building official and the fire official.*

**901.3 Modifications.** Persons shall not remove or modify any fire protection system installed or maintained under the provisions of this code or the *fire code* without approval by the building official *with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1. Termination of fire alarm monitoring services shall be in accordance with Section 901.9 of the fire code.*

**901.4 Threads.** Threads provided for fire department connections to sprinkler systems, standpipes, yard hydrants or any other fire hose connection shall be compatible with the connections used by the local fire department. *Prior to issuance of the certificate of plan approval, the building official shall communicate with the local fire official to verify that the proposed threads are compatible with those currently used by the fire department.*

**901.5 Acceptance tests.** Fire protection systems shall be tested in accordance with the requirements of this code, the *fire code*, and the *applicable standards referenced in this code*. *Required acceptance tests shall be conducted at the expense of the owner or the owner's representative. The building official may require that the acceptance tests be conducted in the presence of a certified building inspector or certified fire protection system inspector. Test results shall be documented and certificates shall be submitted to the building official and the fire official upon completion. Copies of test records and certificates shall also be maintained at the jobsite and made available to the inspector conducting the fire protection systems final inspections.* It shall be unlawful to occupy portions of a structure until the required fire protection systems within that portion of the structure have been tested, *inspected*, and approved.

**901.6 Supervisory service.** Where required, fire protection systems shall be monitored by an approved supervising station in accordance with NFPA 72.

**901.6.1 Automatic sprinkler systems.** Automatic sprinkler systems shall be

monitored by an approved supervising station *in accordance with Section 903.4.1.*

**Exceptions:**

1. *Deleted.*
2. Limited area systems serving fewer than 20 sprinklers.

**901.6.2 Fire alarm systems.** Fire alarm systems required by the provisions of Section 907.2 of this code shall be monitored by an approved supervising station in accordance with Section 907.6.6.

**Exceptions:**

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies.
3. *Deleted.*

**901.6.3 Group H.** Supervision and monitoring of emergency alarm, detection and automatic fire-extinguishing systems in Group H occupancies shall be in accordance with the *Section 908.*

**901.7 Fire areas.** Where buildings, or portions thereof, are divided into fire areas so as not to exceed the limits established for requiring a fire protection system in accordance with this chapter, such fire areas shall be separated by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, having a fire-resistance rating of not less than that determined in accordance with Section 707.3.10.

**901.8 Pump and riser room size.** Where provided, fire pump rooms and automatic sprinkler system riser rooms shall be designed with adequate space for all equipment necessary for the installation, as defined by the manufacturer, with sufficient working room around the stationary equipment. Clearances around equipment to elements of permanent construction, including other installed equipment and appliances, shall be sufficient to allow inspection, service, repair or replacement without removing such elements of permanent construction or disabling the function of a required fire-resistance-rated assembly. Fire pump and automatic sprinkler system riser rooms shall be provided with a door(s) and unobstructed passageway large enough to allow removal of the largest piece of equipment.

**901.9 Welding and brazing.** *Welding and brazing of all metallic fire protection piping shall be done in accordance with Section 313 of the mechanical code.*

## **SECTION 902 DEFINITIONS**

**902.1 Definitions.** The following terms are defined in Chapter 2:

**ALARM NOTIFICATION APPLIANCE.**  
**ALARM SIGNAL.**  
**ALARM VERIFICATION FEATURE.**  
**ANNUNCIATOR.**  
**AUDIBLE ALARM NOTIFICATION APPLIANCE.**  
**AUTOMATIC.**  
**AUTOMATIC FIRE-EXTINGUISHING SYSTEM.**  
**AUTOMATIC SMOKE DETECTION SYSTEM.**  
**AUTOMATIC SPRINKLER SYSTEM.**  
**AUTOMATIC WATER MIST SYSTEM.**  
**AVERAGE AMBIENT SOUND LEVEL.**  
**CARBON DIOXIDE EXTINGUISHING SYSTEMS.**  
**CEILING LIMIT.**  
**CLEAN AGENT.**  
**COMMERCIAL MOTOR VEHICLE.**  
**CONSTANTLY ATTENDED LOCATION.**  
**DELUGE SYSTEM.**  
**DETECTOR, HEAT.**  
**DRY-CHEMICAL EXTINGUISHING AGENT.**  
**ELECTRICAL CIRCUIT PROTECTIVE SYSTEM.**  
**ELEVATOR GROUP.**  
**EMERGENCY ALARM SYSTEM.**  
**EMERGENCY VOICE/ALARM COMMUNICATIONS.**  
**FIRE ALARM BOX, MANUAL.**  
**FIRE ALARM CONTROL UNIT.**  
**FIRE ALARM SIGNAL.**  
**FIRE ALARM SYSTEM.**  
**FIRE AREA.**  
**FIRE COMMAND CENTER.**  
**FIRE DETECTOR, AUTOMATIC.**  
**FIRE PROTECTION SYSTEM.**  
**FIRE SAFETY FUNCTIONS.**  
**FOAM-EXTINGUISHING SYSTEM.**  
**HALOGENATED EXTINGUISHING SYSTEM.**  
**INITIATING DEVICE.**  
**MANUAL FIRE ALARM BOX.**  
**MULTIPLE-STATION ALARM DEVICE.**

**MULTIPLE-STATION SMOKE ALARM.**  
**NOTIFICATION ZONE.**  
**NUISANCE ALARM.**  
**PRIVATE GARAGE.**  
**RECORD DRAWINGS.**  
**SINGLE-STATION SMOKE ALARM.**  
**SMOKE ALARM.**  
**SMOKE DETECTOR.**  
**SMOKEPROOF ENCLOSURE.**  
**STANDPIPE SYSTEM, CLASSES OF.**  
    **Class I system.**  
    **Class II system.**  
    **Class III system.**  
**STANDPIPE, TYPES OF.**  
    **Automatic dry.**  
    **Automatic wet.**  
    **Manual dry.**  
    **Manual wet.**  
    **Semiautomatic dry.**  
**SUPERVISING STATION.**  
**SUPERVISORY SERVICE.**  
**SUPERVISORY SIGNAL.**  
**SUPERVISORY SIGNAL-INITIATING DEVICE.**  
**TIRES, BULK STORAGE OF.**  
**TROUBLE SIGNAL.**  
**VISIBLE ALARM NOTIFICATION APPLIANCE.**  
**WET CHEMICAL EXTINGUISHING SYSTEM.**  
**WIRELESS PROTECTION SYSTEM.**  
**ZONE.**  
**ZONE, NOTIFICATION.**

## **SECTION 903**

### **AUTOMATIC SPRINKLER SYSTEMS**

**903.1 General.** Automatic sprinkler systems shall comply with this section.

**903.1.1 Alternative protection.** Alternative automatic fire-extinguishing systems complying with Section 904 shall be permitted instead of automatic sprinkler protection where recognized by the applicable standard and approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1.*

**903.2 Where required.** Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in Sections 903.2.1 through 903.2.12.

**Exception:** Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided those spaces or areas are equipped throughout with an automatic smoke detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or not less than 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

**903.2.1 Group A.** An automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section. For Group A-1, A-2, A-3 and A-4 occupancies, the automatic sprinkler system shall be provided throughout the story where the fire area containing the Group A-1, A-2, A-3 or A-4 occupancy is located, and throughout all stories from the Group A occupancy to, and including, the levels of exit discharge serving the Group A occupancy. For Group A-5 occupancies, the automatic sprinkler system shall be provided in the spaces indicated in Section 903.2.1.5.

**903.2.1.1 Group A-1.** An automatic sprinkler system shall be provided for fire areas containing Group A-1 occupancies and intervening floors of the building where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. The fire area contains a multi-theater complex.

**903.2.1.2 Group A-2.** An automatic sprinkler system shall be provided for fire areas containing Group A-2 occupancies and intervening floors of the building where one of the following conditions exists:

1. The fire area exceeds 5,000 square feet (464.5 m<sup>2</sup>).
2. The fire area has an occupant load of 100 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.

**903.2.1.3 Group A-3.** An automatic sprinkler system shall be provided for fire areas containing Group A-3 occupancies and intervening floors of the

building where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).

**Exception:**

1.1 *Fire areas used exclusively for religious worship services with fixed seating.*

2. The fire area has an occupant load of 300 or more.

**Exception:**

2.1 *Fire areas used primarily for worship with fixed seating.*

2.2 *Fire areas without fixed seating not used for exhibition or display; or*

3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.

**Exception:** *Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.*

**903.2.1.4 Group A-4.** An automatic sprinkler system shall be provided for fire areas containing Group A-4 occupancies and intervening floors of the building where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.

**Exception:** *Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.*

**903.2.1.5 Group A-5.** An automatic sprinkler system shall be provided for Group A-5 occupancies in the following areas: concession stands, retail areas, press boxes and other accessory use areas in excess of 1,000 square feet (93 m<sup>2</sup>).

**903.2.1.6 Assembly occupancies on roofs.** Where an occupied roof has an assembly occupancy with an occupant load exceeding 100 for Group A-2 and 300 for other Group A occupancies, all floors between the occupied roof and the level of exit discharge shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.

**Exception:** Open parking garages of Type I or Type II construction.

**903.2.1.7 Multiple fire areas.** An automatic sprinkler system shall be provided where multiple fire areas of Group A-1, A-2, A-3 or A-4 occupancies share exit or exit access components and the combined occupant load of these fire areas is 300 or more.

**903.2.2 Ambulatory care facilities.** An automatic sprinkler system shall be installed throughout the entire floor containing an ambulatory care facility where either of the following conditions exist at any time:

1. Four or more care recipients are incapable of self-preservation, whether rendered incapable by staff or staff has accepted responsibility for care recipients already incapable.
2. One or more care recipients that are incapable of self-preservation are located at other than the level of exit discharge serving such a facility. In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor where such care is provided as well as all floors below, and all floors between the level of ambulatory care and the nearest level of exit discharge, including the level of exit discharge.

**903.2.3 Group E.** An automatic sprinkler system shall be provided for Group E occupancies as follows:

1. Throughout all Group E fire areas greater than 20,000 square feet (1115 m<sup>2</sup>) in area.
2. Throughout every portion of educational buildings below the lowest level of exit discharge serving that portion of the building.

**Exception:** An automatic sprinkler system is not required in any area below the lowest level of exit discharge serving that area where every classroom throughout the building has *no* fewer than one exterior exit door at ground level.

3. *Throughout every portion of Group E day care facilities - 2 ½ years or less of age.*

**Exception:** *An automatic sprinkler system is not required in day care facilities that provide care for more than five but no more than 100 children 2 ½ years or less of age and the day care facilities are at the level of exit discharge and where every room where care is provided has no fewer than one exterior exit door for which the exit access and exit discharge do not require the traversing of stairs.*

**903.2.4 Group F-1.** An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. A Group F-1 fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. A Group F-1 fire area is located more than three stories above grade plane.



3. The combined area of all Group F-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m<sup>2</sup>).
4. A Group F-1 occupancy used for the manufacture of upholstered furniture or mattresses exceeds 8000 square feet (232 m<sup>2</sup>).

**903.2.4.1 Woodworking operations.** An automatic sprinkler system shall be provided throughout all Group F-1 occupancy fire areas that contain woodworking operations in excess of 2,500 square feet (232 m<sup>2</sup>) in area that generate finely divided combustible waste or use finely divided combustible materials.

**903.2.5 Group H.** Automatic sprinkler systems shall be provided in high-hazard occupancies as required in Sections 903.2.5.1 through 903.2.5.3.

**903.2.5.1 General.** An automatic sprinkler system shall be installed in Group H occupancies.

**903.2.5.2 Group H-5 occupancies.** An automatic sprinkler system shall be installed throughout buildings containing Group H-5 occupancies. The design of the sprinkler system shall be not less than that required by this code for the occupancy hazard classifications in accordance with Table 903.2.5.2.

Where the design area of the sprinkler system consists of a corridor protected by one row of sprinklers, the maximum number of sprinklers required to be calculated is 13.

**903.2.5.3 Pyroxylin plastics.** An automatic sprinkler system shall be provided in buildings, or portions thereof, where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg).

**TABLE 903.2.5.2  
GROUP H-5 SPRINKLER DESIGN CRITERIA**

LOCATION	OCCUPANCY HAZARD CLASSIFICATION
Fabrication areas	Ordinary Hazard Group 2
Service corridors	Ordinary Hazard Group 2
Storage rooms without dispensing	Ordinary Hazard Group 2
Storage rooms with dispensing	Extra Hazard Group 2
Corridors	Ordinary Hazard Group 2

**903.2.6 Group I.** An automatic sprinkler system shall be provided throughout buildings with a Group I fire area.

**Exceptions:**

1. An automatic sprinkler system installed in accordance with Section 903.3.1.2 or 903.3.1.3 shall be permitted in Group I-1 Condition 1 facilities.
2. An automatic sprinkler system is not required where Group I-4 day care facilities are at the level of exit discharge and where every room where care is provided has *no* fewer than one exterior exit door *for which the exit access and exit discharge do not require the traversing of stairs*.
3. In buildings where Group I-4 day care is provided on levels other than the level of exit discharge, an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 shall be installed on the entire floor where care is provided, all floors between the level of care and the level of exit discharge, and all floors below the level of exit discharge other than areas classified as an open parking garage.

**903.2.7 Group M.** An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

1. A Group M fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. A Group M fire area is located more than three stories above grade plane.
3. The combined area of all Group M fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m<sup>2</sup>).
4. A Group M occupancy *greater than 8000 square feet (464 m<sup>2</sup>)* is used for the display and sale of upholstered furniture or mattresses.

**903.2.7.1 High-piled storage.** An automatic sprinkler system shall be provided in accordance with the *fire code* in all buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

**903.2.8 Group R.** An automatic sprinkler system installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area.

**Exception: Group R-2.** *An automatic sprinkler system is not required in buildings of Group R-2 permitted to have a single exit per Section 1006.3.2 where:*

1. *The building is not used as an "SRO" occupancy as defined in Chapter 2, and*

2. *The exit is constructed as an exterior exit stairway per Section 1027, and*
3. *The dwelling units egress directly into an exit, and*
4. *Two hour fire barriers divide the building into fire areas with a maximum of two dwelling units per floor and not more than six dwelling units per fire area, and*
5. *All dwelling units in the fire area must have separations as required by Section 708.1 for dwelling units, and*
6. *The building is limited to a basement and two stories above grade plane, and*
7. *The building contains no more than four dwelling units per floor and no more than twelve dwelling units per building.*

**903.2.8.1 Group R-3.** An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-3 occupancies.

**903.2.8.2 Group R-4 Condition 1.** An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-4 Condition 1 occupancies.

**903.2.8.3 Group R-4 Condition 2.** An automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be permitted in Group R-4 Condition 2 occupancies. Attics shall be protected in accordance with Section 903.2.8.3.1 or 903.2.8.3.2.

**903.2.8.3.1 Attics used for living purposes, storage or fuel-fired equipment.** Attics used for living purposes, storage or fuel-fired equipment shall be protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2.

**903.2.8.3.2 Attics not used for living purposes, storage or fuel-fired equipment.** Attics not used for living purposes, storage or fuel-fired equipment shall be protected in accordance with one of the following:

1. Attics protected throughout by a heat detector system arranged to activate the building fire alarm system in accordance with Section 907.2.10.
2. Attics constructed of noncombustible materials.
3. Attics constructed of fire-retardant-treated wood framing complying with Section 2303.2.

4. The automatic sprinkler system shall be extended to provide protection throughout the attic space.

**903.2.8.4 Care facilities.** An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in care facilities with five or fewer individuals in a single-family dwelling.

**903.2.9 Group S-1.** An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1 fire area exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. A Group S-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group S-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m<sup>2</sup>).
4. A Group S-1 fire area used for the storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m<sup>2</sup>).
5. A Group S-1 occupancy used for the storage of upholstered furniture or mattresses exceeds 8000 square feet (232 m<sup>2</sup>).

**903.2.9.1 Repair garages.** An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with Section 406, as shown:

1. Buildings having two or more stories above grade plane, including basements, with a fire area containing a repair garage exceeding 10,000 square feet (929 m<sup>2</sup>).
2. Buildings not more than one story above grade plane, with a fire area containing a repair garage exceeding 12,000 square feet (1115 m<sup>2</sup>).
3. Buildings with repair garages servicing vehicles parked in basements.
4. A Group S-1 fire area used for the repair of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m<sup>2</sup>).

**903.2.9.2 Bulk storage of tires.** Buildings and structures where the area for the storage of tires exceeds 20,000 cubic feet (566 m<sup>3</sup>) shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**903.2.10 Group S-2 enclosed parking garages.** An automatic sprinkler system shall be provided throughout buildings classified as enclosed parking

garages in accordance with Section 406.6 where either of the following conditions exists:

1. Where the fire area of the enclosed parking garage exceeds 12,000 square feet (1115 m<sup>2</sup>).
2. Where the enclosed parking garage is located beneath other groups.

**Exception:** Enclosed parking garages located beneath Group R-3 occupancies.

**903.2.10.1 Commercial parking garages.** An automatic sprinkler system shall be provided throughout buildings used for storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m<sup>2</sup>).

**903.2.11 Specific building areas and hazards.** In all occupancies other than Group U, an automatic sprinkler system shall be installed for building design or hazards in the locations set forth in Sections 903.2.11.1 through 903.2.11.6.

**903.2.11.1 Stories without openings.** An automatic sprinkler system shall be installed throughout all stories, including basements, of all buildings where the floor area exceeds 1,500 square feet (139.4 m<sup>2</sup>) and where there is not provided not fewer than one of the following types of exterior wall openings:

1. Openings below grade that lead directly to ground level by an exterior stairway complying with Section 1011 or an outside ramp complying with Section 1012. Openings shall be located in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm).
2. Openings entirely above the adjoining ground level totaling not less than 20 square feet (1.86 m<sup>2</sup>) in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm). The height of the bottom of the clear opening shall not exceed 44 inches (1118 mm) measured from the floor.

**903.2.11.1.1 Opening dimensions and access.** Openings shall have a minimum dimension of not less than 30 inches (762 mm). Such openings shall be accessible to the fire department from the exterior and shall not be obstructed in a manner such that firefighting or rescue cannot be accomplished from the exterior.

**903.2.11.1.2 Openings on one side only.** Where openings in a story are provided on only one side and the opposite wall of such story is more than 75 feet (22 860 mm) from such openings, the story shall be equipped throughout with an approved automatic sprinkler system, or openings as specified above shall be provided on not fewer than two sides of the story.

**903.2.11.1.3 Basements.** Where any portion of a basement is located more than 75 feet (22 860 mm) from openings required by Section 903.2.11.1, the basement shall be equipped throughout with an approved automatic sprinkler system.

**903.2.11.2 Rubbish and linen chutes.** An automatic sprinkler system shall be installed at the top of rubbish and linen chutes and in their terminal rooms. Chutes shall have additional sprinkler heads installed at alternate floors and at the lowest intake. Where a rubbish chute extends through a building more than one floor below the lowest intake, the extension shall have sprinklers installed that are recessed from the drop area of the chute and protected from freezing in accordance with Section 903.3.1.1. Such sprinklers shall be installed at alternate floors, beginning with the second level below the last intake and ending with the floor above the discharge. Chute sprinklers shall be accessible for servicing.

**903.2.11.3 Buildings 55 feet or more in height.** An automatic sprinkler system shall be installed throughout buildings that have one or more stories with an occupant load of 30 or more located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access, measured to the finished floor.

**Exceptions:**

1. Open parking structures.
2. Occupancies in Group F-2.

**903.2.11.4 Ducts conveying hazardous exhausts.** Where required by the *mechanical code*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust or flammable or combustible materials.

**Exception:** Ducts where the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).

**903.2.11.5 Commercial cooking operations.** An automatic sprinkler system shall be installed in commercial kitchen exhaust hood and duct

systems where an automatic sprinkler system is used to comply with Section 904.

**903.2.11.6 Other required suppression systems.** In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.11.6 require the installation of a fire suppression system for certain buildings and areas.

**903.2.12 During construction.** Automatic sprinkler systems required during construction, alteration and demolition operations shall be provided in accordance with *Section 3312*.

**903.3 Installation requirements.** Automatic sprinkler systems shall be designed and installed in accordance with Sections 903.3.1 through 903.3.8.

**TABLE 903.2.11.6  
ADDITIONAL REQUIRED SUPPRESSION SYSTEMS**

SECTION	SUBJECT
402.5, 402.6.2	Covered and open mall buildings
403.3	High-rise buildings
404.3	Atriums
405.3	Underground structures
407.6	Group I-2
410.7	Stages
411.4	Special amusement buildings
412.3.6	Airport traffic control towers
412.4.6, 412.4.6.1, 412.6.5	Aircraft hangars
415.11.11	Group H-5 HPM exhaust ducts
416.5	Flammable finishes
417.4	Drying rooms
419.5	Live/work units
424.3	Children's play structures
507	Unlimited area buildings
509.4	Incidental uses
1029.6.2.3	Smoke-protected assembly seating
IFC	Sprinkler system requirements as set forth in Section 903.2.11.6 of the <i>fire code</i>

**903.3.1 Standards.** Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1 unless otherwise permitted by Sections 903.3.1.2 and 903.3.1.3 and other chapters of this code, as applicable.

**903.3.1.1 NFPA 13 sprinkler systems.** Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Sections 903.3.1.1.1 and 903.3.1.1.2.

**903.3.1.1.1 Exempt locations.** Automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an approved automatic fire detection system in accordance with Section 907.2 that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from a room merely because it is damp, of fire-resistance-rated construction or contains electrical equipment.

1. A room where the application of water, or flame and water, constitutes a serious life or fire hazard.
2. A room or space where sprinklers are considered undesirable because of the nature of the contents, where approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1.*
3. Generator and transformer rooms separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire-resistance rating of not less than 2 hours.
4. Rooms or areas that are of noncombustible construction with wholly noncombustible contents.
5. Fire service access elevator machine rooms and machinery spaces.
6. Machine rooms, machinery spaces, control rooms and control spaces associated with occupant evacuation elevators designed in accordance with Section 3008.

**903.3.1.1.2 Bathrooms.** In Group R occupancies, other than Group R-4 occupancies, sprinklers shall not be required in bathrooms that do not exceed 55 square feet (5 m<sup>2</sup>) in area and are located within individual dwelling units or sleeping units, provided that walls and ceilings, including the walls and ceilings behind a shower enclosure or tub, are



of noncombustible or limited-combustible materials with a 15-minute thermal barrier rating.

**903.3.1.2 NFPA 13R sprinkler systems.** Automatic sprinkler systems in *Groups I-1, I-4 and R* occupancies up to and including four stories in height in buildings not exceeding 60 feet (18 288 mm) in height above grade plane shall be permitted to be installed throughout in accordance with NFPA 13R. The number of stories of Group R occupancies constructed in accordance with Sections 510.2 and 510.4 shall be measured from the horizontal assembly creating separate buildings.

**903.3.1.2.1 Balconies and decks.** Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios of dwelling units and sleeping units where the building is of Type V construction, provided there is a roof or deck above. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies and decks that are constructed of open wood joist construction.

**903.3.1.2.2 Open-ended corridors.** Sprinkler protection shall be provided in open-ended corridors and associated exterior stairways and ramps as specified in Section 1027.6, Exception 3.

**903.3.1.3 NFPA 13D sprinkler systems.** Automatic sprinkler systems installed in *buildings of Groups I-1, R-3, Group R-4 Condition 1 and townhouses* shall be permitted to be installed throughout in accordance with NFPA 13D.

**903.3.2 Quick-response and residential sprinklers.** Where automatic sprinkler systems are required by this code, quick-response or residential automatic sprinklers shall be installed in all of the following areas in accordance with Section 903.3.1 and their listings:

1. Throughout all spaces within a smoke compartment containing care recipient sleeping units in Group I-2 in accordance with this code.
2. Throughout all spaces within a smoke compartment containing treatment rooms in ambulatory care facilities.
3. Dwelling units and sleeping units in Group I-1 and R occupancies.
4. Light-hazard occupancies as defined in NFPA 13.

**903.3.3 Obstructed locations.** Automatic sprinklers shall be installed with due regard to obstructions that will delay activation or obstruct the water distribution pattern. Automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands, or equipment that exceeds 4 feet (1219 mm) in width. Not less than a 3 foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of combustible fibers.

**Exception:** Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with Section 904.

**903.3.4 Actuation.** Automatic sprinkler systems shall be automatically actuated unless specifically provided for in this code.

**903.3.5 Water supplies.** Water supplies for automatic sprinkler systems shall comply with this section and the standards referenced in Section 903.3.1. The potable water supply shall be protected against backflow in accordance with the requirements of this section and the *plumbing code*. For connections to public waterworks systems, the water supply test used for design of fire protection systems shall be adjusted to account for seasonal and daily pressure fluctuations based on information from the water supply authority and as approved by the *building* official.

**903.3.5.1 Domestic services.** Where the domestic service provides the water supply for the automatic sprinkler system, the supply shall be in accordance with this section.

**903.3.5.2 Residential combination services.** A single combination water supply shall be allowed provided that the domestic demand is added to the sprinkler demand as required by NFPA 13R.

**903.3.6 Hose threads.** Fire hose threads and fittings used in connection with automatic sprinkler systems shall be *approved and compatible with the responding fire department hose threads* as prescribed by the *local* fire official. *Prior to issuance of the certificate of plan approval, the building official shall communicate with the local fire official to verify that the proposed threads are compatible with those currently used by the fire department.*

**903.3.7 Fire department connections.** Fire department connections for automatic sprinkler systems shall be installed in accordance with Section 912.

**903.3.8 Limited area sprinkler systems.** Limited area sprinkler systems shall

be in accordance with the standards listed in Section 903.3.1 except as provided in Sections 903.3.8.1 through 903.3.8.5.

**903.3.8.1 Number of sprinklers.** Limited area sprinkler systems shall not exceed *nineteen* sprinklers in any single fire area.

**903.3.8.2 Occupancy hazard classification.** Only areas classified by NFPA 13 as Light Hazard or Ordinary Hazard Group 1 shall be permitted to be protected by limited area sprinkler systems.

**903.3.8.3 Piping arrangement.** Where a limited area sprinkler system is installed in a building with an automatic wet standpipe system, sprinklers shall be supplied by the standpipe system. Where a limited area sprinkler system is installed in a building without an automatic wet standpipe system, water shall be permitted to be supplied by the plumbing system provided that the plumbing system is capable of simultaneously supplying domestic and sprinkler demands.

**903.3.8.4 Supervision.** Control valves shall not be installed between the water supply and sprinklers unless the valves are of an approved indicating type that are supervised or secured in the open position.

**903.3.8.5 Calculations.** Hydraulic calculations in accordance with NFPA 13 shall be provided to demonstrate that the available water flow and pressure are adequate to supply all sprinklers installed in any single fire area with discharge densities corresponding to the hazard classification.

**903.4 Sprinkler system supervision and alarms.** Valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures and waterflow switches on all sprinkler systems shall be electrically supervised by a listed fire alarm control unit.

**Exceptions:**

1. *Deleted.*
2. Limited area sprinkler systems in accordance with Section 903.3.8.
3. Automatic sprinkler systems installed in accordance with NFPA 13R where a common supply main is used to supply both domestic water and the automatic sprinkler system, and a separate shutoff valve for the automatic sprinkler system is not provided.
4. Jockey pump control valves that are sealed or locked in the open position.
5. Control valves to commercial kitchen hoods, paint spray booths or dip tanks that are sealed or locked in the open position.

6. Valves controlling the fuel supply to fire pump engines that are sealed or locked in the open position.
7. Trim valves to pressure switches in dry, preaction and deluge sprinkler systems that are sealed or locked in the open position.

**903.4.1 Monitoring.** Alarm, supervisory and trouble signals shall be distinctly different and shall be automatically transmitted to an approved supervising station or, where approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1*, shall sound an audible signal at a constantly attended location.

**Exceptions:**

1. Underground key or hub valves in roadway boxes provided by the municipality or public utility are not required to be monitored.
2. Backflow prevention device test valves located in limited area sprinkler system supply piping shall be locked in the open position. In occupancies required to be equipped with a fire alarm system, the backflow preventer valves shall be electrically supervised by a tamper switch installed in accordance with NFPA 72 and separately annunciated.

**903.4.2 Alarms.** An approved audible device, located on the exterior of the building in an approved location, shall be connected to each automatic sprinkler system. Such sprinkler waterflow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system.

**Exception:** *Waterflow alarms are not required for limited area sprinkler system installed in accordance with Section 903.3.8.*

**903.4.3 Floor control valves.** Approved supervised indicating control valves shall be provided at the point of connection to the riser on each floor in high-rise buildings.

**903.5 Testing and maintenance.** Sprinkler systems shall be tested and maintained in accordance with the *fire code*.

## SECTION 904

### ALTERNATIVE AUTOMATIC FIRE-EXTINGUISHING SYSTEMS

**904.1 General.** Automatic fire-extinguishing systems, other than automatic sprinkler systems, shall be designed, installed, inspected, tested and maintained in

accordance with the provisions of this section and the applicable referenced standards.

**904.2 Where permitted.** Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1.*

**904.2.1 Restriction on using automatic sprinkler system exceptions or reductions.** Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed for automatic sprinkler systems or by other requirements of this code.

**904.2.2 Commercial hood and duct systems.** Each required commercial kitchen exhaust hood and duct system required by Chapter 5 of the *mechanical code* to have a Type I hood shall be protected with an approved automatic fire-extinguishing system installed in accordance with this code.

**904.3 Installation.** Automatic fire-extinguishing systems shall be installed in accordance with this section.

**904.3.1 Electrical wiring.** Electrical wiring shall be in accordance with NFPA 70.

**904.3.2 Actuation.** Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with Section 904.12.1.

**904.3.3 System interlocking.** Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire-extinguishing system shall be provided as required by the design and installation standard utilized for the hazard.

**904.3.4 Alarms and warning signs.** Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible and visible alarms and warning signs shall be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with

Section 907.5.2.

**904.3.5 Monitoring.** Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with NFPA 72.

**904.4 Inspection and testing.** Automatic fire-extinguishing systems shall be inspected and tested in accordance with the provisions of this section prior to acceptance.

**904.4.1 Inspection.** Prior to conducting final acceptance tests, all of the following items shall be inspected:

1. Hazard specification for consistency with design hazard.
2. Type, location and spacing of automatic- and manual-initiating devices.
3. Size, placement and position of nozzles or discharge orifices.
4. Location and identification of audible and visible alarm devices.
5. Identification of devices with proper designations.
6. Operating instructions.

**904.4.2 Alarm testing.** Notification appliances, connections to fire alarm systems and connections to approved supervising stations shall be tested in accordance with this section and Section 907 to verify proper operation.

**904.4.2.1 Audible and visible signals.** The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, shall be verified.

**904.4.3 Monitor testing.** Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarms from automatic fire-extinguishing systems.

**904.5 Wet-chemical systems.** Wet-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 17A and their listing. Records of inspections and testing shall be maintained.

**904.6 Dry-chemical systems.** Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 17 and their listing. Records of inspections and testing shall be maintained.

**904.7 Foam systems.** Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 11 and NFPA 16 and

their listing. Records of inspections and testing shall be maintained.

**904.8 Carbon dioxide systems.** Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 12 and their listing. Records of inspections and testing shall be maintained.

**904.9 Halon systems.** Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 12A and their listing. Records of inspections and testing shall be maintained.

**904.10 Clean-agent systems.** Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 2001 and their listing. Records of inspections and testing shall be maintained.

**904.11 Automatic water mist systems.** Automatic water mist systems shall be permitted in applications that are consistent with the applicable listing or approvals and shall comply with Sections 904.11.1 through 904.11.3.

**904.11.1 Design and installation requirements.** Automatic water mist systems shall be designed and installed in accordance with Sections 904.11.1.1 through 904.11.1.4.

**904.11.1.1 General.** Automatic water mist systems shall be designed and installed in accordance with NFPA 750 and the manufacturer's instructions.

**904.11.1.2 Actuation.** Automatic water mist systems shall be automatically actuated.

**904.11.1.3 Water supply protection.** Connections to a potable water supply shall be protected against backflow in accordance with the *plumbing code*.

**904.11.1.4 Secondary water supply.** Where a secondary water supply is required for an automatic sprinkler system, an automatic water mist system shall be provided with an approved secondary water supply.

**904.11.2 Water mist system supervision and alarms.** Supervision and alarms shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.

**904.11.2.1 Monitoring.** Monitoring shall be provided as required for

automatic sprinkler systems in accordance with Section 903.4.1.

**904.11.2.2 Alarms.** Alarms shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.2.

**904.11.2.3 Floor control valves.** Floor control valves shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.3.

**904.11.3 Testing and maintenance.** Automatic water mist systems shall be tested and maintained in accordance with the *fire code*.

**904.12 Commercial cooking systems.** The automatic fire-extinguishing system for commercial cooking systems shall be of a type recognized for protection of commercial cooking equipment and exhaust systems of the type and arrangement protected. Pre-engineered automatic dry- and wet-chemical extinguishing systems shall be tested in accordance with UL 300 and listed and labeled for the intended application. Other types of automatic fire-extinguishing systems shall be listed and labeled for specific use as protection for commercial cooking operations. The system shall be installed in accordance with this code, its listing and the manufacturer's installation instructions. Automatic fire-extinguishing systems of the following types shall be installed in accordance with the referenced standard indicated, as follows:

1. Carbon dioxide extinguishing systems, NFPA 12.
2. Automatic sprinkler systems, NFPA 13.
3. Foam-water sprinkler system or foam-water spray systems, NFPA 16.
4. Dry-chemical extinguishing systems, NFPA 17.
5. Wet-chemical extinguishing systems, NFPA 17A.

**Exception:** Factory-built commercial cooking recirculating systems that are tested in accordance with UL 710B and listed, labeled and installed in accordance with Section 304.1 of the *mechanical code*.

**904.12.1 Manual system operation.** A manual actuation device shall be located at or near a means of egress from the cooking area not less than 10 feet (3048 mm) and not more than 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be installed not more than 48 inches (1200 mm) or less than 42 inches (1067 mm) above the floor and shall clearly identify the hazard protected. The manual actuation shall require a maximum force of 40 pounds (178 N) and a maximum movement of 14 inches (356 mm) to actuate the fire suppression system.

**Exception:** Automatic sprinkler systems shall not be required to be



equipped with manual actuation means.

**904.12.2 System interconnection.** The actuation of the fire suppression system shall automatically shut down the fuel or electrical power supply to the cooking equipment. The fuel and electrical supply reset shall be manual.

**904.12.3 Carbon dioxide systems.** Where carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). Dampers shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect against all hazards venting through a common duct simultaneously.

**904.12.3.1 Ventilation system.** Commercial-type cooking equipment protected by an automatic carbon dioxide-extinguishing system shall be arranged to shut off the ventilation system upon activation.

**904.12.4 Special provisions for automatic sprinkler systems.** Automatic sprinkler systems protecting commercial-type cooking equipment shall be supplied from a separate, readily accessible, indicating-type control valve that is identified.

**904.12.4.1 Listed sprinklers.** Sprinklers used for the protection of fryers shall be tested in accordance with UL 199E, listed for that application and installed in accordance with their listing.

**904.13 Domestic cooking systems in Group I-2 Condition 1.** In Group I-2 Condition 1, occupancies where cooking facilities are installed in accordance with Section 407.2.6 of this code, the domestic cooking hood provided over the cooktop or range shall be equipped with an automatic fire-extinguishing system of a type recognized for protection of domestic cooking equipment. Pre-engineered automatic extinguishing systems shall be tested in accordance with UL 300A and listed and labeled for the intended application. The system shall be installed in accordance with this code, its listing and the manufacturer's instructions.

**904.13.1 Manual system operation and interconnection.** Manual actuation and system interconnection for the hood suppression system shall be installed

in accordance with Sections 904.12.1 and 904.12.2, respectively.

**904.13.2 Portable fire extinguishers for domestic cooking equipment in Group I-2 Condition 1.** A portable fire extinguisher complying with Section 906 shall be installed within a 30-foot (9144 mm) distance of travel from domestic cooking appliances.

**904.14 Aerosol fire-extinguishing systems.** *Aerosol fire-extinguishing systems shall be installed, periodically inspected, tested and maintained in accordance with Sections 901 and 904.4, NFPA 2010, and in accordance with their listing.*

*Such devices and appurtenances shall be listed and installed in compliance with manufacturer's instructions.*

## **SECTION 905 STANDPIPE SYSTEMS**

**905.1 General.** Standpipe systems shall be provided in new buildings and structures in accordance with Sections 905.2 through 905.10. In buildings used for high-piled combustible storage, fire protection shall be in accordance with the *fire code*.

**905.2 Installation standard.** Standpipe systems shall be installed in accordance with this section and NFPA 14. Fire department connections for standpipe systems shall be in accordance with Section 912.

**905.3 Required installations.** Standpipe systems shall be installed *when* required by Sections 905.3.1 through 905.3.8. *Where these systems are installed, the hose connections shall be installed in the locations indicated in Section 905.4, 905.5, and 905.6.* Standpipe systems are allowed to be combined with automatic sprinkler systems.

**Exception:** Standpipe systems are not required in Group R-3 occupancies.

**905.3.1 Height.** Class III standpipe systems shall be installed throughout buildings where the floor level of the highest story is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access, or where the floor level of the lowest story is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access.

**Exceptions:**

1. Class I standpipes are allowed in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Class I manual standpipes are allowed in open parking garages where the highest floor is located not more than 150 feet (45 720 mm) above the lowest level of fire department vehicle access.
3. Class I manual dry standpipes are allowed in open parking garages that are subject to freezing temperatures, provided that the hose connections are located as required for Class II standpipes in accordance with Section 905.5.
4. Class I standpipes are allowed in basements equipped throughout with an automatic sprinkler system.
5. In determining the lowest level of fire department vehicle access, it shall not be required to consider either of the following:
  - 5.1. Recessed loading docks for four vehicles or less.
  - 5.2. Conditions where topography makes access from the fire department vehicle to the building impractical or impossible.

**905.3.2 Group A.** Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an occupant load exceeding 1,000 persons.

**Exceptions:**

1. Open-air-seating spaces without enclosed spaces.
2. Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are allowed in buildings that are not high-rise buildings.

**905.3.3 Covered and open mall buildings.** Covered mall and open mall buildings shall be equipped throughout with a standpipe system where required by Section 905.3.1. Mall buildings not required to be equipped with a standpipe system by Section 905.3.1 shall be equipped with Class I hose connections connected to the automatic sprinkler system sized to deliver water at 250 gallons per minute (946.4 L/min) at the most hydraulically remote hose connection while concurrently supplying the automatic sprinkler system demand. The standpipe system shall be designed to not exceed a 50 pounds per square inch (psi) (345 kPa) residual pressure loss with a flow of 250 gallons per minute (946.4 L/min) from the fire department connection to the hydraulically most remote hose connection. Hose connections shall be provided at each of the following locations:

1. Within the mall at the entrance to each exit passageway or corridor.
2. At each floor-level landing within interior exit stairways opening directly on the mall.
3. At exterior public entrances to the mall of a covered mall building.

4. At public entrances at the perimeter line of an open mall building.
5. At other locations as necessary so that the distance to reach all portions of a tenant space does not exceed 200 feet (60 960 mm) from a hose connection.

**905.3.4 Stages.** Stages greater than 1,000 square feet in area (93 m<sup>2</sup>) shall be equipped with a Class III wet standpipe system with 1½-inch and 2½-inch (38 mm and 64 mm) hose connections on each side of the stage.

**Exception:** Where the building or area is equipped throughout with an automatic sprinkler system, a 1½-inch (38 mm) hose connection shall be installed in accordance with NFPA 13 or in accordance with NFPA 14 for Class II or III standpipes.

**905.3.4.1 Hose and cabinet.** The 1½-inch (38 mm) hose connections shall be equipped with sufficient lengths of 1½-inch (38 mm) hose to provide fire protection for the stage area. Hose connections shall be equipped with an approved adjustable fog nozzle and be mounted in a cabinet or on a rack.

**905.3.5 Underground buildings.** Underground buildings shall be equipped throughout with a Class I automatic wet or manual wet standpipe system.

**905.3.6 Helistops and heliports.** Buildings with a rooftop helistop or heliport shall be equipped with a Class I or III standpipe system extended to the roof level on which the helistop or heliport is located in accordance with Section 2007.5 of the *fire code*.

**905.3.7 Marinas and boatyards.** *Deleted.*

**905.3.8 Rooftop gardens and landscaped roofs.** Buildings or structures that have rooftop gardens or landscaped roofs and that are equipped with a standpipe system shall have the standpipe system extended to the roof level on which the rooftop garden or landscaped roof is located.

**905.4 Location of Class I standpipe hose connections.** Class I standpipe hose connections shall be provided in all of the following locations:

1. In every required interior exit stairway, a hose connection shall be provided for each story above and below grade. Hose connections shall be located at an intermediate landing between stories, unless otherwise approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1.*
2. On each side of the wall adjacent to the exit opening of a horizontal exit.

**Exception:** Where floor areas adjacent to a horizontal exit are reachable from an interior exit stairway hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose, a hose connection shall not be required at the horizontal exit.

3. In every exit passageway, at the entrance from the exit passageway to other areas of a building.

**Exception:** Where floor areas adjacent to an exit passageway are reachable from an interior exit stairway hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose, a hose connection shall not be required at the entrance from the exit passageway to other areas of the building.

4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall. In open mall buildings, adjacent to each public entrance to the mall at the perimeter line and adjacent to each entrance from an exit passageway or exit corridor to the mall.
5. Where the roof has a slope less than four units vertical in 12 units horizontal (33.3-percent slope), a hose connection shall be located to serve the roof or at the highest landing of an interior exit stairway with access to the roof provided in accordance with Section 1011.12.
6. Where the most remote portion of a nonsprinklered floor or story is more than 150 feet (45 720 mm) from a hose connection or the most remote portion of a sprinklered floor or story is more than 200 feet (60 960 mm) from a hose connection, the *building official, upon request from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1*, is authorized to require that additional hose connections be provided in locations *as requested by the fire official*.

**905.4.1 Protection.** Risers and laterals of Class I standpipe systems not located within an interior exit stairway shall be protected by a degree of fire-resistance equal to that required for vertical enclosures in the building in which they are located.

**Exception:** In buildings equipped throughout with an approved automatic sprinkler system, laterals that are not located within an interior exit stairway are not required to be enclosed within fire-resistance-rated construction.

**905.4.2 Interconnection.** In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

**905.5 Location of Class II standpipe hose connections.** Class II standpipe hose connections shall be accessible and located so that all portions of the building are

within 30 feet (9144 mm) of a nozzle attached to 100 feet (30 480 mm) of hose.

**905.5.1 Groups A-1 and A-2.** In Group A-1 and A-2 occupancies having occupant loads exceeding 1,000 persons, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.

**905.5.2 Protection.** Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

**905.5.3 Class II system 1-inch hose.** A minimum 1 inch (25 mm) hose shall be allowed to be used for hose stations in light-hazard occupancies where investigated and listed for this service and where approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1.*

**905.6 Location of Class III standpipe hose connections.** Class III standpipe systems shall have hose connections located as required for Class I standpipes in Section 905.4 and shall have Class II hose connections as required in Section 905.5.

**905.6.1 Protection.** Risers and laterals of Class III standpipe systems shall be protected as required for Class I systems in accordance with Section 905.4.1.

**905.6.2 Interconnection.** In buildings where more than one Class III standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

**905.7 Cabinets.** Cabinets containing fire-fighting equipment such as standpipes, fire hoses, fire extinguishers or fire department valves shall not be blocked from use or obscured from view.

**905.7.1 Cabinet equipment identification.** Cabinets shall be identified in an approved manner by a permanently attached sign with letters not less than 2 inches (51 mm) high in a color that contrasts with the background color, indicating the equipment contained therein.

**Exceptions:**

1. Doors not large enough to accommodate a written sign shall be marked with a permanently attached pictogram of the equipment contained therein.
2. Doors that have either an approved visual identification clear glass panel or a complete glass door panel are not required to be marked.

**905.7.2 Locking cabinet doors.** Cabinets shall be unlocked.

**Exceptions:**

1. Visual identification panels of glass or other approved transparent frangible material that is easily broken and allows access.
2. Approved locking arrangements.
3. Group I-3.

**905.8 Dry standpipes.** Dry standpipes shall not be installed.

**Exception:** Where subject to freezing and in accordance with NFPA 14.

**905.9 Valve supervision.** Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by Section 903.4. Where a fire alarm system is provided, a signal shall be transmitted to the control unit.

**Exceptions:**

1. Valves to underground key or hub valves in roadway boxes provided by the municipality or public utility do not require supervision.
2. Valves locked in the normal position and inspected as provided in this code in buildings not equipped with a fire alarm system.

**905.10 During construction.** Standpipe systems required during construction and demolition operations shall be provided in accordance with Section 3311.

## SECTION 906 PORTABLE FIRE EXTINGUISHERS

**906.1 Where required.** Portable fire extinguishers shall be installed in all of the following locations:

1. In Group A, B, E, F, H, I, M, R-1, R-2, R-4 and S occupancies.

**Exceptions:**

*1.1 In Group R-2 occupancies, portable fire extinguishers shall be required only in locations specified in Items 2 through 6 where each dwelling unit is provided with a portable fire extinguisher having a minimum rating of 1-A:10-B:C.*

*1.2 In Group E occupancies, portable fire extinguishers shall be required only in locations specified in Items 2 through 6 where each classroom is provided with a portable fire extinguisher having a minimum rating of 2-A:20-B:C.*

2. Within 30 feet (9144 mm) of commercial cooking appliances and domestic cooking appliances in Group I-2 nursing homes.

3. In areas where flammable or combustible liquids are stored, used or dispensed.
4. On each floor of structures under construction, except Group R-3 occupancies, in accordance with Section 3315.1 of the *fire code*.
5. Where required by the *fire code* sections indicated in Table 906.1.
6. Special-hazard areas, including but not limited to laboratories, computer rooms and generator rooms, where required by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1*.

**906.2 General requirements.** Portable fire extinguishers shall be selected and installed in accordance with this section and NFPA 10.

**Exceptions:**

1. The distance of travel to reach an extinguisher shall not apply to the spectator seating portions of Group A-5 occupancies.
2. In Group I-3, portable fire extinguishers shall be permitted to be located at staff locations.

**906.3 Size and distribution.** The size and distribution of portable fire extinguishers shall be in accordance with Sections 906.3.1 through 906.3.4.

**906.3.1 Class A fire hazards.** The minimum sizes and distribution of portable fire extinguishers for occupancies that involve primarily Class A fire hazards shall comply with Table 906.3(1).

**906.3.2 Class B fire hazards.** Portable fire extinguishers for occupancies involving flammable or combustible liquids with depths less than or equal to 0.25-inch (6.4 mm) shall be selected and placed in accordance with Table 906.3(2).

Portable fire extinguishers for occupancies involving flammable or combustible liquids with a depth of greater than 0.25-inch (6.4 mm) shall be selected and placed in accordance with NFPA 10.

**906.3.3 Class C fire hazards.** Portable fire extinguishers for Class C fire hazards shall be selected and placed on the basis of the anticipated Class A or B hazard.

**906.3.4 Class D fire hazards.** Portable fire extinguishers for occupancies involving combustible metals shall be selected and placed in accordance with NFPA 10.

**906.4 Cooking grease fires.** Fire extinguishers provided for the protection of



cooking grease fires shall be of an approved type compatible with the automatic fire-extinguishing system agent and in accordance with Section 904.12.5 of the *fire code*.

**906.5 Conspicuous location.** Portable fire extinguishers shall be located in conspicuous locations where they will be readily accessible and immediately available for use. These locations shall be along normal paths of travel, unless the *building official, with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1*, determines that the hazard posed indicates the need for placement away from normal paths of travel.

**TABLE 906.1**  
**ADDITIONAL REQUIRED PORTABLE FIRE EXTINGUISHERS**  
**IN THE *FIRE CODE***

<b>OFC SECTION</b>	<b>SUBJECT</b>
303.5	Asphalt kettles
307.5	Open burning
308.1.3	Open flames—torches
309.4	Powered industrial trucks
2005.2	Aircraft towing vehicles
2005.3	Aircraft welding apparatus
2005.4	Aircraft fuel-servicing tank vehicles
2005.5	Aircraft hydrant fuel-servicing vehicles
2005.6	Aircraft fuel-dispensing stations
2007.7	Heliports and helistops
2108.4	Dry cleaning plants
2305.5	Motor fuel-dispensing facilities
2310.6.4	Marine motor fuel-dispensing facilities
2311.6	Repair garages
2404.4.1	Spray-finishing operations
2405.4.2	Dip-tank operations
2406.4.2	Powder-coating areas
2804.3	Lumberyards/woodworking facilities
2808.8	Recycling facilities
2809.5	Exterior lumber storage
2903.5	Organic-coating areas
3006.3	Industrial ovens

3104.12	Tents and membrane structures
3206.10	High-piled storage
3315.1	Buildings under construction or demolition
3317.3	Roofing operations
3408.2	Tire rebuilding/storage
3504.2.6	Welding and other hot work
3604.4	Marinas
3703.6	Combustible fibers
5703.2.1	Flammable and combustible liquids, general
5704.3.3.1	Indoor storage of flammable and combustible liquids
5704.3.7.5.2	Liquid storage rooms for flammable and combustible liquids
5705.4.9	Solvent distillation units
5706.2.7	Farms and construction sites—flammable and combustible liquids storage
5706.4.10.1	Bulk plants and terminals for flammable and combustible liquids
5706.5.4.5	Commercial, industrial, governmental or manufacturing establishments—fuel dispensing
5706.6.4	Tank vehicles for flammable and combustible liquids
5906.5.7	Flammable solids
6108.2	LP-gas

**TABLE 906.3(1)**  
**FIRE EXTINGUISHERS FOR CLASS A FIRE HAZARDS**

	<b>LIGHT (Low) HAZARD OCCUPANCY</b>	<b>ORDINARY (Moderate) HAZARD OCCUPANCY</b>	<b>EXTRA (High) HAZARD OCCUPANCY</b>
Minimum rated single extinguisher	2-A <sup>c</sup>	2-A	4-A <sup>a</sup>
Maximum floor area per unit of A	3000 square feet	1500 square feet	1000 square feet
Maximum floor	11,250	11,250	11,250

area for extinguisher <sup>b</sup>	square feet	square feet	square feet
Maximum distance of travel to extinguisher	75 feet	75 feet	75 feet

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929m<sup>2</sup>, 1 gallon = 3.785 L.

- a. Two 2½-gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.
- b. Annex E.3.3 of NFPA 10 provides more details concerning application of the maximum floor area criteria.
- c. Two water-type extinguishers each with a 1-A rating shall be deemed the equivalent of one 2-A rated extinguisher for Light (Low) Hazard Occupancies.

**TABLE 906.3(2)**  
**FIRE EXTINGUISHERS FOR**  
**FLAMMABLE OR COMBUSTIBLE LIQUIDS WITH**  
**DEPTHS LESS THAN OR EQUAL TO 0.25 INCH**

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM DISTANCE OF TRAVEL TO EXTINGUISHERS (feet)
Light (Low)	5-B 10-B	30 50
Ordinary (Moderate)	10-B 20-B	30 50
Extra (High)	40-B 80-B	30 50

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**Note:** For requirements on water-soluble flammable liquids and alternative sizing criteria, see Section 5.5 of NFPA 10.

**906.6 Unobstructed and unobscured.** Portable fire extinguishers shall not be obstructed or obscured from view. In rooms or areas in which visual obstruction cannot be completely avoided, means shall be provided to indicate the locations of extinguishers.

**906.7 Hangers and brackets.** Hand-held portable fire extinguishers, not housed in cabinets, shall be installed on the hangers or brackets supplied. Hangers or brackets shall be securely anchored to the mounting surface in accordance with the manufacturer's installation instructions.

**906.8 Cabinets.** Cabinets used to house portable fire extinguishers shall not be locked.

**Exceptions:**

1. Where portable fire extinguishers subject to malicious use or damage are provided with a means of ready access.
2. In Group I-3 occupancies and in mental health areas in Group I-2 occupancies, access to portable fire extinguishers shall be permitted to be locked or to be located in staff locations provided the staff has keys.

**906.9 Extinguisher installation.** The installation of portable fire extinguishers shall be in accordance with Sections 906.9.1 through 906.9.3.

**906.9.1 Extinguishers weighing 40 pounds or less.** Portable fire extinguishers having a gross weight not exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 5 feet (1524 mm) above the floor.

**906.9.2 Extinguishers weighing more than 40 pounds.** Hand-held portable fire extinguishers having a gross weight exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 3.5 feet (1067 mm) above the floor.

**906.9.3 Floor clearance.** The clearance between the floor and the bottom of installed hand-held portable fire extinguishers shall be not less than 4 inches (102 mm).

**906.10 Wheeled units.** Wheeled fire extinguishers shall be conspicuously located in a designated location.

## **SECTION 907 FIRE ALARM AND DETECTION SYSTEMS**

**907.1 General.** This section covers the application, installation, performance and maintenance of fire alarm systems and their components.

**907.1.1 Construction documents.** Construction documents for fire alarm systems shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code, relevant laws, rules and regulations, as determined by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1.*

**907.1.2 Fire alarm shop drawings.** Shop drawings for fire alarm systems shall be submitted for review and approval prior to system installation, and shall include, but not be limited to, all of the following where applicable to the system being installed:

1. A floor plan that indicates the use of all rooms.
2. Locations of alarm-initiating devices.
3. Locations of alarm notification appliances, including candela ratings for visible alarm notification appliances.
4. Design minimum audibility level for occupant notification.
5. Location of fire alarm control unit, transponders and notification power supplies.
6. Annunciators.
7. Power connection.
8. Battery calculations.
9. Conductor type and sizes.
10. Voltage drop calculations.
11. Manufacturers' data sheets indicating model numbers and listing information for equipment, devices and materials.
12. Details of ceiling height and construction.
13. The interface of fire safety control functions.
14. Classification of the supervising station.

**907.1.3 Equipment.** Systems and components shall be listed and approved for the purpose for which they are installed.

**907.2 Where required—new buildings and structures.** An approved fire alarm system installed in accordance with the provisions of this code and NFPA 72 shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.23 and provide occupant notification in accordance with Section 907.5, unless other requirements are provided by another section of this code. Not fewer than one manual fire alarm box shall be provided in an approved location to initiate a fire alarm signal for fire alarm systems employing automatic fire detectors or waterflow detection devices. Where other sections of this code allow elimination of fire alarm boxes due to sprinklers, a single fire alarm box shall be installed.

**Exceptions:**

1. The manual fire alarm box is not required for fire alarm systems dedicated to elevator recall control and supervisory service.
2. The manual fire alarm box is not required for Group R-2 occupancies unless required by the *building official, upon request from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1*, to provide a means for fire watch personnel to initiate an alarm during a sprinkler system impairment event. Where provided, the manual fire alarm box shall *be located as requested by the fire official, but not be located in an area that is accessible to the public.*

**907.2.1 Group A.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more. Group A occupancies not separated from one another in accordance with Section 707.3.10 shall be considered as a single occupancy for the purposes of applying this section. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy.

**Exception:** Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

**907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more.** Activation of the fire alarm in Group A occupancies with an occupant load of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with Section 907.5.2.2.

**Exception:** Where approved, the prerecorded announcement is allowed to be manually deactivated for a period of time, not to exceed 3 minutes, for the sole purpose of allowing a live voice announcement from an approved, constantly attended location.

**907.2.1.2 Emergency voice/alarm communication captions.** Stadiums, arenas and grandstands required to caption audible public announcements shall be in accordance with Section 907.5.2.2.4.

**907.2.2 Group B.** A manual fire alarm system shall be installed in Group B occupancies where one of the following conditions exists:

1. The combined Group B occupant load of all floors is 500 or more.
2. The Group B occupant load is more than 100 persons above or below the lowest level of exit discharge.
3. The fire area contains an ambulatory care facility.

**Exception:** Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

**907.2.2.1 Ambulatory care facilities.** Fire areas containing ambulatory care facilities shall be provided with an electronically supervised automatic

smoke detection system installed within the ambulatory care facility and in public use areas outside of tenant spaces, including public corridors and elevator lobbies.

**Exception:** Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, provided the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

**907.2.3 Group E.** A manual fire alarm system that initiates the occupant notification signal utilizing an emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall be installed in Group E occupancies. When automatic sprinkler systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

**Exceptions:**

1. A manual fire alarm system is not required in Group E occupancies with an occupant load of 50 or less.
2. Emergency voice/alarm communication systems meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall not be required in Group E occupancies with occupant loads of 100 or less, provided that activation of the manual fire alarm system initiates an approved occupant notification signal in accordance with Section 907.5.
3. Manual fire alarm boxes are not required in Group E occupancies where all of the following apply:
  - 3.1. Interior corridors are protected by smoke detectors.
  - 3.2. Auditoriums, cafeterias, gymnasiums and similar areas are protected by heat detectors or other approved detection devices.
  - 3.3. Shops and laboratories involving dusts or vapors are protected by heat detectors or other approved detection devices.
4. Manual fire alarm boxes shall not be required in Group E occupancies where all of the following apply:
  - 4.1. The building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.
  - 4.2. The emergency voice/alarm communication system will activate on sprinkler waterflow.
  - 4.3. Manual activation is provided from a normally occupied location.

**907.2.4 Group F.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group F occupancies where both of the following conditions exist:

1. The Group F occupancy is two or more stories in height.

2. The Group F occupancy has a combined occupant load of 500 or more above or below the lowest level of exit discharge.

**Exception:** Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

**907.2.5 Group H.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group H-5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers in accordance with Chapters 60, 62 and 63, respectively, of the *fire code*.

**907.2.6 Group I.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group I occupancies. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in accordance with Sections 907.2.6.1, 907.2.6.2 and 907.2.6.3.3.

**Exceptions:**

1. Manual fire alarm boxes in sleeping units of Group I-1 and I-2 occupancies shall not be required at exits if located at all care providers' control stations or other constantly attended staff locations, provided such stations are visible and continuously accessible and that the distances of travel required in Section 907.4.2.1 are not exceeded.
2. Occupant notification systems are not required to be activated where private mode signaling installed in accordance with NFPA 72 is approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1* and staff evacuation responsibilities are included in the fire safety and evacuation plan required by Section 404 of the *fire code*.

**907.2.6.1 Group I-1.** In Group I-1 occupancies, an automatic smoke detection system shall be installed in corridors, waiting areas open to corridors and habitable spaces other than sleeping units and kitchens. The system shall be activated in accordance with Section 907.5.

**Exceptions:**

1. For Group I-1 Condition 1 occupancies, smoke detection in habitable spaces is not required where the facility is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.



2. Smoke detection is not required for exterior balconies.

**907.2.6.1.1 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

**907.2.6.2 Group I-2.** An automatic smoke detection system shall be installed in corridors in Group I-2 Condition 1 facilities and spaces permitted to be open to the corridors by Section 407.2. The system shall be activated in accordance with Section 907.4. Group I-2 Condition 2 occupancies shall be equipped with an automatic smoke detection system as required in Section 407.

**Exceptions:**

1. Corridor smoke detection is not required in smoke compartments that contain sleeping units where such units are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each sleeping unit and shall provide an audible and visual alarm at the care providers' station attending each unit.
2. Corridor smoke detection is not required in smoke compartments that contain sleeping units where sleeping unit doors are equipped with automatic door-closing devices with integral smoke detectors on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

**907.2.6.3 Group I-3 occupancies.** Group I-3 occupancies shall be equipped with a manual fire alarm system and automatic smoke detection system installed for alerting staff.

**907.2.6.3.1 System initiation.** Actuation of an automatic fire-extinguishing system, automatic sprinkler system, a manual fire alarm box or a fire detector shall initiate an approved fire alarm signal that automatically notifies staff.

**907.2.6.3.2 Manual fire alarm boxes.** Manual fire alarm boxes are not required to be located in accordance with Section 907.4.2 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted.

**907.2.6.3.2.1 Manual fire alarm boxes in detainee areas.** Manual fire alarm boxes are allowed to be locked in areas occupied by

detainees, provided that staff members are present within the subject area and have keys readily available to operate the manual fire alarm boxes.

**907.2.6.3.3 Automatic smoke detection system.** An automatic smoke detection system shall be installed throughout resident housing areas, including sleeping units and contiguous day rooms, group activity spaces and other common spaces normally accessible to residents.

**Exceptions:**

1. Other approved smoke detection arrangements providing equivalent protection, including, but not limited to, placing detectors in exhaust ducts from cells or behind protective guards listed for the purpose, are allowed when necessary to prevent damage or tampering.
2. Sleeping units in Use Conditions 2 and 3 as described in Section 308.
3. Smoke detectors are not required in sleeping units with four or fewer occupants in smoke compartments that are equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

**907.2.7 Group M.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group M occupancies where one of the following conditions exists:

1. The combined Group M occupant load of all floors is 500 or more persons.
2. The Group M occupant load is more than 100 persons above or below the lowest level of exit discharge.

**Exceptions:**

1. A manual fire alarm system is not required in covered or open mall buildings complying with Section 402.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will automatically activate throughout the notification zones upon sprinkler water flow.

**907.2.7.1 Occupant notification.** During times that the building is occupied, the initiation of a signal from a manual fire alarm box or from a waterflow switch shall not be required to activate the alarm notification appliances when an alarm signal is activated at a constantly attended

location from which evacuation instructions shall be initiated over an emergency voice/ alarm communication system installed in accordance with Section 907.5.2.2.

**907.2.8 Group R-1.** Fire alarm systems and smoke alarms shall be installed in Group R-1 occupancies as required in Sections 907.2.8.1 through 907.2.8.3.

**907.2.8.1 Manual fire alarm system.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R- 1 occupancies.

**Exceptions:**

1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contiguous attic and crawl spaces to those units are separated from each other and public or common areas by not less than 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required throughout the building where all of the following conditions are met:
  - 2.1 The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
  - 2.2 The notification appliances will activate upon sprinkler water flow.
  - 2.3 Not fewer than one manual fire alarm box is installed at an approved location.

**907.2.8.2 Automatic smoke detection system.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed throughout all interior corridors serving sleeping units.

**Exception:** An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.

**907.2.8.3 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

**907.2.9 Group R-2.** Fire alarm systems and smoke alarms shall be installed in Group R-2 occupancies as required in Sections 907.2.9.1 through 907.2.9.3.

**907.2.9.1 Manual fire alarm system.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5

shall be installed in Group R-2 occupancies where any of the following conditions apply:

1. Any dwelling unit or sleeping unit is located three or more stories above the lowest level of exit discharge.
2. Any dwelling unit or sleeping unit is located more than one story below the highest level of exit discharge of exits serving the dwelling unit or sleeping unit.
3. The building contains more than 16 dwelling units or sleeping units.

**Exceptions:**

1. A fire alarm system is not required in buildings not more than two stories in height where all dwelling units or sleeping units and contiguous attic and crawl spaces are separated from each other and public or common areas by not less than 1-hour fire partitions and each dwelling unit or sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and the occupant notification appliances will automatically activate throughout the notification zones upon a sprinkler water flow.
3. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units and are protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, provided that dwelling units either have a means of egress door opening directly to an exterior exit access that leads directly to the exits or are served by open-ended corridors designed in accordance with Section 1027.6, Exception 3.

**907.2.9.2 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

**907.2.9.3 Group R-2 college and university buildings.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R2 occupancies *owned or* operated by a college or university for student or staff housing in all of the following locations:

1. Common spaces outside of dwelling units and sleeping units.
2. Laundry rooms, mechanical equipment rooms and storage rooms.
3. All interior corridors serving sleeping units or dwelling units.

**Exception:** An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units

or dwelling units and where each sleeping unit or dwelling unit either has a means of egress door opening directly to an exterior exit access that leads directly to an exit or a means of egress door opening directly to an exit.

Required smoke alarms in dwelling units and sleeping units in Group R-2 occupancies operated by a college or university for student or staff housing shall be interconnected with the fire alarm system in accordance with NFPA 72.

**907.2.10 Group R-4.** Fire alarm systems and smoke alarms shall be installed in Group R-4 occupancies as required in Sections 907.2.10.1 through 907.2.10.3.

**907.2.10.1 Manual fire alarm system.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-4 occupancies.

**Exceptions:**

1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contiguous attic and crawl spaces to those units are separated from each other and public or common areas by not less than 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required throughout the building where all of the following conditions are met:
  - 2.1 The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
  - 2.2 The notification appliances will activate upon sprinkler water flow.
  - 2.3 Not fewer than one manual fire alarm box is installed at an approved location.
3. Manual fire alarm boxes in resident or patient sleeping areas shall not be required at exits where located at all nurses' control stations or other constantly attended staff locations, provided such stations are visible and continuously accessible and that the distances of travel required in Section 907.4.2.1 are not exceeded.

**907.2.10.2 Automatic smoke detection system.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in corridors, waiting areas open to corridors and habitable spaces other than sleeping units and kitchens.

**Exceptions:**

1. Smoke detection in habitable spaces is not required where the facility is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.

**907.2.10.3 Smoke alarms.** Single- and multiple station smoke alarms shall be installed in accordance with Section 907.2.11.

**907.2.11 Single- and multiple-station smoke alarms.** Listed single- and multiple-station smoke alarms complying with UL 217 shall be installed in accordance with Sections 907.2.11.1 through 907.2.11.6 and NFPA 72.

**907.2.11.1 Group R-1.** Single- or multiple-station smoke alarms shall be installed in all of the following locations in Group R-1:

1. In sleeping areas.
2. In every room in the path of the means of egress from the sleeping area to the door leading from the sleeping unit.
3. In each story within the sleeping unit, including basements. For sleeping units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

**907.2.11.2 Groups R-2, R-3, R-4 and I-1.** Single or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-3, R-4 and I-1 regardless of occupant load at all of the following locations:

1. On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms.
2. In each room used for sleeping purposes.
3. In each story within a dwelling unit, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

**907.2.11.3 Installation near cooking appliances.** Smoke alarms shall not be installed in the following locations unless this would prevent placement

of a smoke alarm in a location required by Section 907.2.11.1 or 907.2.11.2:

1. Ionization smoke alarms shall not be installed less than 20 feet (6096 mm) horizontally from a permanently installed cooking appliance.
2. Ionization smoke alarms with an alarm-silencing switch shall not be installed less than 10 feet (3048 mm) horizontally from a permanently installed cooking appliance.
3. Photoelectric smoke alarms shall not be installed less than 6 feet (1829 mm) horizontally from a permanently installed cooking appliance.

**907.2.11.4 Installation near bathrooms.** Smoke alarms shall be installed not less than 3 feet (914 mm) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by Section 907.2.11.1 or 907.2.11.2.

**907.2.11.5 Interconnection.** Where more than one smoke alarm is required to be installed within an individual dwelling unit or sleeping unit in Group R or I-1 occupancies, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

**907.2.11.6 Power source.** In new construction, required smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system in accordance with Section 2702. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

**Exception:** Smoke alarms are not required to be equipped with battery backup where they are connected to an emergency electrical system that complies with Section 2702.

**907.2.11.7 Smoke detection system.** Smoke detectors listed in accordance with UL 268 and provided as part of the building fire alarm system shall be an acceptable alternative to single- and multiple-station smoke alarms and shall comply with the following:

1. The fire alarm system shall comply with all applicable requirements in Section 907.
2. Activation of a smoke detector in a dwelling unit or sleeping unit shall initiate alarm notification in the dwelling unit or sleeping unit in accordance with Section 907.5.2.
3. Activation of a smoke detector in a dwelling unit or sleeping unit shall not activate alarm notification appliances outside of the dwelling unit or sleeping unit, provided that a supervisory signal is generated and monitored in accordance with Section 907.6.6.

**907.2.12 Special amusement buildings.** An automatic smoke detection system shall be provided in special amusement buildings in accordance with Sections 907.2.12.1 through 907.2.12.3.

**907.2.12.1 Alarm.** Activation of any single smoke detector, the automatic sprinkler system or any other automatic fire detection device shall immediately activate an audible and visible alarm at the building at a constantly attended location from which emergency action can be initiated, including the capability of manual initiation of requirements in Section 907.2.12.2.

**907.2.12.2 System response.** The activation of two or more smoke detectors, a single smoke detector equipped with an alarm verification feature, the automatic sprinkler system or other approved fire detection device shall automatically do all of the following:

1. Cause illumination of the means of egress with light of not less than 1 foot candle (11 lux) at the walking surface level.
2. Stop any conflicting or confusing sounds and visual distractions.
3. Activate an approved directional exit marking that will become apparent in an emergency.
4. Activate a prerecorded message, audible throughout the special amusement building, instructing patrons to proceed to the nearest exit. Alarm signals used in conjunction with the prerecorded message shall produce a sound that is distinctive from other sounds used during normal operation.

**907.2.12.3 Emergency voice/alarm communication system.** An emergency voice/alarm communication system, which is also allowed to serve as a public address system, shall be installed in accordance with Section 907.5.2.2 and be audible throughout the entire special amusement building.



**907.2.13 High-rise buildings.** High-rise buildings shall be provided with an automatic smoke detection system in accordance with Section 907.2.13.1, a fire department communication system in accordance with Section 907.2.13.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.

**Exceptions:**

1. Airport traffic control towers in accordance with Sections 412 and 907.2.22.
2. Open parking garages in accordance with Section 406.5.
3. Buildings with an occupancy in Group A-5 in accordance with Section 303.1.
4. Low-hazard special occupancies in accordance with Section 503.1.1.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with Section 415.
6. In Group I-1 and I-2 occupancies, the alarm shall sound at a constantly attended location and occupant notification shall be broadcast by the emergency voice/alarm communication system.

**907.2.13.1 Automatic smoke detection.** Automatic smoke detection in high-rise buildings shall be in accordance with Sections 907.2.13.1.1 and 907.2.13.1.2.

**907.2.13.1.1 Area smoke detection.** Area smoke detectors shall be provided in accordance with this section. Smoke detectors shall be connected to an automatic fire alarm system. The activation of any detector required by this section shall activate the emergency voice/alarm communication system in accordance with Section 907.5.2.2. In addition to smoke detectors required by Sections 907.2.1 through 907.2.10, smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room that is not provided with sprinkler protection.
2. In each elevator machine room, machinery space, control room and control space and in elevator lobbies.

**907.2.13.1.2 Duct smoke detection.** Duct smoke detectors complying with Section 907.3.1 shall be located as follows:

1. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic

feet per minute (cfm) (0.94 m<sup>3</sup>/s). Such detectors shall be located in a serviceable area downstream of the last duct inlet.

2. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies, a smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m<sup>3</sup>/s) and serving not more than 10 air-inlet openings.

**907.2.13.2 Fire department communication system.** Where a wired communication system is approved in lieu of an emergency responder radio coverage system in accordance with Section 510 of the *fire code*, the wired fire department communication system shall be designed and installed in accordance with NFPA 72 and shall operate between a fire command center complying with Section 911, elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside interior exit stairways. The fire department communication device shall be provided at each floor level within the interior exit stairway.

**907.2.14 Atriums connecting more than two stories.** A fire alarm system shall be installed in occupancies with an atrium that connects more than two stories, with smoke detection installed in locations required by a rational analysis in Section 909.4 and in accordance with the system operation requirements in Section 909.17. The system shall be activated in accordance with Section 907.5. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of Section 907.5.2.2.

**907.2.15 High-piled combustible storage areas.** An automatic smoke detection system shall be installed throughout high-piled combustible storage areas where required by Section 3206.5 of the *fire code*.

**907.2.16 Aerosol storage uses.** Aerosol storage rooms and general-purpose warehouses containing aerosols shall be provided with an approved manual fire alarm system where required by the *fire code*.

**907.2.17 Lumber, wood structural panel and veneer mills.** Lumber, wood structural panel and veneer mills shall be provided with a manual fire alarm system.

**907.2.18 Underground buildings with smoke control systems.** Where a

smoke control system is installed in an underground building in accordance with this code, automatic smoke detectors shall be provided in accordance with Section 907.2.18.1.

**907.2.18.1 Smoke detectors.** Not fewer than one smoke detector listed for the intended purpose shall be installed in all of the following areas:

1. Mechanical equipment, electrical, transformer, telephone equipment, elevator machine or similar rooms.
2. Elevator lobbies.
3. The main return and exhaust air plenum of each air-conditioning system serving more than one story and located in a serviceable area downstream of the last duct inlet.
4. Each connection to a vertical duct or riser serving two or more floors from return air ducts or plenums of heating, ventilating and air-conditioning systems, except that in Group R occupancies, a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m<sup>3</sup>/s) and serving not more than 10 air inlet openings.

**907.2.18.2 Alarm required.** Activation of the smoke control system shall activate an audible alarm at a constantly attended location.

**907.2.19 Deep underground buildings.** Where the lowest level of a structure is more than 60 feet (18 288 mm) below the finished floor of the lowest level of exit discharge, the structure shall be equipped throughout with a manual fire alarm system, including an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

**907.2.20 Covered and open mall buildings.** Where the total floor area exceeds 50,000 square feet (4645 m<sup>2</sup>) within either a covered mall building or within the perimeter line of an open mall building, an emergency voice/ alarm communication system shall be provided. Emergency voice/alarm communication systems serving a mall, required or otherwise, shall be accessible to the fire department. The system shall be provided in accordance with Section 907.5.2.2.

**907.2.21 Residential aircraft hangars.** Not fewer than one single-station smoke alarm shall be installed within a residential aircraft hangar as defined in Chapter 2 and shall be interconnected into the residential smoke alarm or other sounding device to provide an alarm that will be audible in all sleeping areas of the dwelling.

**907.2.22 Airport traffic control towers.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in airport control towers in accordance with Sections 907.2.22.1 and 907.2.22.2.

**Exception:** Audible appliances shall not be installed within the control tower cab.

**907.2.22.1 Airport traffic control towers with multiple exits and automatic sprinklers.** Airport traffic control towers with multiple exits and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Outside each opening into interior exit stairways.
5. Along the single means of egress permitted from observation levels.
6. Outside each opening into the single means of egress permitted from observation levels.

**907.2.22.2 Other airport traffic control towers.** Airport traffic control towers with a single exit or where sprinklers are not installed throughout shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.
6. Means of egress.
7. Accessible utility shafts.

**907.2.23 Battery rooms.** An automatic smoke detection system shall be installed in areas containing stationary storage battery systems with a liquid capacity of more than 50 gallons (189 L).

**907.3 Fire safety functions.** Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control unit where a fire alarm system is required by Section 907.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a constantly

attended location. In buildings not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with NFPA 72.

**907.3.1 Duct smoke detectors.** Smoke detectors installed in ducts shall be listed for the air velocity, temperature and humidity present in the duct. Duct smoke detectors shall be connected to the building's fire alarm control unit when a fire alarm system is required by Section 907.2. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a constantly attended location and shall perform the intended fire safety function in accordance with this code and the *mechanical code*. In facilities that are required to be monitored by a supervising station, duct smoke detectors shall report only as a supervisory signal and not as a fire alarm. They shall not be used as a substitute for required open area detection.

**Exceptions:**

1. The supervisory signal at a constantly attended location is not required where duct smoke detectors activate the building's alarm notification appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

**907.3.2 Delayed egress locks.** Where delayed egress locks are installed on means of egress doors in accordance with Section 1010.1.9.7, an automatic smoke or heat detection system shall be installed as required by that section.

**907.3.3 Elevator emergency operation.** Automatic fire detectors installed for elevator emergency operation shall be installed in accordance with the provisions of ASME A17.1 *as referenced in rule 4101:5-3-01 of the Administrative Code* and NFPA 72.

**907.3.4 Wiring.** The wiring to the auxiliary devices and equipment used to accomplish the fire safety functions shall be monitored for integrity in accordance with NFPA 72.

**907.4 Initiating devices.** Where manual or automatic alarm initiation is required as part of a fire alarm system, the initiating devices shall be installed in accordance with Sections 907.4.1 through 907.4.3.1.

**907.4.1 Protection of fire alarm control unit.** In areas that are not continuously occupied, a single smoke detector shall be provided at the location of each fire alarm control unit, notification appliance circuit power extenders, and supervising station transmitting equipment.

**Exception:** Where ambient conditions prohibit installation of a smoke detector, a heat detector shall be permitted.

**907.4.2 Manual fire alarm boxes.** Where a manual fire alarm system is required by another section of this code, it shall be activated by fire alarm boxes installed in accordance with Sections 907.4.2.1 through 907.4.2.6.

**907.4.2.1 Location.** Manual fire alarm boxes shall be located not more than 5 feet (1524 mm) from the entrance to each exit. In buildings not protected by an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, additional manual fire alarm boxes shall be located so that the exit access travel distance to the nearest box does not exceed 200 feet (60 960 mm).

**907.4.2.2 Height.** The height of the manual fire alarm boxes shall be not less than 42 inches (1067 mm) and not more than 48 inches (1372 mm) measured vertically, from the floor level to the activating handle or lever of the box.

**907.4.2.3 Color.** Manual fire alarm boxes shall be red in color.

**907.4.2.4 Signs.** Where fire alarm systems are not monitored by a supervising station, an approved permanent sign shall be installed adjacent to each manual fire alarm box that reads: WHEN ALARM SOUNDS CALL FIRE DEPARTMENT.

**Exception:** Where the manufacturer has permanently provided this information on the manual fire alarm box.

**907.4.2.5 Protective covers.** The *building* official is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or to provide the manual fire alarm box with protection from physical damage. The protective cover shall be transparent or red in color with a transparent face to permit visibility of the manual fire alarm box. Each cover shall include proper operating instructions. A protective cover that emits a local alarm signal shall not be installed unless approved. Protective covers shall not project more than that permitted by

Section 1003.3.3.

**907.4.2.6 Unobstructed and unobscured.** Manual fire alarm boxes shall be accessible, unobstructed, *and* unobscured at all times.

**907.4.3 Automatic smoke detection.** Where an automatic smoke detection system is required it shall utilize smoke detectors unless ambient conditions prohibit such an installation. In spaces where smoke detectors cannot be utilized due to ambient conditions, approved automatic heat detectors shall be permitted.

**907.4.3.1 Automatic sprinkler system.** For conditions other than specific fire safety functions noted in Section 907.3, in areas where ambient conditions prohibit the installation of smoke detectors, an automatic sprinkler system installed in such areas in accordance with Section 903.3.1.1 or 903.3.1.2 and that is connected to the fire alarm system shall be approved as automatic heat detection.

**907.5 Occupant notification systems.** A fire alarm system shall annunciate at the fire alarm control unit and shall initiate occupant notification upon activation, in accordance with Sections 907.5.1 through 907.5.2.3.3. Where a fire alarm system is required by another section of this code, it shall be activated by:

1. Automatic fire detectors.
2. Automatic sprinkler system waterflow devices.
3. Manual fire alarm boxes.
4. Automatic fire-extinguishing systems.

**Exception:** Where notification systems are allowed elsewhere in Section 907 to annunciate at a constantly attended location.

**907.5.1 Presignal feature.** A presignal feature shall not be installed unless approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1*. Where a presignal feature is provided, a signal shall be annunciated at a constantly attended location *as requested* by the *fire official* so that occupant notification can be activated in the event of fire or other emergency.

**907.5.2 Alarm notification appliances.** Alarm notification appliances shall be provided and shall be listed for their purpose. *Audible and visual alarm notification appliances shall be located and installed in accordance with this section, NFPA 72, Chapter 11, and ICC A117.1.*

**907.5.2.1 Audible alarms.** Audible alarm notification appliances shall be provided and emit a distinctive sound that is not to be used for any purpose other than that of a fire alarm.

**Exceptions:**

1. Audible alarm notification appliances are not required in critical care areas of Group I-2 Condition 2 occupancies that are in compliance with Section 907.2.6, Exception 2.
2. A visible alarm notification appliance installed in a nurses' control station or other continuously attended staff location in a Group I-2 Condition 2 suite shall be an acceptable alternative to the installation of audible alarm notification appliances throughout the suite in Group I-2 Condition 2 occupancies that are in compliance with Section 907.2.6, Exception 2.
3. Where provided, audible notification appliances located in each occupant evacuation elevator lobby in accordance with Section 3008.9.1 shall be connected to a separate notification zone for manual paging only.

**907.5.2.1.1 Average sound pressure.** The audible alarm notification appliances shall provide a sound pressure level of 15 decibels (dBA) above the average ambient sound level or 5 dBA above the maximum sound level having a duration of not less than 60 seconds, whichever is greater, in every occupiable space within the building.

**907.5.2.1.2 Maximum sound pressure.** The maximum sound pressure level for audible alarm notification appliances shall be 110 dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 95 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required.

**907.5.2.2 Emergency voice/alarm communication systems.** Emergency voice/alarm communication systems required by this code shall be designed and installed in accordance with NFPA 72. The operation of any automatic fire detector, sprinkler waterflow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving approved information and directions for a general or staged evacuation in accordance with the building's fire safety and evacuation plans required by Section 404 of the *fire code*. In high-rise buildings, the system shall operate on at least the alarming floor, the floor above and the floor below. Speakers shall be provided throughout the building by paging zones. At a minimum,



paging zones shall be provided as follows:

1. Elevator groups.
2. Interior exit stairways.
3. Each floor.
4. Areas of refuge as defined in Chapter 2.

**Exception:** In Group I-1 and I-2 occupancies, the alarm shall sound in a constantly attended area and a general occupant notification shall be broadcast over the overhead page.

**907.5.2.2.1 Manual override.** A manual override for emergency voice communication shall be provided on a selective and all-call basis for all paging zones.

**907.5.2.2.2 Live voice messages.** The emergency voice/alarm communication system shall have the capability to broadcast live voice messages by paging zones on a selective and all-call basis.

**907.5.2.2.3 Alternate uses.** The emergency voice/alarm communication system shall be allowed to be used for other announcements, provided the manual fire alarm use takes precedence over any other use.

**907.5.2.2.4 Emergency voice/alarm communication captions.** Where stadiums, arenas and grandstands are required to caption audible public announcements in accordance with Section 1108.2.7.3, the emergency/voice alarm communication system shall be captioned. Prerecorded or live emergency captions shall be from an approved location constantly attended by personnel trained to respond to an emergency.

**907.5.2.2.5 Emergency power.** Emergency voice/alarm communications systems shall be provided with emergency power in accordance with Section 2702. The system shall be capable of powering the required load for a duration of not less than 24 hours, as required in NFPA 72.

**907.5.2.3 Visible alarms.** Visible alarm notification appliances shall be provided in accordance with Sections 907.5.2.3.1 through 907.5.2.3.3.

**Exceptions:**

1. Visible alarm notification appliances are not required in alterations, except where, *as part of the alteration, an existing notification*

*appliance is relocated*, an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.

2. Visible alarm notification appliances shall not be required in exits as defined in Chapter 2.
3. Visible alarm notification appliances shall not be required in elevator cars.
4. Visual alarm notification appliances are not required in critical care areas of Group I-2 Condition 2 occupancies that are in compliance with Section 907.2.6, Exception 2.

**907.5.2.3.1 Public use areas and common use areas.** Visible alarm notification appliances shall be provided in public use areas and common use areas.

**Exception:** Where employee work areas have audible alarm coverage, the notification appliance circuits serving the employee work areas shall be initially designed with not less than 20 percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing-impaired employee(s).

**907.5.2.3.2 Groups I-1 and R-1.** Group I-1 and R-1 dwelling units or sleeping units in accordance with Table 907.5.2.3.2 shall be provided with a visible alarm notification appliance, activated by both the in-room smoke alarm and the building fire alarm system.

**TABLE 907.5.2.3.2  
VISIBLE ALARMS**

NUMBER OF SLEEP UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE ALARMS
2 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

**907.5.2.3.3 Group R-2.** In Group R-2 occupancies required by Section 907 to have a fire alarm system, all dwelling units and sleeping units shall be provided with the capability to support visible alarm notification appliances in accordance with Chapter 10 of ICC A117.1. Such capability shall be permitted to include the potential for future interconnection of the building fire alarm system with the unit smoke alarms, replacement of audible appliances with combination audible/visible appliances, or future extension of the existing wiring from the unit smoke alarm locations to required locations for visible appliances.

**907.6 Installation and monitoring.** A fire alarm system shall be installed and monitored in accordance with Sections 907.6.1 through 907.6.6.2 and NFPA 72.

**907.6.1 Wiring.** Wiring shall comply with the requirements of NFPA 70 and NFPA 72. Wireless protection systems utilizing radio-frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in NFPA 72.

**907.6.2 Power supply.** The primary and secondary power supply for the fire alarm system shall be provided in accordance with NFPA 72.

**Exception:** Back-up power for single-station and multiple-station smoke alarms as required in Section 907.2.11.6.

**907.6.3 Initiating device identification.** *Required fire alarm systems and initiating devices* shall identify the specific initiating device address, location, device type, floor level where applicable and status including indication of normal, alarm, trouble and supervisory status, as appropriate.

**Exceptions:**

1. Fire alarm systems in single-story buildings less than 22,500 square feet (2090 m<sup>2</sup>) in area.
2. Fire alarm systems that only include manual fire alarm boxes, waterflow initiating devices and not more than 10 additional alarm-initiating devices.
3. Special initiating devices that do not support individual device identification.
4. Fire alarm systems or devices that are replacing existing equipment.

**907.6.3.1 Annunciation.** The initiating device status shall be annunciated at an approved on-site location.

**907.6.4 Zones.** Each floor shall be zoned separately and a zone shall not exceed 22,500 square feet (2090 m<sup>2</sup>). The length of any zone shall not exceed 300 feet (91 440 mm) in any direction.

**Exception:** Automatic sprinkler system zones shall not exceed the area permitted by NFPA 13.

**907.6.4.1 Zoning indicator panel.** A zoning indicator panel and the associated controls shall be provided in an approved location. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible alarm silencing switch.

**907.6.4.2 High-rise buildings.** In high-rise buildings, a separate zone by floor shall be provided for each of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler waterflow devices.
3. Manual fire alarm boxes.
4. Other approved types of automatic fire detection devices or suppression systems.

**907.6.5 Access.** Access shall be provided to each fire alarm device and notification appliance for periodic inspection, maintenance and testing.

**907.6.6 Monitoring.** Fire alarm systems required by this chapter or by the *fire code* shall be monitored by an approved supervising station in accordance with NFPA 72.

**Exception:** Monitoring by a supervising station is not required for:

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies.
3. *Deleted.*

**907.6.6.1 Automatic telephone-dialing devices.** Automatic telephone-dialing devices used to transmit an emergency alarm shall not be connected to any fire department telephone number unless approved by the *building official with input from the fire chief*.

**907.6.6.2 Termination of monitoring service.** *Deleted.*

**907.7 Acceptance tests and completion.** Upon completion of the installation, the

fire alarm system and all fire alarm components shall be tested in accordance with NFPA 72 and Section 901.5.

**907.7.1 Single- and multiple-station alarm devices.** When the installation of the alarm devices is complete, each device and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the smoke alarm provisions of NFPA 72.

**907.7.2 Record of completion.** A record of completion in accordance with NFPA 72 verifying that the system has been installed and tested in accordance with the approved plans and specifications shall be provided.

**907.7.3 Instructions.** Operating, testing and maintenance instructions and record drawings (“as-builts”) and equipment specifications shall be provided at an approved location.

**907.8 Inspection, testing and maintenance.** The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with Section 907.8 of the *fire code*.

## **SECTION 908 EMERGENCY ALARM SYSTEMS**

**908.1 Group H occupancies.** Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided in accordance with Section 415.5.

**908.2 Group H-5 occupancy.** Emergency alarms for notification of an emergency condition in an HPM facility shall be provided as required in Section 415.11.3.5. A continuous gas detection system shall be provided for HPM gases in accordance with Section 415.11.7.

**908.3 Highly toxic and toxic materials.** A gas detection system shall be provided to detect the presence of highly toxic or toxic gas at or below the permissible exposure limit (PEL) or ceiling limit of the gas for which detection is provided. The system shall be capable of monitoring the discharge from the treatment system at or below one-half the immediately dangerous to life and health (IDLH) limit.

**Exception:** A gas detection system is not required for toxic gases when the physiological warning threshold level for the gas is at a level below the accepted PEL for the gas.

**908.3.1 Alarms.** The gas detection system shall initiate a local alarm and transmit a signal to a constantly attended control station when a short-term hazard condition is detected. The alarm shall be both visible and audible and shall provide warning both inside and outside the area where gas is detected. The audible alarm shall be distinct from all other alarms.

**Exception:** Signal transmission to a constantly attended control station is not required when not more than one cylinder of highly toxic or toxic gas is stored.

**908.3.2 Shutoff of gas supply.** The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for whichever gas is detected.

**Exception:** Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic compressed gases where such reactors are:

1. Operated at pressures less than 15 pounds per square inch gauge (psig) (103.4 kPa).
2. Constantly attended.
3. Provided with readily accessible emergency shutoff valves.

**908.3.3 Valve closure.** The automatic closure of shutoff valves shall be in accordance with the following:

1. When the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas room and compressed gas containers are not in gas cabinets or exhausted enclosures, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the compressed container of specific gas detected supplying the manifold shall automatically close.

**Exception:** When the gas-detection sampling point initiating the gas detection system alarm is at a use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve in the gas valve enclosure for the branch line located in the piping distribution manifold enclosure shall automatically close.

**908.4 Ozone gas-generator rooms.** Ozone gas-generator rooms shall be equipped

with a continuous gas detection system that will shut off the generator and sound a local alarm when concentrations above the PEL occur.

**908.5 Repair garages.** A flammable-gas detection system shall be provided in repair garages for vehicles fueled by nonodorized gases in accordance with Section 406.8.5.

**908.6 Refrigerant detector.** Machinery rooms shall contain a refrigerant detector with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values for the refrigerant classification shown in the *mechanical code* for the refrigerant classification. Detectors and alarms shall be placed in approved locations. The detector shall transmit a signal to an approved location.

**908.7 Carbon dioxide (CO<sub>2</sub>) systems.** Emergency alarm systems in accordance with Section 5307.5.2 of the *fire code* shall be provided where required for compliance with Section 5307.5 of the *fire code*.

## SECTION 909 SMOKE CONTROL SYSTEMS

**909.1 Scope and purpose.** This section applies to mechanical or passive smoke control systems where they are required by other provisions of this code. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different purpose than the smoke- and heat venting provisions found in Section 910. Mechanical smoke control systems shall not be considered exhaust systems under Chapter 5 of the *mechanical code*.

**909.2 General design requirements.** Buildings, structures or parts thereof required by this code to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper

implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance with these provisions.

**909.3 Special inspection and test requirements.** In addition to the ordinary inspection and test requirements that buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the construction documents shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved. The special inspections and tests required by this section shall be conducted under the same terms in Section 1704.

**909.4 Analysis.** A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted construction documents and shall include, but not be limited to, the items indicated in Sections 909.4.1 through 909.4.7.

**909.4.1 Stack effect.** The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system's capabilities. In determining the maximum probable stack effect, altitude, elevation, weather history and interior temperatures shall be used.

**909.4.2 Temperature effect of fire.** Buoyancy and expansion caused by the design fire in accordance with Section 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system's capabilities.

**909.4.3 Wind effect.** The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of Chapter 16.

**909.4.4 HVAC systems.** The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the HVAC systems.



**909.4.5 Climate.** The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

**909.4.6 Duration of operation.** All portions of active or engineered smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is greater.

**909.4.7 Smoke control system interaction.** The design shall consider the interaction effects of the operation of multiple smoke control systems for all design scenarios.

**909.5 Smoke barrier construction.** *Where provided, smoke barriers* required for passive smoke control and a smoke control system using the pressurization method shall comply with Section 709. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls  $A/A_w = 0.00100$
2. Interior exit stairways and ramps and exit passageways:  
 $A/A_w = 0.00035$
3. Enclosed exit access stairways and ramps and all other shafts:  
 $A/A_w = 0.00150$
4. Floors and roofs:  $A/A_F = 0.00050$

where:

A = Total leakage area, square feet ( $m^2$ ).

$A_F$  = Unit floor or roof area of barrier, square feet ( $m^2$ ).

$A_w$  = Unit wall area of barrier, square feet ( $m^2$ ).

The leakage area ratios shown do not include openings due to gaps around doors and operable windows. The total leakage area of the smoke barrier shall be determined in accordance with Section 909.5.1 and tested in accordance with Section 909.5.2.

**909.5.1 Total leakage area.** Total leakage area of the barrier is the product of the smoke barrier gross area multiplied by the allowable leakage area ratio, plus the area of other openings such as gaps around doors and operable windows.

**909.5.2 Testing of leakage area.** Compliance with the maximum total leakage area shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems utilizing the pressurization method. Compliance with

the maximum total leakage area of passive smoke control systems shall be verified through methods such as door fan testing or other methods, as approved by the *building* official.

**909.5.3 Opening protection.** Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by fire door assemblies complying with Section 716.5.3.

**Exceptions:**

1. Passive smoke control systems with automatic closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with Section 907.3.
2. Fixed openings between smoke zones that are protected utilizing the airflow method.
3. In Group I-1 Condition 2, Group I-2 and ambulatory care facilities, where a pair of opposite swinging doors are installed across a corridor in accordance with Section 909.5.3.1, the doors shall not be required to be protected in accordance with Section 716. The doors shall be closefitting within operational tolerances and shall not have a center mullion or undercuts in excess of  $\frac{3}{4}$  inch (19.1 mm), louvers or grilles. The doors shall have head and jamb stops and astragals or rabbets at meeting edges and, where permitted by the door manufacturer's listing, positive-latching devices are not required.
4. In Group I-2 and ambulatory care facilities, where such doors are special-purpose horizontal sliding, accordion or folding door assemblies installed in accordance with Section 1010.1.4.3 and are automatic closing by smoke detection in accordance with Section 716.5.9.3.
5. Group I-3.
6. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank-down capacity of greater than 20 minutes as determined by the design fire size.

**909.5.3.1 Group I-1 Condition 2; Group I-2 and ambulatory care facilities.** In Group I-1 Condition 2, Group I-2 and ambulatory care facilities, where doors are installed across a corridor, the doors shall be automatic closing by smoke detection in accordance with Section 716.5.9.3 and shall have a vision panel with fire protection-rated glazing materials in fire protection-rated frames, the area of which shall not exceed that tested.

**909.5.3.2 Ducts and air transfer openings.** Ducts and air transfer openings are required to be protected with a minimum Class II, 250°F (121°C) smoke

damper complying with Section 717.

**909.6 Pressurization method.** The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

**909.6.1 Minimum pressure difference.** The minimum pressure difference across a smoke barrier shall be 0.05-inch water gage (0.0124 kPa) in fully sprinklered buildings.

In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences not less than two times the maximum calculated pressure difference produced by the design fire.

**909.6.2 Maximum pressure difference.** The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with Section 1010.1.3. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$$F = F_{dc} + K(WA \Delta P)/2(W-d) \quad \text{(Equation 9-1)}$$

where:

A = Door area, square feet (m<sup>2</sup>).

d = Distance from door handle to latch edge of door, feet (m).

F = Total door opening force, pounds (N).

F<sub>dc</sub> = Force required to overcome closing device, pounds (N).

K = Coefficient 5.2 (1.0).

W = Door width, feet (m).

ΔP = Design pressure difference, inches of water (Pa).

**909.6.3 Pressurized stairways and elevator hoistways.** Where stairways or elevator hoistways are pressurized, such pressurization systems shall comply with Section 909 as smoke control systems, in addition to the requirements of Sections 909.20 and 909.21 of this code.

**909.7 Airflow design method.** Where approved by the *building* official, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with this section. Airflow shall be

directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects. Smoke control systems using the airflow method shall be designed in accordance with NFPA 92.

**909.7.1 Prohibited conditions.** This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. In no case shall airflow toward the fire exceed 200 feet per minute (1.02 m/s). Where the calculated airflow exceeds this limit, the airflow method shall not be used.

**909.8 Exhaust method.** Where approved by the *building* official, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92.

**909.8.1 Smoke layer.** The height of the lowest horizontal surface of the smoke layer interface shall be maintained not less than 6 feet (1829 mm) above a walking surface that forms a portion of a required egress system within the smoke zone.

**909.9 Design fire.** The design fire shall be based on a rational analysis performed by the registered design professional and approved by the *building* official. The design fire shall be based on the analysis in accordance with Section 909.4 and this section.

**909.9.1 Factors considered.** The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

**909.9.2 Design fire fuel.** Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

**909.9.3 Heat-release assumptions.** The analysis shall make use of best available data from approved sources and shall not be based on excessively stringent limitations of combustible material.

**909.9.4 Sprinkler effectiveness assumptions.** A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

**909.10 Equipment.** Equipment including, but not limited to, fans, ducts, automatic dampers and balance dampers, shall be suitable for its intended use, suitable for the probable exposure temperatures that the rational analysis indicates and as approved by the *building* official.

**909.10.1 Exhaust fans.** Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

$$T_s = (Q_c/mc) + (T_a) \quad \text{(Equation 9-3)}$$

where:

$c$  = Specific heat of smoke at smoke layer temperature, Btu/lb°F (kJ/kg · K).

$m$  = Exhaust rate, pounds per second (kg/s).

$Q_c$  = Convective heat output of fire, Btu/s (kW).

$T_a$  = Ambient temperature, °F (K).

$T_s$  = Smoke temperature, °F (K).

**Exception:** Reduced  $T_s$  as calculated based on the assurance of adequate dilution air.

**909.10.2 Ducts.** Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 909.10.1. Ducts shall be constructed and supported in accordance with the *mechanical code*. Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

**Exception:** Flexible connections, for the purpose of vibration isolation, complying with the *mechanical code* and that are constructed of approved fire-resistance-rated materials.

**909.10.3 Equipment, inlets and outlets.** Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outside air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

**909.10.4 Automatic dampers.** Automatic dampers, regardless of the purpose

for which they are installed within the smoke control system, shall be listed and conform to the requirements of *Section 717.3*.

**909.10.5 Fans.** In addition to other requirements, belt driven fans shall have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the requirements of Chapter 16.

Motors driving fans shall not be operated beyond their nameplate horsepower (kilowatts), as determined from measurement of actual current draw, and shall have a minimum service factor of 1.15.

**909.11 Standby power.** Smoke control systems shall be provided with standby power in accordance with Section 2702.

**909.11.1 Equipment room.** The standby power source and its transfer switches shall be in a room separate from the normal power transformers and switch gears and ventilated directly to and from the exterior. The room shall be enclosed with not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**909.11.2 Power sources and power surges.** Elements of the smoke control system relying on volatile memories or the like shall be supplied with uninterruptable power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke control system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

**909.12 Detection and control systems.** Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control equipment.

**909.12.1 Verification.** Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override and the presence of power downstream of all disconnects. A preprogrammed weekly test sequence shall report abnormal conditions audibly, visually and by printed report. The

preprogrammed weekly test shall operate all devices, equipment and components used for smoke control.

**Exception:** Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the preprogrammed weekly testing, where approved by the building official and in accordance with both of the following:

1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a listed control unit.
2. Testing of all components bypassed from the preprogrammed weekly test shall be in accordance with Section 909.20.6 of the *fire code*.

**909.12.2 Wiring.** In addition to meeting requirements of NFPA 70, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

**909.12.3 Activation.** Smoke control systems shall be activated in accordance with this section.

**909.12.3.1 Pressurization, airflow or exhaust method.** Mechanical smoke control systems using the pressurization, airflow or exhaust method shall have completely automatic control.

**909.12.3.2 Passive method.** Passive smoke control systems actuated by approved spot-type detectors listed for releasing service shall be permitted.

**909.12.4 Automatic control.** Where completely automatic control is required or used, the automatic-control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Section 903.3.1.1, manual controls that are readily accessible to the fire department and any smoke detectors required by engineering analysis.

**909.13 Control air tubing.** Control air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections and shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

**909.13.1 Materials.** Control-air tubing shall be hard drawn copper, Type L, ACR in accordance with ASTM B 42, ASTM B 43, ASTM B 68, ASTM B 88,

ASTM B 251 and ASTM B 280. Fittings shall be wrought copper or brass, solder type in accordance with ASME B 16.18 or ASME B16.22. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP-5 brazing alloy with solidus above 1,100°F (593°C) and liquids below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

**Exception:** Nonmetallic tubing used within control panels and at the final connection to devices provided all of the following conditions are met:

1. *Combustible pneumatic tubing exposed within a plenum shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread of not greater than 5 feet (1524 mm) when tested in accordance with UL 1820. Combustible pneumatic tubing shall be listed and labeled.*
2. Tubing and connected devices shall be completely enclosed within a galvanized or paint grade steel enclosure having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage). Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or Teflon or by suitable brass compression to male barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or moveable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing serving devices on doors shall be fastened along hinges.

**909.13.2 Isolation from other functions.** Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

**909.13.3 Testing.** Control air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

**909.14 Marking and identification.** The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

**909.15 Control diagrams.** Identical control diagrams showing all devices in the system and identifying their location and function shall be maintained current and kept on file with the *building official*, the *fire official*, and in the fire command center in a format and manner approved by the *building official with input from the*



fire official.

**909.16 Fire fighter's smoke control panel.** A fire fighter's smoke control panel for fire department emergency response purposes only shall be provided and shall include manual control or override of automatic control for mechanical smoke control systems. The panel shall be located in a fire command center complying with Section 911 in high-rise buildings or buildings with smoke-protected assembly seating. In all other buildings, the fire fighter's smoke control panel shall be installed in an approved location adjacent to the fire alarm control panel. The fire fighter's smoke control panel shall comply with Sections 909.16.1 through 909.16.3.

**909.16.1 Smoke control systems.** Fans within the building shall be shown on the fire fighter's control panel. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all smoke control equipment, annunciated by fan and zone, and by pilot-lamp-type indicators as follows:

1. Fans, dampers and other operating equipment in their normal status—WHITE.
2. Fans, dampers and other operating equipment in their off or closed status—RED.
3. Fans, dampers and other operating equipment in their on or open status—GREEN.
4. Fans, dampers and other operating equipment in a fault status—YELLOW/AMBER.

**909.16.2 Smoke control panel.** The fire fighter's control panel shall provide control capability over the complete smoke control system equipment within the building as follows:

1. ON-AUTO-OFF control over each individual piece of operating smoke control equipment that can also be controlled from other sources within the building. This includes stairway pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator shaft fans and other operating equipment used or intended for smoke control purposes.
2. OPEN-AUTO-CLOSE control over individual dampers relating to smoke control and that are also controlled from other sources within the building.
3. ON-OFF or OPEN-CLOSE control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire fighter's control panel.

**Exceptions:**

1. Complex systems, where approved, where the controls and indicators are combined to control and indicate all elements of a single smoke zone as a unit.
2. Complex systems, where approved, where the control is accomplished by computer interface using approved, plain English commands.

**909.16.3 Control action and priorities.** The firefighter's control panel actions shall be as follows:

1. ON-OFF and OPEN-CLOSE control actions shall have the highest priority of any control point within the building. Once issued from the fire fighter's control panel, automatic or manual control from any other control point within the building shall not contradict the control action. Where automatic means are provided to interrupt normal, nonemergency equipment operation or produce a specific result to safeguard the building or equipment including, but not limited to, duct freeze stats, duct smoke detectors, high-temperature cutouts, temperature-actuated linkage and similar devices, such means shall be capable of being overridden by the fire fighter's control panel. The last control action as indicated by each fire fighter's control panel switch position shall prevail. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

**Exception:** Power disconnects required by NFPA 70.

2. Only the AUTO position of each three-position firefighter's control panel switch shall allow automatic or manual control action from other control points within the building. The AUTO position shall be the NORMAL, nonemergency, building control position. Where a fire fighter's control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator described in Section 909.16.1. Where directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

**909.17 System response time.** Smoke-control system activation shall be initiated immediately after receipt of an appropriate automatic or manual activation command. Smoke control systems shall activate individual components (such as dampers and fans) in the sequence necessary to prevent physical damage to the fans, dampers, ducts and other equipment. For purposes of smoke control, the fire fighter's control panel response time shall be the same for automatic or manual smoke control action initiated from any other building control point. The total response time, including that necessary for detection, shutdown of operating

equipment and smoke control system startup, shall allow for full operational mode to be achieved before the conditions in the space exceed the design smoke condition. The system response time for each component and their sequential relationships shall be detailed in the required rational analysis and verification of their installed condition reported in the required final report.

**909.18 Acceptance testing.** Devices, equipment, components and sequences shall be individually tested. These tests, in addition to those required by other provisions of this code, shall consist of determination of function, sequence and, where applicable, capacity of their installed condition.

**909.18.1 Detection devices.** Smoke or fire detectors that are a part of a smoke control system shall be tested in accordance with Chapter 9 in their installed condition. Where applicable, this testing shall include verification of airflow in both minimum and maximum conditions.

**909.18.2 Ducts.** Ducts that are part of a smoke control system shall be traversed using generally accepted practices to determine actual air quantities.

**909.18.3 Dampers.** Dampers shall be tested for function in their installed condition.

**909.18.4 Inlets and outlets.** Inlets and outlets shall be read using generally accepted practices to determine air quantities.

**909.18.5 Fans.** Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute (rpm) and belt tension shall be made.

**909.18.6 Smoke barriers.** Measurements using inclined manometers or other approved calibrated measuring devices shall be made of the pressure differences across smoke barriers. Such measurements shall be conducted for each possible smoke control condition.

**909.18.7 Controls.** Each smoke zone equipped with an automatic-initiation device shall be put into operation by the actuation of one such device. Each additional device within the zone shall be verified to cause the same sequence without requiring the operation of fan motors in order to prevent damage. Control sequences shall be verified throughout the system, including verification of override from the fire-fighter's control panel and simulation of standby power conditions.

**909.18.8 Testing for smoke control.** Smoke control systems shall be tested by a special inspector in accordance with Section 1705.18.

**909.18.8.1 Scope of testing.** Testing shall be conducted in accordance with the following:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.

**909.18.8.2 Qualifications.** Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

**909.18.8.3 Reports.** A complete report of testing shall be prepared by the approved agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or mark. The report shall be reviewed by the responsible registered design professional and, when satisfied that the design intent has been achieved, the responsible registered design professional shall sign, seal and date the report.

**909.18.8.3.1 Report filing.** A copy of the final report shall be filed with the *building* official, the *fire official*, and an identical copy shall be maintained in an approved location at the building.

**909.18.9 Identification and documentation.** Charts, drawings and other documents identifying and locating each component of the smoke control system, and describing its proper function and maintenance requirements, shall be maintained on file at the building as an attachment to the report required by Section 909.18.8.3. Devices shall have an approved identifying tag or mark on them consistent with the other required documentation and shall be dated indicating the last time they were successfully tested and by whom.

**909.19 System acceptance.** Buildings, or portions thereof, required by this code to comply with this section shall not be issued a certificate of occupancy until such time that the *building* official determines that the provisions of this section have been fully complied with and that the fire department has received satisfactory instruction on the operation, both automatic and manual, of the system and a written maintenance program complying with the requirements of Section 909.20.1 of the

*fire code* has been submitted and approved by the *building* official.

**Exception:** In buildings of phased construction, a temporary certificate of occupancy, as approved by the *building* official, shall be allowed provided that those portions of the building to be occupied meet the requirements of this section and that the remainder does not pose a significant hazard to the safety of the proposed occupants or adjacent buildings.

**909.20 Smokeproof enclosures.** Where required by Section 1023.11, a smokeproof enclosure shall be constructed in accordance with this section. A smokeproof enclosure shall consist of an interior exit stairway or ramp that is enclosed in accordance with the applicable provisions of Section 1023 and an open exterior balcony or ventilated vestibule meeting the requirements of this section. Where access to the roof is required by *Section 1011.12*, such access shall be from the smokeproof enclosure where a smokeproof enclosure is required.

**909.20.1 Access.** Access to the stairway or ramp shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall be not less than the required width of the corridor leading to the vestibule but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.

**909.20.2 Construction.** The smokeproof enclosure shall be separated from the remainder of the building by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Openings are not permitted other than the required means of egress doors. The vestibule shall be separated from the stairway or ramp by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The open exterior balcony shall be constructed in accordance with the fire-resistance rating requirements for floor assemblies.

**909.20.2.1 Door closers.** Doors in a smokeproof enclosure shall be self- or automatic closing by actuation of a smoke detector in accordance with Section 716.5.9.3 and shall be installed at the floor-side entrance to the smokeproof enclosure. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smokeproof enclosure at all levels. Smoke detectors shall be installed in accordance with Section 907.3.

**909.20.3 Natural ventilation alternative.** The provisions of Sections 909.20.3.1 through 909.20.3.3 shall apply to ventilation of smokeproof

enclosures by natural means.

**909.20.3.1 Balcony doors.** Where access to the stairway or ramp is by way of an open exterior balcony, the door assembly into the enclosure shall be a fire door assembly in accordance with Section 716.5.

**909.20.3.2 Vestibule doors.** Where access to the stairway or ramp is by way of a vestibule, the door assembly into the vestibule shall be a fire door assembly complying with Section 716.5. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating complying with Section 716.5.

**909.20.3.3 Vestibule ventilation.** Each vestibule shall have a minimum net area of 16 square feet (1.5 m<sup>2</sup>) of opening in a wall facing an outer court, yard or public way that is not less than 20 feet (6096 mm) in width.

**909.20.4 Mechanical ventilation alternative.** The provisions of Sections 909.20.4.1 through 909.20.4.4 shall apply to ventilation of smokeproof enclosures by mechanical means.

**909.20.4.1 Vestibule doors.** The door assembly from the building into the vestibule shall be a fire door assembly complying with Section 716.5.3. The door assembly from the vestibule to the stairway or ramp shall not have less than a 20-minute fire protection rating and shall meet the requirements for a smoke door assembly in accordance with Section 716.5.3. The door shall be installed in accordance with NFPA 105.

**909.20.4.2 Vestibule ventilation.** The vestibule shall be supplied with not less than one air change per minute and the exhaust shall be not less than 150 percent of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within 6 inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than 6 inches (152 mm) down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling dampers are permitted where necessary to meet the design requirements, but dampers are not otherwise required.

**909.20.4.2.1 Engineered ventilation system.** Where a specially engineered system is used, the system shall exhaust a quantity of air

equal to not less than 90 air changes per hour from any vestibule in the emergency operation mode and shall be sized to handle three vestibules simultaneously. Smoke detectors shall be located at the floor-side entrance to each vestibule and shall activate the system for the affected vestibule. Smoke detectors shall be installed in accordance with Section 907.3.

**909.20.4.3 Smoke trap.** The vestibule ceiling shall be not less than 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward-moving air column. The height shall not be decreased unless approved and justified by design and test.

**909.20.4.4 Stairway or ramp shaft air movement system.** The stairway or ramp shaft shall be provided with a dampered relief opening and supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) in the shaft relative to the vestibule with all doors closed.

**909.20.5 Stairway and ramp pressurization alternative.** Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the vestibule is not required, provided each interior exit stairway or ramp is pressurized to not less than 0.10 inch of water (25 Pa) and not more than 0.35 inches of water (87 Pa) in the shaft relative to the building measured with all interior exit stairway and ramp doors closed under maximum anticipated conditions of stack effect and wind effect.

**909.20.6 Ventilating equipment.** The activation of ventilating equipment required by the alternatives in Sections 909.20.4 and 909.20.5 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure. When the closing device for the stairway and ramp shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.3.

**909.20.6.1 Ventilation systems.** Smokeproof enclosure ventilation systems shall be independent of other building ventilation systems. The equipment, control wiring, power wiring and ductwork shall comply with one of the following:

1. Equipment, control wiring, power wiring and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by

ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

2. Equipment, control wiring, power wiring and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
3. Equipment, control wiring, power wiring and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**Exceptions:**

1. Control wiring and power wiring utilizing a 2-hour rated cable or cable system.
2. Where encased with not less than 2 inches (51 mm) of concrete.
3. Control wiring and power wiring protected by a listed electrical circuit protective system with a fire-resistance rating of not less than 2 hours.

**909.20.6.2 Standby power.** Mechanical vestibule and stairway and ramp shaft ventilation systems and automatic fire detection systems shall be provided with standby power in accordance with Section 2702.

**909.20.6.3 Acceptance and testing.** Before the mechanical equipment is approved, the system shall be tested in the presence of the building official to confirm that the system is operating in compliance with these requirements.

**909.21 Elevator hoistway pressurization alternative.** Where elevator hoistway pressurization is provided in lieu of required enclosed elevator lobbies, the pressurization system shall comply with Sections 909.21.1 through 909.21.11.

**909.21.1 Pressurization requirements.** Elevator hoistways shall be pressurized to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to adjacent occupied space on all floors. This pressure shall be measured at the midpoint of each hoistway door, with all elevator cars at the floor of recall and all hoistway doors on the floor of recall open and all other hoistway doors



closed. The pressure differentials shall be measured between the hoistway and the adjacent elevator landing. The opening and closing of hoistway doors at each level must be demonstrated during this test. The supply air intake shall be from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any air exhaust system or outlet.

**Exceptions:**

1. On floors containing only Group R occupancies, the pressure differential is permitted to be measured between the hoistway and a dwelling unit or sleeping unit.
2. Where an elevator opens into a lobby enclosed in accordance with Section 3007.6 or 3008.6, the pressure differential is permitted to be measured between the hoistway and the space immediately outside the door(s) from the floor to the enclosed lobby.
3. The pressure differential is permitted to be measured relative to the outdoor atmosphere on floors other than the following:
  - 3.1. The fire floor.
  - 3.2. The two floors immediately below the fire floor.
  - 3.3. The floor immediately above the fire floor.
4. The minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to occupied floors are not required at the floor of recall with the doors open.

**909.21.1.1 Use of ventilation systems.** Ventilation systems, other than hoistway supply air systems, are permitted to be used to exhaust air from adjacent spaces on the fire floor, two floors immediately below and one floor immediately above the fire floor to the building's exterior where necessary to maintain positive pressure relationships as required in Section 909.21.1 during operation of the elevator shaft pressurization system.

**909.21.2 Rational analysis.** A rational analysis complying with Section 909.4 shall be submitted with the construction documents.

**909.21.3 Ducts for system.** Any duct system that is part of the pressurization system shall be protected with the same fire-resistance rating as required for the elevator shaft enclosure.

**909.21.4 Fan system.** The fan system provided for the pressurization system shall be as required by Sections 909.21.4.1 through 909.21.4.4.

**909.21.4.1 Fire-resistance.** Where located within the building, the fan

system that provides the pressurization shall be protected with the same fire-resistance rating required for the elevator shaft enclosure.

**909.21.4.2 Smoke detection.** The fan system shall be equipped with a smoke detector that will automatically shut down the fan system when smoke is detected within the system.

**909.21.4.3 Separate systems.** A separate fan system shall be used for each elevator hoistway.

**909.21.4.4 Fan capacity.** The supply fan shall be either adjustable with a capacity of not less than 1,000 cfm (0.4719 m<sup>3</sup>/s) per door, or that specified by a registered design professional to meet the requirements of a designed pressurization system.

**909.21.5 Standby power.** The pressurization system shall be provided with standby power in accordance with Section 2702.

**909.21.6 Activation of pressurization system.** The elevator pressurization system shall be activated upon activation of either the building fire alarm system or the elevator lobby smoke detectors. Where both a building fire alarm system and elevator lobby smoke detectors are present, each shall be independently capable of activating the pressurization system.

**909.21.7 Testing.** Testing for performance shall be required in accordance with Section 909.18.8. System acceptance shall be in accordance with Section 909.19.

**909.21.8 Marking and identification.** Detection and control systems shall be marked in accordance with Section 909.14.

**909.21.9 Control diagrams.** Control diagrams shall be provided in accordance with Section 909.15.

**909.21.10 Control panel.** A control panel complying with Section 909.16 shall be provided.

**909.21.11 System response time.** Hoistway pressurization systems shall comply with the requirements for smoke control system response time in Section 909.17.

## SECTION 910 SMOKE AND HEAT REMOVAL

**910.1 General.** Where required by this code, smoke and heat vents or mechanical smoke removal systems shall conform to the requirements of this section.

**910.2 Where required.** Smoke and heat vents or a mechanical smoke removal system shall be installed as required by Sections 910.2.1 and 910.2.2.

**Exceptions:**

1. Frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.
2. Smoke and heat removal shall not be required in areas of buildings equipped with early suppression fast-response (ESFR) sprinklers.
3. Smoke and heat removal shall not be required in areas of buildings equipped with control mode special application sprinklers with a response time index of  $50 \text{ (m} \cdot \text{s)}^{1/2}$  or less that are listed to control a fire in stored commodities with 12 or fewer sprinklers.

**910.2.1 Group F-1 or S-1.** Smoke and heat vents installed in accordance with Section 910.3 or a mechanical smoke removal system installed in accordance with Section 910.4 shall be installed in buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m<sup>2</sup>) of undivided area. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.

**Exception:** Group S-1 aircraft repair hangars.

**910.2.2 High-piled combustible storage.** Smoke and heat removal required by Table 3206.2 of the *fire code* for buildings and portions thereof containing high-piled combustible storage shall be installed in accordance with Section 910.3 in unsprinklered buildings. In buildings and portions thereof containing high-piled combustible storage equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a smoke and heat removal system shall be installed in accordance with Section 910.3 or 910.4. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.

**910.3 Smoke and heat vents.** The design and installation of smoke and heat vents

shall be in accordance with Sections 910.3.1 through 910.3.3.

**910.3.1 Listing and labeling.** Smoke and heat vents shall be listed and labeled to indicate compliance with UL 793 or FM 4430.

**910.3.2 Smoke and heat vent locations.** Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent lot lines and fire walls and 10 feet (3048 mm) or more from fire barriers. Vents shall be uniformly located within the roof in the areas of the building where the vents are required to be installed by Section 910.2 with consideration given to roof pitch, sprinkler location and structural members.

**910.3.3 Smoke and heat vents area.** The required aggregate area of smoke and heat vents shall be calculated as follows:

For buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1:

$$A_{VR} = V/9000 \quad \text{(Equation 9-4)}$$

where:

$A_{VR}$  = The required aggregate vent area (ft<sup>2</sup>).

$V$  = Volume (ft<sup>3</sup>) of the area that requires smoke removal.

For unsprinklered buildings:

$$A_{VR} = A_{FA}/50 \quad \text{(Equation 9-5)}$$

where:

$A_{VR}$  = The required aggregate vent area (ft<sup>2</sup>).

$A_{FA}$  = The area of the floor in the area that requires smoke removal.

**910.4 Mechanical smoke removal systems.** Mechanical smoke removal systems shall be designed and installed in accordance with Sections 910.4.1 through 910.4.7.

**910.4.1 Automatic sprinklers required.** The building shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

**910.4.2 Exhaust fan construction.** Exhaust fans that are part of a mechanical smoke removal system shall be rated for operation at 221°F (105°C). Exhaust

fan motors shall be located outside of the exhaust fan air stream.

**910.4.3 System design criteria.** The mechanical smoke removal system shall be sized to exhaust the building at a minimum rate of two air changes per hour based upon the volume of the building or portion thereof without contents. The capacity of each exhaust fan shall not exceed 30,000 cubic feet per minute (14.2 m<sup>3</sup>/sec).

**910.4.3.1 Makeup air.** Makeup air openings shall be provided within 6 feet (1829 mm) of the floor level. Operation of makeup air openings shall be manual or automatic. The minimum gross area of makeup air inlets shall be 8 square feet per 1,000 cubic feet per minute (0.74 m<sup>2</sup> per 0.4719 m<sup>3</sup>/s) of smoke exhaust.

**910.4.4 Activation.** The mechanical smoke removal system shall be activated by manual controls only.

**910.4.5 Manual control location.** Manual controls shall be located so as to be accessible to the fire service from an exterior door of the building and protected against interior fire exposure by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

**910.4.6 Control wiring.** Wiring for operation and control of mechanical smoke removal systems shall be connected ahead of the main disconnect in accordance with Section 701.12E of NFPA 70 and be protected against interior fire exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes.

**910.4.7 Controls.** Where building air-handling and mechanical smoke removal systems are combined or where independent building air-handling systems are provided, fans shall automatically shut down in accordance with the *mechanical code*. The manual controls provided for the smoke removal system shall have the capability to override the automatic shutdown of fans that are part of the smoke removal system.

**910.5 Maintenance.** Smoke and heat vents and mechanical smoke removal systems shall be maintained in accordance with the *fire code*.

## SECTION 911 FIRE COMMAND CENTER

**911.1 General.** Where required by other sections of this code and in buildings classified as high-rise buildings by this code, a fire command center for fire department operations shall be provided and shall comply with Sections 911.1.1 through 911.1.6.

**911.1.1 Location and access.** The location and accessibility of the fire command center shall be *as requested by the fire official and approved by the building official*.

**911.1.2 Separation.** The fire command center shall be separated from the remainder of the building by not less than a 1-hour fire barrier constructed in accordance with Section 707 or horizontal assembly constructed in accordance with Section 711, or both.

**911.1.3 Size.** The room shall be not less than 200 square feet (19 m<sup>2</sup>) with a minimum dimension of 10 feet (3048 mm).

**911.1.4 Layout approval.** A layout of the fire command center and all features required by this section to be contained therein shall be submitted for approval prior to installation.

**911.1.5 Storage.** Storage unrelated to operation of the fire command center shall be prohibited.

**911.1.6 Required features.** The fire command center shall comply with NFPA 72 and shall contain all of the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system annunciator.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking interior exit stairway doors simultaneously.
8. Sprinkler valve and waterflow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.

12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire fighter air replenishment system, fire-fighting equipment and fire department access and the location of fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions.
13. An approved Building Information Card that contains, but is not limited to, the following information:
  - 13.1. General building information that includes: property name, address, the number of floors in the building above and below grade, use and occupancy classification (for mixed uses, identify the different types of occupancies on each floor), and the estimated building population during the day, night and weekend.
  - 13.2. Building emergency contact information that includes: a list of the building's emergency contacts including but not limited to building manager and building engineer and their respective work phone number, cell phone number, e-mail address.
  - 13.3. Building construction information that includes: the type of building construction including but not limited to floors, walls, columns, and roof assembly.
  - 13.4. Exit access and exit stairway information that includes: number of exit access and exit stairways in the building, each exit access and exit stairway designation and floors served, location where each exit access and exit stairway discharges, interior exit stairways that are pressurized, exit stairways provided with emergency lighting, each exit stairway that allows reentry, exit stairways providing roof access; elevator information that includes: number of elevator banks, elevator bank designation, elevator car numbers and respective floors that they serve; location of elevator machine rooms, control rooms and control spaces; location of sky lobby, location of freight elevator banks.
  - 13.5. Building services and system information that includes: location of mechanical rooms, location of building management system, location and capacity of all fuel oil tanks, location of emergency generator, location of natural gas service.
  - 13.6. Fire protection system information that includes: location of standpipes, location of fire pump room, location of fire department connections, floors protected by automatic sprinklers, location of different types of automatic sprinkler systems installed including, but not limited to, dry, wet and pre-action.
  - 13.7. Hazardous material information that includes: location of hazardous material, quantity of hazardous material.
14. Work table.
15. Generator supervision devices, manual start and transfer features.
16. Public address system, where specifically required by other sections of this code.

17. Elevator fire recall switch in accordance with ASME A17.1 *as referenced in rule 4101:5-3-01 of the Administrative Code.*
18. Elevator emergency or standby power selector switch(es), where emergency or standby power is provided.

## SECTION 912

### FIRE DEPARTMENT CONNECTIONS

**912.1 Installation.** Fire department connections shall be installed in accordance with the NFPA standard applicable to the system design and shall comply with Sections 912.2 through 912.6.

***Exceptions:*** *Fire department connections are not required for:*

1. *Limited area sprinkler systems supplied from the domestic water system.*
2. *Automatic sprinkler systems having less than 20 sprinklers.*

**912.2 Location.** With respect to hydrants, driveways, buildings and landscaping, fire department connections shall be so located that fire apparatus and hose connected to supply the system will not obstruct access to the buildings for other fire apparatus. The location of fire department connections shall be *as requested by the fire official and approved by the building official.*

**912.2.1 Visible location.** Fire department connections shall be located *as requested by the fire official and approved by the building official. In the absence of input from the fire official during the plan review process outlined in Sections 106.1.2(5) and 901.2.1.1, the fire department connection shall be located on the street side of buildings, fully visible and recognizable from the street or nearest point of fire department vehicle access.*

**912.2.2 Existing buildings.** On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an approved sign mounted on the street front or on the side of the building. Such sign shall have the letters “FDC” not less than 6 inches (152 mm) high and words in letters not less than 2 inches (51 mm) high or an arrow to indicate the location. Such signs shall be subject to the approval of the *fire official.*

**912.3 Fire hose threads.** Fire hose threads used in connection with standpipe systems shall be *as prescribed by the fire official and approved by the building official with input from the fire chief* and shall be compatible with fire department hose threads. *Prior to issuance of the certificate of plan approval, the building official shall communicate with the local fire official to verify that the proposed*



*threads are compatible with those currently used by the fire department.*

**912.4 Access.** Immediate access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other fixed or moveable object. Access to fire department connections shall be approved by *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1.*

**Exception:** Fences, where provided with an access gate equipped with a sign complying with the legend requirements of this section and a means of emergency operation. The gate and the means of emergency operation shall be approved by the *building official with input from the fire official as outlined in Sections 106.1.2(5) and 901.2.1.1* and maintained operational at all times.

**912.4.1 Locking fire department connection caps.** The *building official* is authorized to require locking caps on fire department connections for water-based fire protection systems where the responding fire department *requests the locks and carries appropriate key wrenches for removal.*

**912.4.2 Clear space around connections.** A working space of not less than 36 inches (762 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be provided and maintained in front of and to the sides of wall-mounted fire department connections and around the circumference of free-standing fire department connections, except as otherwise *requested by the fire official and approved by the building official.*

**912.4.3 Physical protection.** Where fire department connections are subject to impact by a motor vehicle, vehicle impact protection shall be provided in accordance with Section 312 of the *fire code.*

**912.5 Signs.** A metal sign with raised letters not less than 1 inch (25 mm) in size shall be mounted on all fire department connections serving automatic sprinklers, standpipes or fire pump connections. Such signs shall read: AUTOMATIC SPRINKLERS or STANDPIPES or TEST CONNECTION or a combination thereof as applicable. Where the fire department connection does not serve the entire building, a sign shall be provided indicating the portions of the building served.

**912.6 Backflow protection.** The potable water supply to automatic sprinkler and standpipe systems shall be protected against backflow as required by the *plumbing code.*

## SECTION 913 FIRE PUMPS

**913.1 General.** Where provided, fire pumps shall be installed in accordance with this section and NFPA 20.

***913.1 Minimum suction pressure to be maintained.** When a fire pump is installed, the “Ohio Environmental Protection Agency” requires the installation of a low pressure cut-off, a low suction throttling valve, or variable speed suction limiting controls to ensure that a minimum of 10 psi is maintained in the suction line while the pump is operating (see rule 3745-95-07 of the Administrative Code).*

**913.2 Protection against interruption of service.** The fire pump, driver and controller shall be protected in accordance with NFPA 20 against possible interruption of service through damage caused by explosion, fire, flood, earthquake, rodents, insects, windstorm, freezing, vandalism and other adverse conditions.

**913.2.1 Protection of fire pump rooms.** Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour fire barriers constructed in accordance with Section 707 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

**Exceptions:**

1. In other than high-rise buildings, separation by 1-hour fire barriers constructed in accordance with Section 707 or 1-hour horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Separation is not required for fire pumps physically separated in accordance with NFPA 20.

**913.2.2 Circuits supplying fire pumps.** Cables used for survivability of circuits supplying fire pumps shall be listed in accordance with UL 2196. Electrical circuit protective systems shall be installed in accordance with their listing requirements.

**913.3 Temperature of pump room.** Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 40°F (5°C).

**913.3.1 Engine manufacturer’s recommendation.** Temperature of the pump

room, pump house or area where engines are installed shall never be less than the minimum recommended by the engine manufacturer. The engine manufacturer's recommendations for oil heaters shall be followed.

**913.4 Valve supervision.** Where provided, the fire pump suction, discharge and bypass valves, and isolation valves on the backflow prevention device or assembly shall be supervised open by one of the following methods:

1. Central-station, proprietary or remote-station signaling service.
2. Local signaling service that will cause the sounding of an audible signal at a constantly attended location.
3. Locking valves open.
4. Sealing of valves and approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

**913.4.1 Test outlet valve supervision.** Fire pump test outlet valves shall be supervised, *sealed, or locked* in the closed position.

**913.5 Acceptance test.** Acceptance testing shall be done in accordance with the requirements of NFPA 20 *and Section 901.5*.

## **SECTION 914 EMERGENCY RESPONDER SAFETY FEATURES**

**914.1 Shaftway markings.** Vertical shafts shall be identified as required by Sections 914.1.1 and 914.1.2.

**914.1.1 Exterior access to shaftways.** Outside openings accessible to the fire department and that open directly on a hoistway or shaftway communicating between two or more floors in a building shall be plainly marked with the word "SHAFTWAY" in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible from the outside of the building.

**914.1.2 Interior access to shaftways.** Door or window openings to a hoistway or shaftway from the interior of the building shall be plainly marked with the word "SHAFTWAY" in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible.

**Exception:** Markings shall not be required on shaftway openings that are readily discernible as openings onto a shaftway by the construction or arrangement.

**914.2 Equipment room identification.** Fire protection equipment shall be identified in an approved manner. Rooms containing controls for air-conditioning systems, sprinkler risers and valves or other fire detection, suppression or control elements shall be identified for the use of the fire department. Approved signs required to identify fire protection equipment and equipment location shall be constructed of durable materials, permanently installed and readily visible.

## **SECTION 915 CARBON MONOXIDE DETECTION**

**915.1 General.** Carbon monoxide detection shall be installed in new buildings in accordance with Sections 915.1.1 through 915.6. Carbon monoxide detection shall be installed in existing buildings in accordance with Chapter 11 of the *fire code*.

**915.1.1 Where required.** Carbon monoxide detection shall be provided in Group I-1, I-2, I-4 and R occupancies and in classrooms in Group E occupancies in the locations specified in Section 915.2 where any of the conditions in Sections 915.1.2 through 915.1.6 exist.

**915.1.2 Fuel-burning appliances and fuel-burning fireplaces.** Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms that contain a fuel-burning appliance or a fuel-burning fireplace.

**915.1.3 Forced-air furnaces.** Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms served by a fuel-burning, forced-air furnace.

**Exception:** Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms if carbon monoxide detection is provided in the first room or area served by each main duct leaving the furnace, and the carbon monoxide alarm signals are automatically transmitted to an approved location.

**915.1.4 Fuel-burning appliances outside of dwelling units, sleeping units and classrooms.** Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms located in buildings that contain fuel burning appliances or fuel-burning fireplaces.

**Exceptions:**

1. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms where there are no communicating

openings between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom.

2. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms where carbon monoxide detection is provided in one of the following locations:
  - 2.1. In an approved location between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom.
  - 2.2. On the ceiling of the room containing the fuel-burning appliance or fuel-burning fireplace.

**915.1.5 Private garages.** Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms in buildings with attached private garages.

**Exceptions:**

1. Carbon monoxide detection shall not be required where there are no communicating openings between the private garage and the dwelling unit, sleeping unit or classroom.
2. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms located more than one story above or below a private garage.
3. Carbon monoxide detection shall not be required where the private garage connects to the building through an open-ended corridor.
4. Where carbon monoxide detection is provided in an approved location between openings to a private garage and dwelling units, sleeping units or classrooms, carbon monoxide detection shall not be required in the dwelling units, sleeping units or classrooms.

**915.1.6 Exempt garages.** For determining compliance with Section 915.1.5, an open parking garage complying with Section 406.5 or an enclosed parking garage complying with Section 406.6 shall not be considered a private garage.

**915.2 Locations.** Where required by Section 915.1.1, carbon monoxide detection shall be installed in the locations specified in Sections 915.2.1 through 915.2.3.

**915.2.1 Dwelling units.** Carbon monoxide detection shall be installed in dwelling units outside of each separate sleeping area in the immediate vicinity of the bedrooms. Where a fuel-burning appliance is located within a bedroom or its attached bathroom, carbon monoxide detection shall be installed within the bedroom.

**915.2.2 Sleeping units.** Carbon monoxide detection shall be installed in sleeping units.

**Exception:** Carbon monoxide detection shall be allowed to be installed outside of each separate sleeping area in the immediate vicinity of the sleeping unit where the sleeping unit or its attached bathroom does not contain a fuel-burning appliance and is not served by a forced air furnace.

**915.2.3 Group E occupancies.** Carbon monoxide detection shall be installed in classrooms in Group E occupancies. Carbon monoxide alarm signals shall be automatically transmitted to an on-site location that is staffed by school personnel.

**Exception:** Carbon monoxide alarm signals shall not be required to be automatically transmitted to an on-site location that is staffed by school personnel in Group E occupancies with an occupant load of 30 or less.

**915.3 Detection equipment.** Carbon monoxide detection required by Sections 915.1 through 915.2.3 shall be provided by carbon monoxide alarms complying with Section 915.4 or carbon monoxide detection systems complying with Section 915.5.

**915.4 Carbon monoxide alarms.** Carbon monoxide alarms shall comply with Sections 915.4.1 through 915.4.3.

**915.4.1 Power source.** Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than that required for overcurrent protection.

**Exception:** Where installed in buildings without commercial power, battery-powered carbon monoxide alarms shall be an acceptable alternative.

**915.4.2 Listings.** Carbon monoxide alarms shall be listed in accordance with UL 2034.

**915.4.3 Combination alarms.** Combination carbon monoxide/smoke alarms shall be an acceptable alternative to carbon monoxide alarms. Combination carbon monoxide/smoke alarms shall be listed in accordance with UL 2034 and UL 217.

**915.5 Carbon monoxide detection systems.** Carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide alarms and shall comply with Sections 915.5.1 through 915.5.3.

**915.5.1 General.** Carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be listed in accordance with UL 2075.

**915.5.2 Locations.** Carbon monoxide detectors shall be installed in the locations specified in Section 915.2. These locations supersede the locations specified in NFPA 720.

**915.5.3 Combination detectors.** Combination carbon monoxide/smoke detectors installed in carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide detectors, provided they are listed in accordance with UL 2075 and UL 268.

**915.6 Maintenance.** Carbon monoxide alarms and carbon monoxide detection systems shall be maintained in accordance with the *fire code*.

## **SECTION 916 EMERGENCY RESPONDER RADIO COVERAGE**

**916.1 General.** Emergency responder radio coverage shall be provided in all new buildings in accordance with Section 510 of the *fire code*.

Effective:

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Certification

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Date

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