

## CHAPTER 9

# FIRE PROTECTION SYSTEMS

### 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, inspection, operation, testing and maintenance of all fire protection systems. For the purposes of this chapter, fire walls not located on a property line shall not constitute a separate building.

**901.2 Construction documents.** The fire code official shall have the authority to require construction documents and calculations for all fire protection systems and to require permits be issued for the installation, rehabilitation or modification of any fire protection system. Construction documents for fire protection systems shall be submitted for review and approval prior to system installation.

**901.2.1 Statement of compliance.** Before requesting final approval of the installation, where required by the fire code official, the installing contractor shall furnish a written statement to the fire code official that the subject fire protection system has been installed in accordance with approved plans and has been tested in accordance with the manufacturer's specifications and the appropriate installation standard. Any deviations from the design standards shall be noted and copies of the approvals for such deviations shall be attached to the written statement.

**901.3 Permits.** Permits shall be required as set forth in Section 105.6 and 105.7.

**901.4 Installation.** Individuals who install, service or maintain life safety systems and equipment shall obtain the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment.

Fire protection systems shall be maintained in accordance with the original installation standards for that system. Required systems shall be extended, altered, or augmented as necessary to maintain and continue protection whenever the building is altered, remodeled or added to. Alterations to fire protection systems shall be done in accordance with applicable standards.

**901.4.1 Required fire protection systems.** Fire protection systems required by this code or the *International Building Code* shall be installed, repaired, operated, tested and maintained in accordance with this code.

**901.4.2 Nonrequired fire protection systems.** Any fire protection system or portion thereof not required by this code or the *International Building Code* shall be allowed to be furnished for partial or complete protection provided

such installed system meets the requirements of this code and the *International Building Code*.

**901.4.3 Additional fire protection systems.** In occupancies of a hazardous nature, where special hazards exist in addition to the normal hazards of the occupancy, or where the fire code official determines that access for fire apparatus is unduly difficult, the fire code official shall have the authority to require additional safeguards. Such safeguards include, but shall not be limited to, the following: automatic fire detection systems, fire alarm systems, automatic fire-extinguishing systems, standpipe systems, or portable or fixed extinguishers. Fire protection equipment required under this section shall be installed in accordance with this code and the applicable referenced standards.

**901.4.4 Appearance of equipment.** Any device that has the physical appearance of life safety or fire protection equipment but that does not perform that life safety or fire protection function, shall be prohibited.

**901.5 Installation acceptance testing.** Fire detection and alarm systems, fire-extinguishing systems, fire hydrant systems, fire standpipe systems, fire pump systems, private fire service mains and all other fire protection systems and appurtenances thereto shall be subject to acceptance tests as contained in the installation standards and as approved by the fire code official. The fire code official shall be notified before any required acceptance testing. Individuals who perform acceptance tests on fire and life safety systems shall obtain the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment.

**901.5.1 Occupancy.** It shall be unlawful to occupy any portion of a building or structure until the required fire detection, alarm and suppression systems have been tested and approved.

**901.6 Inspection, testing and maintenance.** Fire detection, alarm and extinguishing systems shall be maintained in an operative condition at all times, and shall be replaced or repaired where defective. Fire and life safety systems shall be confidence tested in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems. Nonrequired fire protection systems and equipment shall be inspected, tested and maintained in an operative condition or removed when approved by the fire code official.

**901.6.1 Standards.** Fire protection systems shall be inspected, tested and maintained in accordance with the referenced standards listed in Table 901.6.1.

**TABLE 901.6.1  
FIRE PROTECTION SYSTEM MAINTENANCE STANDARDS**

SYSTEM	STANDARD
Portable fire extinguishers	NFPA 10
Carbon dioxide fire-extinguishing system	NFPA 12
Halon 1301 fire-extinguishing systems	NFPA 12A
Dry-chemical extinguishing systems	NFPA 17
Wet-chemical extinguishing systems	NFPA 17A
Water-based fire protection systems	NFPA 25
Fire alarm systems	NFPA 72
Water-mist systems	NFPA 750
Clean-agent extinguishing systems	NFPA 2001

**901.6.2 Records.** Records of all system inspections, tests, and maintenance required by the referenced standards shall be maintained on the premises for a minimum of 3 years and made available to the fire code official upon request. In addition, confidence test documentation shall be submitted to the fire code official in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**901.7 Systems out of service.** Where a required fire protection system is out of service the procedures detailed in Administrative Rule 9.06.04, Out-Of-Service Fire Alarm, Standpipe, Fire Sprinkler and Emergency Alarm Systems, shall be implemented. , the fire department and the fire code official shall be notified immediately and, where required by the fire code official, the building shall either be evacuated or an approved fire watch shall be provided for all occupants left unprotected by the shut down until the fire protection system has been returned to service.

Where utilized, fire watches shall be provided with at least one approved means for notification of the fire department and their only duty shall be to perform constant patrols of the protected premises and keep watch for fires.

**901.7.1 Impairment coordinator.** The building owner shall assign an impairment coordinator to comply with the requirements of this section. In the absence of a specific designee, the owner shall be considered the impairment coordinator.

**901.7.2 Tag required.** A tag shall be used to indicate that a system, or portion thereof, has been removed from service.

**901.7.3 Placement of tag.** The tag shall be posted at each fire department connection, system control valve, fire alarm control unit, fire alarm annunciator and fire command center, indicating which system, or part thereof, has been removed from service. The fire code official shall specify where the tag is to be placed.

**901.7.4 Preplanned impairment programs.** Preplanned impairments shall be authorized by the impairment coordinator. Before authorization is given, a designated individual shall be responsible for verifying that all of the following procedures have been implemented:

1. The extent and expected duration of the impairment have been determined.
2. The areas or buildings involved have been inspected and the increased risks determined.
3. Recommendations have been submitted to management or building owner/manager.
4. The fire department has been notified.
5. The insurance carrier, the alarm company, building owner/manager, and other authorities having jurisdiction have been notified.
6. The supervisors in the areas to be affected have been notified.
7. A tag impairment system has been implemented.
8. Necessary tools and materials have been assembled on the impairment site.

**901.7.5 Emergency impairments.** When unplanned impairments occur, appropriate emergency action shall be taken to minimize potential injury and damage. The impairment coordinator shall implement the steps outlined in Section 901.7.4.

**901.7.6 Restoring systems to service.** When impaired equipment is restored to normal working order, the impairment coordinator shall verify that all of the following procedures have been implemented:

1. Necessary inspections and tests have been conducted to verify that affected systems are operational.
2. Supervisors have been advised that protection is restored.
3. The fire department has been advised that protection is restored.
4. The building owner/manager, insurance carrier, alarm company, and other involved parties have been advised that protection is restored.
5. The impairment tag has been removed.

**901.8 Removal of or tampering with equipment.** It shall be unlawful for any person to remove, tamper with or otherwise disturb any fire hydrant, fire detection and alarm system, fire suppression system, or other fire appliance required by this code except for the purpose of extinguishing fire, training purposes, recharging or making necessary repairs, or when approved by the fire code official.

**901.8.1 Removal of or tampering with appurtenances.** Locks, gates, doors, barricades, chains, enclosures, signs, tags or seals which have been installed by or at the direction of the fire code official shall not be removed, unlocked, destroyed, tampered with or otherwise vandalized in any manner.

**SECTION 902  
DEFINITIONS**

**902.1 Definitions.** The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

**ALARM NOTIFICATION APPLIANCE.** A fire alarm system component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs, or any combination thereof.

**ALARM SIGNAL.** A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

**ALARM VERIFICATION FEATURE.** A feature of automatic fire detection and alarm systems to reduce unwanted alarms wherein smoke detectors report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period, after being automatically reset, in order to be accepted as a valid alarm-initiation signal.

**ANNUNCIATOR.** A unit containing one or more indicator lamps, alphanumeric displays, or other equivalent means in which each indication provides status information about a circuit, condition or location.

**AUDIBLE ALARM NOTIFICATION APPLIANCE.** A notification appliance that alerts by the sense of hearing.

**AUTOMATIC.** As applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise, or combustion products.

**AUTOMATIC FIRE-EXTINGUISHING SYSTEM.** An approved system of devices and equipment which automatically detects a fire and discharges an approved fire-extinguishing agent onto or in the area of a fire.

**AUTOMATIC SPRINKLER SYSTEM.** A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

**AVERAGE AMBIENT SOUND LEVEL.** The root mean square, A-weighted sound pressure level measured over a 24-hour period.

**CARBON DIOXIDE EXTINGUISHING SYSTEM.** A system supplying carbon dioxide (CO<sub>2</sub>) from a pressurized vessel through fixed pipes and nozzles. The system includes a manual- or automatic-actuating mechanism.

**CLEAN AGENT.** Electrically nonconducting, volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation.

**CONSTANTLY ATTENDED LOCATION.** A designated location at a facility staffed by trained personnel on a continuous basis where alarm or supervisory signals are monitored and facilities are provided for notification of the fire department or other emergency services.

**DELUGE SYSTEM.** A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same area as the sprinklers. When

this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

**DETECTOR, HEAT.** A fire detector that senses heat produced by burning substances. Heat is the energy produced by combustion that causes substances to rise in temperature.

**DRY-CHEMICAL EXTINGUISHING AGENT.** A powder composed of small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium-based bicarbonate, potassium chloride or monoammonium phosphate, with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking) and the proper flow capabilities.

**EMERGENCY ALARM SYSTEM.** A system to provide indication and warning of emergency situations involving hazardous materials.

**EMERGENCY VOICE/ALARM COMMUNICATIONS.** Dedicated manual or automatic facilities for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire emergency, to the occupants of a building.

**FIRE ALARM BOX, MANUAL.** See “Manual fire alarm box.”

**FIRE ALARM CONTROL UNIT.** A system component that receives inputs from automatic and manual fire alarm devices and is capable of supplying power to detection devices and transponder(s) of off-premises transmitter(s). The control unit is capable of providing a transfer of power to the notification appliances and transfer of condition to relays of devices.

**FIRE ALARM SIGNAL.** A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, water-flow switch, or other device whose activation is indicative of the presence of a fire or fire signature.

**FIRE ALARM SYSTEM.** A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

**FIRE AREA.** The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls, or fire-resistance-rated horizontal assemblies of a building.

**FIRE DETECTION SYSTEM.** A system of smoke or heat detectors monitored at an approved central station, with no requirement for notification appliances in the building.

**FIRE DETECTOR, AUTOMATIC.** A device designed to detect the presence of a fire signature and to initiate action.

**FIRE PROTECTION SYSTEM.** Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

**FIRE SAFETY FUNCTIONS.** Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of the harmful effects of fire.

**FOAM-EXTINGUISHING SYSTEM.** A special system discharging a foam made from concentrates, either mechanically or chemically, over the area to be protected.

**HALOGENATED EXTINGUISHING SYSTEM.** A fire-extinguishing system using one or more atoms of an element from the halogen chemical series: fluorine, chlorine, bromine and iodine.

**IMPAIRMENT COORDINATOR.** The person responsible for the maintenance of a particular fire protection system.

**INITIATING DEVICE.** A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch.

**MANUAL FIRE ALARM BOX.** A manually operated device used to initiate an alarm signal.

**MULTIPLE-STATION ALARM DEVICE.** Two or more single-station alarm devices that can be interconnected such that actuation of one causes all integral or separate audible alarms to operate. It also can consist of one single-station alarm device having connections to other detectors or to a manual fire alarm box.

**MULTIPLE-STATION SMOKE ALARM.** Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

**NUISANCE ALARM.** An alarm caused by mechanical failure, malfunction, improper installation, or lack of proper maintenance, or an alarm activated by a cause that cannot be determined.

**[W] PORTABLE SCHOOL CLASSROOM.** A structure, transportable in one or more sections, which requires a chassis to be transported, and is designed to be used as an educational space with or without a permanent foundation. The structure shall be trailerable and capable of being demounted and relocated to other locations as needs arise.

**RECORD DRAWINGS.** Drawings (“as built”) that document the location of all devices, appliances, wiring, sequences, wiring methods, and connections of the components of a fire alarm system as installed.

**SINGLE-STATION SMOKE ALARM.** An assembly incorporating the detector, the control equipment, and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

**[B] SLEEPING UNIT.** A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

**SMOKE ALARM.** A single- or multiple-station alarm responsive to smoke and not connected to a system.

**SMOKE DETECTOR.** A listed device that senses visible or invisible particles of combustion.

**STANDPIPE SYSTEM, CLASSES OF.** Standpipe classes are as follows:

**Class I system.** A system providing 2.5-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

**Class II system.** A system providing 1.5-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

**Class III system.** A system providing 1.5-inch (38 mm) hose stations to supply water for use by building occupants and 2.5-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

**STANDPIPE, TYPES OF.** Standpipe types are as follows:

**Automatic dry.** A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as a dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.

**Automatic wet.** A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

**Manual dry.** A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to supply the system demand.

**Manual wet.** A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but which does not have a water supply capable of delivering the system demand attached to the system. Manual wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to supply the system demand.

**Semiautomatic dry.** A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

**SUPERVISING STATION.** A facility that receives signals and at which personnel are in attendance at all times to respond to these signals.

**SUPERVISORY SERVICE.** The service required to monitor performance of guard tours and the operative condition of fixed suppression systems or other systems for the protection of life and property.

**SUPERVISORY SIGNAL.** A signal indicating the need of action in connection with the supervision of guard tours, the fire suppression systems or equipment, or the maintenance features of related systems.

**SUPERVISORY SIGNAL-INITIATING DEVICE.** An initiating device such as a valve supervisory switch, water level indicator, or low-air pressure switch on a dry-pipe sprinkler system whose change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system; or a need for action in connection with guard tours, fire suppression systems or equipment, or maintenance features of related systems.

**TIRES, BULK STORAGE OF.** Storage of tires where the area available for storage exceeds 20,000 cubic feet (566 m<sup>3</sup>).

**TROUBLE SIGNAL.** A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component.

**VISIBLE ALARM NOTIFICATION APPLIANCE.** A notification appliance that alerts by the sense of sight.

**WET-CHEMICAL EXTINGUISHING AGENT.** A solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof, forming an extinguishing agent.

**WIRELESS PROTECTION SYSTEM.** A system or a part of a system that can transmit and receive signals without the aid of wire.

**ZONE.** A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent, or an area in which a form of control can be executed.

**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 in lieu of automatic sprinkler protection where recognized by the applicable standard and approved by the fire code official.

**903.2 Where required.** Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in this section.

**Exception:** Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, and batteries and standby engines, provided those spaces or areas are equipped throughout with an automatic fire alarm smoke detection system and are separated from the remainder of the building by a wall with a fire-resistance rating of not less than 1 hour and a floor/ceiling assembly with a fire-resistance rating of not less than 2 hours.

**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 floor area where the Group A-1, A-2, A-3 or A-4 occupancy is located, and in all floors between the Group A occupancy and the level of exit discharge. 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 Group A-1 occupancies 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 the level of exit discharge; or
4. The fire area contains a multitheater complex.

**903.2.1.2 Group A-2.** An automatic sprinkler system shall be provided for Group A-2 occupancies 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 300 ~~100~~ or more; or
3. The fire area is located on a floor other than the level of exit discharge.

**Exception:** Item 3 does not apply to fire areas that include space located one floor above the level of exit discharge where the occupant load of the upper floor is less than 50.

**903.2.1.3 Group A-3.** An automatic sprinkler system shall be provided for Group A-3 occupancies 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; or
3. The fire area is located on a floor other than the level of exit discharge.

**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 Group A-4 occupancies 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; or
3. The fire area is located on a floor other than the level of exit discharge.

**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 in concession stands, retail areas, press boxes, and other accessory use areas in excess of 1,000 square feet (93 m<sup>2</sup>).

**[W] 903.2.1.6 Nightclub.** An automatic sprinkler system shall be provided throughout an occupancy with a nightclub. Existing nightclubs constructed prior to July 1, 2006, shall be provided with automatic sprinklers not later than December 1, 2007. The fire code official, for the application of this rule, may establish an occupant load based on the observed use of the occupancy in accordance with Table 1004.1.2.

**[W]903.2.2 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 (1858 m<sup>2</sup>) in area.
2. Throughout every portion of educational buildings below the level of exit discharge.

**Exception:** An automatic sprinkler system is not required in any fire area or area below the level of exit discharge where every classroom throughout the building has at least one exterior exit door at ground level.

3. Throughout all newly constructed Group E occupancies having an occupant load of 50 or more for more than 12 hours per week or 4 hours in any one day. A minimum water supply meeting the requirements of NFPA 13 shall be required. The fire code official may reduce fire flow requirements for buildings protected by an approved automatic sprinkler system.

For the purpose of this section, additions exceeding 60 percent of the value of such building or structure, or alterations and repairs to any portion of a building or structure within a 12-month period that exceeds 100 percent of the value of such building or structure shall be considered new construction. In the case of additions, fire walls shall define separate buildings.

**Exceptions:**

1. Portable school classrooms, provided aggregate areas of clusters of portable school classrooms does not exceed 5,000 square feet (465 m<sup>2</sup>); and clusters of portable school classrooms shall be separated as required in Chapter 5 of the *Seattle Building Code*.
2. Group E day care.

When not required by other provisions of this chapter, a fire-extinguishing system installed in accordance with NFPA 13 may be used for increases and substitutions allowed in Section 504.2, 506.3 and Table 601 of the *Seattle Building Code*.

**903.2.3 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 exist:

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

**903.2.3.1 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 in area (232 m<sup>2</sup>) which generate finely divided combustible waste or which use finely divided combustible materials.

**903.2.4 Group H.** Automatic sprinkler systems shall be provided in high-hazard occupancies as required in Sections 903.2.4.1 through 903.2.4.3.

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

**903.2.4.2 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 not be less than that required under the *International Building Code* for the occupancy hazard classifications in accordance with Table 903.2.4.2.

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.

**TABLE 903.2.4.2  
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

**903.2.4.3 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).

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

**Exception:** An automatic sprinkler system installed in accordance with Section 903.3.1.2 or 903.3.1.3 shall be allowed in Group I-1 facilities.

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

**Exception:** An automatic sprinkler system need not be installed in any Group LC occupancy licensed for six or fewer clients.

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

1. Where a Group M fire area exceeds 12,000 square feet (1115 m<sup>2</sup>);
2. Where a Group M fire area is located more than three stories above grade; or
3. Where 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>).

**903.2.6.1 High-piled storage.** An automatic sprinkler system shall be provided as required in Chapter 23 in all

buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

**903.2.6.2 Covered mall buildings.** The covered mall building and buildings connected shall be provided throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, which shall comply with the following:

1. The automatic sprinkler system shall be complete and operative throughout occupied space in the



covered mall building prior to occupancy of any tenant spaces. Unoccupied tenant spaces shall be similarly protected unless provided with alternate protection, as approved by the fire code official.

2. Sprinkler protection for the mall shall be independent from that provided for tenant spaces or anchors. Where tenant spaces are supplied by the same system, they shall be independently controlled by separate shutoff valves.

**Exception:** An automatic sprinkler system shall not be required in spaces or areas of open parking garages constructed in accordance with Section 406.3 of the *Seattle Building Code*.

**903.2.7 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:** Buildings complying with the *International Residential Code* and Chapter 5 of this code are not required to be sprinklered.

**903.2.8 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 exist:

1. Where a Group S-1 fire area exceeds 12,000 square feet (1115 m<sup>2</sup>);
2. Where a Group S-1 fire area is located more than three stories above grade; or
3. Where 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>).

**903.2.8.1 Repair garages.** An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with the *International Building Code*, as follows:

1. Buildings two or more stories in height, including basements, with a fire area containing a repair garage exceeding 10,000 square feet (929 m<sup>2</sup>).
2. One-story buildings with a fire area containing a repair garage exceeding 12,000 square feet (1115 m<sup>2</sup>).
3. Buildings with a repair garage servicing vehicles parked in the basement.

**903.2.8.2 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.

**903.2.8.3 Liquor warehouses.** An automatic sprinkler system shall be installed in liquor warehouses.

**Point of Information**

Stockrooms of retail liquor sales outlets are not liquor warehouses.

**903.2.9 Group S-2.** An automatic sprinkler system shall be provided throughout buildings classified as an enclosed

parking garage in accordance with the *International Building Code* or where located beneath other groups.

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

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

**903.2.10 All occupancies except Groups R-3 and U.** An automatic sprinkler system shall be installed in the locations set forth in Sections 903.2.10.1 through 903.2.10.1.3.

**Exception:** Group R-3 and Group U.

**903.2.10.1 Stories and basements without openings.**

An automatic sprinkler system shall be installed in every story or basement of all buildings where the floor area exceeds 1,500 square feet (139.4 m<sup>2</sup>) and where there is not provided at least 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 1009 or an outside ramp complying with Section 1010. 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.
2. Openings entirely above the adjoining ground level totaling at least 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.

**903.2.10.1.1 Opening dimensions and access.**

Openings shall have a minimum width and height 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 that fire fighting or rescue cannot be accomplished from the exterior.

**903.2.10.1.2 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 at least two sides the story.

**903.2.10.1.3 Basements.**

Where any portion of a basement is located more than 75 feet (22 860 mm) from openings required by Section 903.2.10.1, the basement shall be equipped throughout with an approved automatic sprinkler system.

**903.2.10.2 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 extending through three or more floors shall have additional sprinkler heads installed within such chutes at alternate floors. Chute sprinklers shall be accessible for servicing.

**903.2.10.3 Buildings more than 55 feet in height.**

An automatic sprinkler system shall be installed throughout

buildings with a floor level having an occupant load of 30 or more that is located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access.

**Exceptions:**

1. Airport control towers.
2. Open parking structures.
3. Occupancies in Group F-2.

**903.2.10.4 Basement storage and sale of combustible materials.** An automatic sprinkler system shall be installed throughout basements that are not stories above grade plane that are used for storage or sale of combustible materials.

**Exceptions:**

1. Sprinklers are not required in portions of the basement not containing combustible materials and protected by a fire barrier with at least a 1-hour fire-resistance rating.
2. Sprinklers are not required in storage rooms meeting the following criteria:
  - 2.1. The area of the room does not exceed 500 square feet (46 m<sup>2</sup>);
  - 2.2. The room is protected by a fire barrier with at least a 1-hour fire-resistance rating;
  - 2.3. The room contains no material classified as a flammable liquid, hazardous material or highly combustible material;
  - 2.4. The room is served by exterior fire access or interior access by a 1-hour fire-resistance-rated corridor.
  - 2.5. No more than three such rooms are permitted in any one basement.

**903.2.10.5 High-rise buildings.** High-rise buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 903.3.5.2.

**Exception:** An automatic sprinkler system shall not be required in spaces or areas used exclusively for telecommunications equipment, associated electrical power distribution equipment, and batteries, provided those spaces or areas are equipped throughout with automatic smoke detectors and are separated from the remainder of the building by a wall with a fire-resistance rating of not less than 1 hour and a floor/ceiling assembly with a fire-resistance rating of not less than 2 hours.

**903.2.10.5.1 High-rise building sprinkler system design.** Combination standpipe/sprinkler risers in high-rise buildings using 6-inch (152 mm) pipe minimum, shall be used with the sprinkler system interconnected between and served from two standpipe risers. Shutoff valves, waterflow devices and check valves (or pressure reducing valves) shall be provided on each floor at the sprinkler system connection to

each standpipe. Two four-way fire department connections shall be provided on separate streets well separated from each other. At least one of the fire department connections shall be connected to the riser above a riser isolation valve.

**Exception:** Dry pipe sprinkler systems serving parking garages may be supplied separately from the standpipe risers and use a single, separate two-way fire department connection.

**903.2.10.6 Atriums.** An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be installed throughout buildings containing an atrium.

**Exceptions:**

1. That area of the building adjacent to or above the atrium need not be sprinklered, provided that portion of the building is separated from the atrium portion by a 2-hour fire barrier wall or horizontal assembly or both.
2. Where the ceiling of the atrium is more than 55 feet (16 764 mm) above any floor area open to the atrium, sprinkler protection at the ceiling of the atrium is not required.

**903.2.10.7 Special amusement buildings.** Special amusement buildings shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where the special amusement building is temporary, the sprinkler water supply shall be of an approved temporary means.

**Exception:** Automatic fire sprinklers are not required where the total floor area of a temporary special amusement building is less than 1,000 square feet (93 m<sup>2</sup>) and the travel distance from any point to an exit is less than 50 feet (15 240 mm).

**903.2.10.8 Stages.** Stages shall be equipped with an automatic fire-extinguishing system in accordance with Chapter 9. The system shall be installed under the roof and gridiron, in the tie and fly galleries and in places behind the proscenium wall of the stage and in dressing rooms, lounges, workshops and storerooms accessory to such stages.

**Exceptions:**

1. Sprinklers are not required under stage areas less than 4 feet (1219 mm) in clear height utilized exclusively for storage of tables and chairs, provided the concealed space is separated from the adjacent spaces by not less than 5/8-inch (15.9 mm) Type X gypsum board.
2. Sprinklers are not required for stages 1,000 square feet (93 m<sup>2</sup>) or less in area and 50 feet (15 240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.

**903.2.10.9 Underground buildings.** The highest level of exit discharge serving the underground portions of an

underground building and all levels below shall be equipped with an automatic sprinkler system installed in accordance with Section 903.3.1.1. Waterflow switches and control valves shall be supervised in accordance with Section 903.4.

**903.2.11 During construction.** Automatic sprinkler systems required during construction, alteration and demolition operations shall be provided in accordance with Section 1413.

**903.2.12 Other hazards.** Automatic sprinkler protection shall be provided for the hazards indicated in Sections 903.2.12.1 and 903.2.12.2.

**903.2.12.1 Ducts conveying hazardous exhausts.** Where required by the *International Mechanical Code*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust, flammable or combustible materials.

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

**903.2.12.2 Commercial cooking operations.** An automatic sprinkler system shall be installed in a commercial kitchen exhaust hood and duct system where an automatic sprinkler system is used to comply with Section 904.

**903.2.13 Other required suppression systems.** In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.13 also require the installation of a suppression system for certain buildings and areas.

**TABLE 903.2.13  
ADDITIONAL REQUIRED FIRE-EXTINGUISHING SYSTEMS**

SECTION	SUBJECT
1024.6.2.3	Smoke-protected seating
1208.2	Dry cleaning plants
1208.3	Dry cleaning machines
1504.1	Spray finishing in Group A, E, I or R
1504.6	Spray booths and rooms
1505.1	Dip-tank rooms
1505.6.1	Dip tanks
1505.8.4	Hardening and tempering tanks
1803.10	HPM facilities
1803.10.1.1	HPM work station exhaust
1803.10.2	HPM gas cabinets
1803.10.3	HPM corridors
1803.10.4	HPM exhaust
1803.10.4.1	HPM noncombustible ducts
1803.10.4.2	HPM combustible ducts

(continued)

**TABLE 903.2.13—continued  
ADDITIONAL REQUIRED FIRE-EXTINGUISHING SYSTEMS**

1907.3	Lumber production conveyor enclosures
1908.7	Recycling facility conveyor enclosures
2106.1	Class A and B ovens
2106.2	Class C and D ovens
Table 2306.2	Storage fire protection
2306.4	Storage
2703.8.4.1	Gas rooms
2703.8.5.3	Exhausted enclosures
2704.5	Indoor storage of hazardous materials
2705.1.8	Indoor dispensing of hazardous materials
2804.4.1	Aerosol warehouses
2904.5	Storage of more than 1,000 cubic feet of loose combustible fibers
3306.5.2.1	Storage of smokeless propellant
3306.5.2.3	Storage of small arms primers
3404.3.7.5.1	Flammable and combustible liquid storage rooms
3404.3.8.4	Flammable and combustible liquid storage warehouses
3405.3.7.3	Flammable and combustible liquid Group H-2 or H-3 areas
3704.1.2	Gas cabinets for highly toxic and toxic gas
3704.1.3	Exhausted enclosures for highly toxic and toxic gas
3704.2.2.6	Gas rooms for highly toxic and toxic gas
3704.3.3	Outdoor storage for highly toxic and toxic gas
4106.2.2	Exhausted enclosures or gas cabinets for silane gas
4204.1.1	Pyroxylin plastic storage cabinets
4204.1.3	Pyroxylin plastic storage vaults
4204.2	Pyroxylin plastic storage and manufacturing
<i>International Building Code</i>	Sprinkler requirements as set forth in Section 903.2.13 of the <i>International Building Code</i>

For SI: 1 cubic foot = 0.023 m<sup>3</sup>.

**903.3 Installation requirements.** Automatic sprinkler systems shall be designed and installed in accordance with Sections 903.3.1 through 903.3.7.

**903.3.1 Standards.** Sprinkler systems shall be designed and installed in accordance with Sections 903.3.1.1, 903.3.1.2 or 903.3.1.3, except as required by Administrative Rule 9.03.04, *Automatic Sprinklers and Standpipes*.

**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 sprin-

kler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Section 903.3.1.1.1.

**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 any room merely because it is damp, of fire-resistance rated construction or contains electrical equipment.

1. Any room where the application of water, or flame and water, constitutes a serious life or fire hazard, when approved by the fire code official.
2. Any room or space where sprinklers are considered undesirable because of the nature of the contents, when approved by the fire code official.
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. In rooms or areas that are of noncombustible construction with wholly noncombustible contents.

**903.3.1.2 NFPA 13R sprinkler systems.** Where allowed in LC occupancies and buildings of Group R, up to and including four stories in height, automatic sprinkler systems shall be installed throughout in accordance with NFPA 13R.

**903.3.1.2.1 Balconies.** Sprinkler protection shall be provided for exterior balconies and ground floor patios of dwelling units where the building is of Type V construction. 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 that are constructed of open wood joist construction.

**903.3.1.3 NFPA 13D sprinkler systems.** Where allowed, automatic sprinkler systems installed in one- and two-family dwellings shall be installed throughout in accordance with NFPA 13D. A NFPA 13D sprinkler system may be installed in townhouses when approved by the fire code official where each unit has its own water service, each unit exits to a public way, no unit is located above any other unit or common space, and each unit and contiguous attic and crawl spaces are separated from other units by at least a 1-hour fire partition.

**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 the following areas in accordance with Section 903.3.1 and their listings:

1. Throughout all spaces within a smoke compartment containing patient sleeping units in Group I-2 in accordance with the *International Building Code*.
2. Dwelling units and sleeping units in Group R, LC and I-1 occupancies.
3. Light-hazard occupancies as defined in NFPA 13.

**903.3.3 Obstructed locations.** Automatic sprinklers shall be installed in accordance with NFPA 13 obstruction criteria, and the listing requirements of the sprinkler head with due regard to obstructions that will delay activation or obstruct the water distribution pattern. In addition, automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands, or equipment that exceeds 4 feet (1219 mm) in width and depth. Not less than a 3-foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of combustible fibers.

**Exceptions:**

1. Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with Section 904.
2. Temporary covered booths, kiosks or concession stands less than 300 square feet (28 m<sup>2</sup>) in area that are in spaces operating under a temporary place of assembly permit.

**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 *International Plumbing Code*.

**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.

**903.3.5.1.1 Limited area sprinkler systems.** Limited area sprinkler systems serving fewer than 20 sprinklers on any single connection are permitted to be connected to the domestic service where a wet automatic standpipe is not available. Limited area sprinkler systems connected to domestic water supplies shall comply with each of the following requirements:

1. Valves shall not be installed between the domestic water riser control valve and the sprinklers.

**Exception:** An approved indicating control valve supervised in the open position in accordance with Section 903.4.

2. The domestic service shall be capable of supplying the simultaneous domestic demand and the sprinkler demand required to be hydraulically calculated by NFPA 13, NFPA 13R or NFPA 13D.

**903.3.5.1.2 Residential combination services.** A single combination water supply shall be permitted for buildings that are not high-rise buildings provided

that the domestic demand is added to the sprinkler demand as required by NFPA 13R.

**903.3.5.2 Secondary water supply.** A secondary on-site water supply equal of at least 15,000 gallons (56 775 L) automatically available to the sprinkler system to the hydraulically calculated sprinkler demand, including the hose stream requirement, shall be provided for high-rise buildings, in Seismic Design Category C, D, E or F as determined by the *International Building Code*. The secondary water supply shall have a duration not less than 30 minutes as determined by the occupancy hazard classification in accordance with NFPA 13.

**Exception:** Existing buildings including those undergoing substantial renovation.

**903.3.6 Hose threads.** Fire hose threads used in connection with automatic sprinkler systems shall be approved and shall be compatible with fire department hose threads.

**903.3.7 Fire department connections.** The location of fire department connections shall be approved by the fire code official.

**903.4 Sprinkler system monitoring and alarms.** All valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures, and water-flow switches on all sprinkler systems shall be electrically supervised.

**Exceptions:**

1. Automatic sprinkler systems protecting one- and two-family dwellings.
2. Limited area systems serving fewer than 20 sprinklers.
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 Signals.** Alarm, supervisory and trouble signals shall be distinctly different and shall be automatically transmitted to a central station service that is listed in the current edition of the Underwriter's Laboratories *Fire Protection Equipment Directory* under the category Central Station (UUFX) as a Full Service Company or as a Monitoring

Company. Fire alarm systems in high-rise buildings and Group I and A occupancies (other than Group A-5) shall be monitored by a central station service that is listed in the current edition of the Underwriter's Laboratories *Fire Protection Equipment Directory* under the category Central Station (UUFX) as a Full Service Company or as a Fire Alarm Service – Local Company, which subcontracts the monitoring, retransmission and associated record keeping and reporting to a listed Full Service Company or Monitoring Company. The listing shall indicate that the Full Service Company or Fire Alarm Service – Local Company provides service to the Seattle area, an approved central station, remote supervising station or proprietary supervising station as defined in NFPA 72 or, when approved by the fire code official, 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.** Approved audible devices shall be connected to every automatic sprinkler system. Such sprinkler water-flow 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. Alarm devices shall be provided on the exterior of the building in an approved location. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system.

**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 Section 901.

**903.6 Existing buildings.** The provisions of this section are intended to provide a reasonable degree of safety in existing structures not complying with the minimum requirements of the *International Building Code* by requiring installation of an automatic fire-extinguishing system.

**903.6.1 Pyroxylin plastics.** All structures occupied for the manufacture or storage of articles of cellulose nitrate (pyroxylin) plastic shall be equipped with an approved automatic fire-extinguishing system. Vaults located within buildings for the storage of raw pyroxylin shall be protected with an approved automatic sprinkler system capable of dis-

charging 1.66 gallons per minute per square foot (68 L/min/m<sup>2</sup>) over the area of the vault.

**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 required.** Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the fire code official. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions permitted by other requirements of this code.

**904.2.1 Hood system suppression.** Each required commercial kitchen exhaust hood and duct system required by Section 610 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 by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment.

**904.3.1 Electrical wiring.** Electrical wiring shall be in accordance with the *IEC Seattle Electrical Code*.

**904.3.2 Actuation.** Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with Section 904.11.1.

**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, 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 907.10.2.

**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, 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 by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment.

**904.5.1 System test.** Systems shall be inspected and tested for proper operation at 6-month intervals by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment. Tests shall include a check of the detection system, alarms and releasing devices, including manual stations and other associated equipment. Extinguishing system units shall be weighed and the required amount of agent verified. Stored pressure-type units shall be checked for the required pressure. The cartridge of cartridge-operated units shall be weighed and replaced at intervals indicated by the manufacturer. Documentation of testing shall be forwarded to the fire code official in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**904.5.2 Fusible link maintenance.** Fixed temperature-sensing elements shall be maintained to ensure proper operation of the system.

**904.6 Dry-chemical systems.** Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and

Testing Life Safety Systems and Equipment in accordance with NFPA 17 and their listing.

**904.6.1 System test.** Systems shall be inspected and tested for proper operation at 6-month intervals. Tests shall include a check of the detection system, alarms and releasing devices, including manual stations and other associated equipment. Extinguishing system units shall be weighed, and the required amount of agent verified. Stored pressure-type units shall be checked for the required pressure. The cartridge of cartridge-operated units shall be weighed and replaced at intervals indicated by the manufacturer. Documentation of testing shall be forwarded to the fire code official in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**904.6.2 Fusible link maintenance.** Fixed temperature-sensing elements shall be maintained to ensure proper operation of the system.

**904.7 Foam systems.** Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment in accordance with NFPA 11, NFPA 11A and NFPA 16 and their listing.

**904.7.1 System test.** Foam-extinguishing systems shall be inspected and tested at intervals in accordance with NFPA 25. Documentation of testing shall be forwarded to the fire code official in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**904.8 Carbon dioxide systems.** Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment in accordance with NFPA 12 and their listing.

**904.8.1 System test.** Systems shall be inspected and tested for proper operation at 12-month intervals. Documentation of testing shall be forwarded to the fire code official in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**904.8.2 High-pressure cylinders.** High-pressure cylinders shall be weighed and the date of the last hydrostatic test shall be verified at 6-month intervals. Where a container shows a loss in original content of more than 10 percent, the cylinder shall be refilled or replaced.

**904.8.3 Low-pressure containers.** The liquid-level gauges of low-pressure containers shall be observed at one-week intervals. Where a container shows a content loss of more than 10 percent, the container shall be refilled to maintain the minimum gas requirements.

**904.8.4 System hoses.** System hoses shall be examined at 12-month intervals for damage. Damaged hoses shall be replaced or tested. At five-year intervals, all hoses shall be tested.

**904.8.4.1 Test procedure.** Hoses shall be tested at not less than 2,500 pounds per square inch (psi) (17 238 kPa) for high-pressure systems and at not less than 900 psi (6206 kPa) for low-pressure systems.

**904.8.5 Auxiliary equipment.** Auxiliary and supplementary components, such as switches, door and window releases, interconnected valves, damper releases and supplementary alarms, shall be manually operated at 12-month intervals to ensure that such components are in proper operating condition.

**904.9 Halon systems.** Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.01, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment in accordance with NFPA 12A and their listing.

**904.9.1 System test.** Systems shall be inspected and tested for proper operation at 12-month intervals. Documentation of testing shall be forwarded to the fire code official in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**904.9.2 Containers.** The extinguishing agent quantity and pressure of containers shall be checked at 6-month intervals. Where a container shows a loss in original weight of more than 5 percent or a loss in original pressure (adjusted for temperature) of more than 10 percent, the container shall be refilled or replaced. The weight and pressure of the container shall be recorded on a tag attached to the container.

**904.9.3 System hoses.** System hoses shall be examined at 12-month intervals for damage. Damaged hoses shall be replaced or tested. At 5-year intervals, all hoses shall be tested.

**904.9.3.1 Test procedure.** For Halon 1301 systems, hoses shall be tested at not less than 1,500 psi (10 343 kPa) for 600 psi (4137 kPa) charging pressure systems and not less than 900 psi (6206 kPa) for 360 psi (2482 kPa) charging pressure systems. For Halon 1211 hand-hose line systems, hoses shall be tested at 2,500 psi (17 238 kPa) for high-pressure systems and 900 psi (6206 kPa) for low-pressure systems.

**904.9.4 Auxiliary equipment.** Auxiliary and supplementary components, such as switches, door and window releases, interconnected valves, damper releases and supplementary alarms, shall be manually operated at 12-month intervals to ensure such components are in proper operating condition.

**904.10 Clean-agent systems.** Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment in accordance with NFPA 2001 and their listing.

**904.10.1 System test.** Systems shall be inspected and tested for proper operation at 12-month intervals. Documentation of testing shall be forwarded to the fire code official in ac-

cordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**904.10.2 Containers.** The extinguishing agent quantity and pressure of the containers shall be checked at 6-month intervals. Where a container shows a loss in original weight of more than 5 percent or a loss in original pressure, adjusted for temperature, of more than 10 percent, the container shall be refilled or replaced. The weight and pressure of the container shall be recorded on a tag attached to the container.

**904.10.3 System hoses.** System hoses shall be examined at 12-month intervals for damage. Damaged hoses shall be replaced or tested. All hoses shall be tested at 5-year intervals.

**904.11 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. Preengineered 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 by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment 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 197 and listed, labeled and installed in accordance with Section 304.1 of the *International Mechanical Code*.

**904.11.1 Manual system operation.** A manual actuation device shall be located at or near a means of egress from the cooking area, a minimum of 10 feet (3048 mm) and a maximum of 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be located a minimum of 4 feet (1219 mm) and a maximum of 5 feet (1524 mm) above the floor. 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.

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

**904.11.3 Carbon dioxide systems.** When carbon dioxide systems are used, there shall be a nozzle at the top of the ven-

tilating 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. When 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 all hazards venting through a common duct simultaneously.

**904.11.3.1 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.

**904.11.4 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.

**904.11.4.1 Listed sprinklers.** Sprinklers used for the protection of fryers shall be listed for that application and installed in accordance with their listing.

**904.11.5 Portable fire extinguishers for commercial cooking equipment.** Portable fire extinguishers shall be provided within a 30-foot (9144 mm) travel distance of commercial-type cooking equipment. Cooking equipment involving vegetable or animal oils and fats shall be protected by a Class K rated portable extinguisher.

**904.11.6 Operations and maintenance.** Commercial cooking systems shall be operated and maintained in accordance with this section.

**904.11.6.1 Ventilation system.** The ventilation system in connection with hoods shall be operated at the required rate of air movement, and classified grease filters shall be in place when equipment under a kitchen grease hood is used.

**904.11.6.2 Grease extractors.** Where grease extractors are installed, they shall be operated when the commercial-type cooking equipment is used.

**904.11.6.3 Cleaning.** Hoods, grease-removal devices, fans, ducts and other appurtenances shall be cleaned at intervals necessary to prevent the accumulation of grease. Cleanings shall be recorded, and records shall state the extent, time and date of cleaning. Such records shall be maintained on the premises.

**904.11.6.4 Extinguishing system service.** Automatic fire-extinguishing systems shall be serviced by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment at least every 6 months and after activation of the system. Inspection shall be by qualified individuals, and a certificate of inspection shall be forwarded to the fire code official upon completion in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety System.

**904.11.6.5 Fusible link and sprinkler head replacement.** Fusible links and automatic sprinkler heads shall be replaced at least annually, and other protection devices shall be serviced or replaced in accordance with the manufacturer's instructions.

**Exception:** Frangible bulbs are not required to be replaced annually.

## SECTION 905 STANDPIPE SYSTEMS

**905.1 General.** Standpipe systems shall be provided in new buildings and structures in accordance with this section. Fire hose threads used in connection with standpipe systems shall be approved and shall be compatible with fire department hose threads. The location of fire department hose connections shall be approved. In buildings used for high-piled combustible storage, fire protection shall be in accordance with Chapter 23.

**905.2 Installation standards.** Standpipe systems shall be installed in accordance with this section and NFPA 14, *and Administrative Rule 9.03.04, Automatic Sprinklers and Standpipes.*

**905.3 Required installations.** Standpipe systems shall be installed where required by Sections 905.3.1 through 905.3.6 and in the locations indicated in Sections 905.4, 905.5 and 905.6. Standpipe systems are permitted to be combined with automatic sprinkler systems.

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

**905.3.1 Building 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 the 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. Standpipe systems are not required in townhouses.

**905.3.2 Group A.** Class I automatic or manual 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 where the highest floor surface used for human occupancy is 75 feet (22 860 mm) or less above the lowest level of fire department vehicle access.~~

**905.3.3 Covered mall buildings.** A covered mall building shall be equipped throughout with a Class I manual standpipe system ~~with~~ where required by Section 905.3. Covered mall buildings not required to be equipped with a standpipe system by Section 905.3 shall be equipped with Class I hose connections connected to a system sized to deliver 250 gallons per minute (946.4 L/min) at the most hydraulically remote outlet. ~~H~~ hose connections shall be provided at each of the following locations:

1. Within the mall at the entrance to each exit passage-way or corridor.
2. At each floor-level landing within enclosed stairways opening directly on the mall.
3. At exterior public entrances to the mall.

**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 1.5-inch and 2.5-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, the hose connections are allowed to be supplied from the automatic sprinkler system and shall have a flow rate of not less than that required by NFPA 14 for Class III standpipes.

**905.3.4.1 Hose and cabinet.** The 1.5-inch (38 mm) hose connections shall be equipped with sufficient lengths of 1.5-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 helistop or heliport that are equipped with a standpipe shall extend the standpipe to the roof level on which the helistop or heliport is located in accordance with Section 1107.5.

**905.3.7 High-rise building standpipes.** Standpipe risers in high-rise buildings shall be combination standpipe/sprinkler risers using a minimum pipe size of 6 inches (152 mm). Two 2½-inch (64 mm) hose connections shall be provided on every intermediate floor level landing in every required stairway. Where pressure reduction valves (prv) are required, each hose connection shall be provided with its own prv. The system shall be designed to provide a minimum flow of 300 gpm (19 L/s) at a minimum pressure of 150 psi (1034 kPa) [maximum 200 psi (1379 kPa)] at each standpipe connection, in addition to the flow and pressure requirements contained in NFPA 14.

**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 stairway, a hose connection shall be provided for each floor level above or below grade. Hose connections shall be located at an intermediate floor level landing between floors, unless otherwise approved by the fire code official.
2. On each side of the wall adjacent to the exit opening of a horizontal exit.
3. In every exit passageway at the entrance from the exit passageway to other areas of a 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, and at each floor level landing within enclosed stairways opening directly onto the mall.
5. ~~Where the roof has a slope less than four units vertical in 12 units horizontal (33.3-percent slope), each~~ At least one standpipe shall be provided with a two 2½-inch (64 mm) hose connections located either on the roof at least 10 feet (3048 mm) from the roof edge, skylight, light well or other opening, unless protected by a 42-inch-high (1067 mm) guardrail or equivalent. Additional roof connections shall be provided so that all portions of the roof are within 200 feet (60 960 mm), of hose travel distance from a standpipe hose connection. Where stairs are required to provide roof access, the standpipe roof connections shall be located adjacent to the stair opening.

The roof hose connections shall be arranged to be operable without entering the building.

Roof connections in high-rise buildings are allowed to be located at the highest landing of stairways with stair access to the roof. An additional hose connection shall be provided at the top of the most hydraulically remote standpipe for testing purposes.

6. Where the most remote portion of a nonsprinklered floor or story is more than 150 feet (45 720 mm) of hose travel distance from a hose connection or the most remote portion of a sprinklered floor or story is more than 200 feet (60 960 mm) of hose travel distance from a hose connection, additional hose connections shall be provided in protected locations that are accessed through protected enclosures. Additional hose connections in parking garages are not required to be accessed through or located in protected enclosures. Protected enclosures and protected locations are either smoke barriers or exit enclosures constructed in accordance with the Seattle Building Code, the fire code official is authorized to require that additional hose connections be provided in approved locations.

**905.4.1 Protection.** Risers and laterals of Class I standpipe systems not located within an enclosed stairway or pressurized enclosure 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 enclosed stairway or pressurized enclosure 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 shall be 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 with occupant loads of more than 1,000, 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 fire code official.

**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 at the bottom.

**905.7 Cabinets.** Cabinets containing fire-fighting equipment, such as standpipes, fire hose, 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 occupancies.

**905.8 Dry standpipes.** Dry standpipes are acceptable in other than high-rise buildings, 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 also 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 nor provided with monitoring by a central station service.

**905.10 During construction.** Standpipe systems required during construction and demolition operations shall be provided in accordance with Section 1413.

**905.11 Existing buildings.** Existing structures with occupied floors located more than 50 feet (15 240 mm) above or below the lowest level of fire department access shall be equipped with standpipes installed in accordance with Section 905. The standpipes shall have an approved fire department connection with hose connections at each floor level above or below the lowest level of fire department access. The fire code official is authorized to approve the installation of manual standpipe systems to achieve compliance with this section where the responding fire department is capable of providing the required hose flow at the highest standpipe outlet.

**SECTION 906  
PORTABLE FIRE EXTINGUISHERS**

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

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

> **Exception:** In all Group A, B and E occupancies equipped throughout with quick-response sprinklers, fire extinguishers shall be required only in special-hazard areas.

2. Within 30 feet (9144 mm) of commercial cooking equipment.
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 1415.1.
5. Where required by the 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 fire code official.

**TABLE 906.1  
ADDITIONAL REQUIRED PORTABLE FIRE EXTINGUISHERS**

SECTION	SUBJECT
303.5	Asphalt kettles
307.4	Open burning
308.4	Open flames
309.4	Powered industrial trucks
1105.2	Aircraft towing vehicles
1105.3	Aircraft welding apparatus
1105.4	Aircraft fuel-servicing tank vehicles
1105.5	Aircraft hydrant fuel-servicing vehicles
1105.6	Aircraft fuel-dispensing stations
1107.7	Heliports and helistops
1208.4	Dry cleaning plants
1415.1	Buildings under construction or demolition
1417.3	Roofing operations
1504.6.4	Spray-finishing operations
1505.5	Dip-tank operations
1904.2	Lumberyards/woodworking facilities
1908.8	Recycling facilities
1909.5	Exterior lumber storage
2003.5	Organic-coating areas
2106.3	Industrial ovens
2205.5	Motor fuel-dispensing facilities
2210.6.4	Marine motor fuel-dispensing facilities
2211.6	Repair garages
2306.10	Rack storage
2404.12	Tents, canopies and membrane structures
2508.2	Tire rebuilding/storage
2604.2.6	Welding and other hot work
2903.6	Combustible fibers
3308.11	Fireworks
3403.2.1	Flammable and combustible liquids, general
3404.3.3.1	Indoor storage of flammable and combustible liquids
3404.3.7.5.2	Liquid storage rooms for flammable and combustible liquids
3405.4.9	Solvent distillation units
3406.2.7	Farms and construction sites—flammable and combustible liquids storage
3406.4.10.1	Bulk plants and terminals for flammable and combustible liquids
3406.5.4.5	Commercial, industrial, governmental or manufacturing establishments—fuel dispensing
3406.6.4	Tank vehicles for flammable and combustible liquids
3606.5.7	Flammable solids
3808.2	LP-gas

**906.2 General requirements.** Fire extinguishers shall be selected, installed and maintained in accordance with this section and NFPA 10.

**Exception:** The travel distance to reach an extinguisher shall not apply to the spectator seating portions of Group A-5 occupancies.

**906.3 Size and distribution.** For occupancies that involve primarily Class A fire hazards, the minimum sizes and distribution shall comply with Table 906.3(1). Fire extinguishers for occupancies involving flammable or combustible liquids with depths of less than or equal to 0.25-inch (6.35 mm) shall be selected and placed in accordance with Table 906.3(2). Fire extinguishers for occupancies involving flammable or combustible liquids with a depth of greater than 0.25-inch (6.35 mm) or involving combustible metals shall be selected and placed in accordance with NFPA 10. Extinguishers for Class C fire hazards shall be selected and placed on the basis of the anticipated Class A or Class B hazard.

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

	LIGHT (Low) HAZARD OCCUPANCY	ORDINARY (Moderate) HAZARD OCCUPANCY	EXTRA (High) HAZARD OCCUPANCY
Minimum Rated Single Extinguisher	2-A <sup>c</sup>	2-A	4-A <sup>a</sup>
Maximum Floor Area Per Unit of A	3,000 square feet	1,500 square feet	1,000 square feet
Maximum Floor Area For Extinguisher <sup>b</sup>	11,250 square feet	11,250 square feet	11,250 square feet
Maximum Travel Distance to Extinguisher	75 feet	75 feet	75 feet

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>, 1 gallon = 3.785 L.  
 a. Two 2.5-gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.  
 b. NFPA 10 Appendix E-3-3 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)  
FLAMMABLE OR COMBUSTIBLE LIQUIDS WITH DEPTHS OF  
LESS THAN OR EQUAL TO 0.25-INCH**

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM TRAVEL DISTANCE TO EXTINGUISHERS (feet)
Light (Low)	5-B	30
	10-B	50
Ordinary (Moderate)	10-B	30
	20-B	50
Extra (High)	40-B	30
	80-B	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 NFPA 10, Sections 3-3 and 3-4.

**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 904.11.5.

**906.5 Conspicuous location.** 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 fire code official determines that the hazard posed indicates the need for placement away from normal paths of travel.

**906.6 Unobstructed and unobscured.** 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 fire extinguishers shall not be locked.

**Exceptions:**

1. Where 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 Height above floor.** Portable fire extinguishers having a gross weight not exceeding 40 pounds (18 kg) shall be installed so that its top is not more than 5 feet (1524 mm) above the floor. Hand-held portable fire extinguishers having a gross weight exceeding 40 pounds (18 kg) shall be installed so that its top is not more than 3.5 feet (1067 mm) above the floor. The clearance between the floor and the bottom of installed hand-held extinguishers shall not be 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 in new and existing buildings and structures. The requirements of Section 907.2 are applicable to new buildings and structures, and new fire alarm systems being installed in existing structures. The requirements of Section 907.3 are applicable to existing buildings and structures. All fire alarm and fire detection systems shall be designed, installed and maintained in accordance with the requirements of NFPA 72, except for the locations of initiating devices which shall meet Section 907 of the Seattle Fire Code.

Buildings required by this section to be provided with a fire alarm system shall be provided with a single fire alarm system.

**Exception:** A single system is not required in existing buildings that are being increased in size and the existing fire alarm system is unable to expand into the new space. In those cases the multiple systems shall be arranged as described below for nonrequired fire alarm systems.

Buildings not required by this section to be provided with a fire alarm system may be provided with multiple partial fire alarm systems provided:

1. The systems are connected so that all systems simultaneously activate alarm notification appliances upon a signal from any of the fire alarm systems in the building.
2. The location of each systems annunciator panel (or main panel) is also provided with annunciator panels with reset capability for every other system in the building.

**907.1.1 Construction documents.** Construction documents for fire alarm systems shall be submitted for review and approval prior to system installation. Construction documents shall include, but not be limited to, all of the following:

1. A floor plan which indicates the use of all rooms.
2. Locations of alarm-initiating and notification appliances.
3. Alarm control and trouble signaling equipment.
4. Annunciation.
5. Power connection.
6. Battery calculations.
7. Conductor type and sizes.
8. Voltage drop calculations.
9. Manufacturers, model numbers and listing information for equipment, devices and materials.
10. Details of ceiling height and construction.
11. The interface of fire safety control functions.

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

**907.2 Where required—new buildings and structures.** An approved manual, automatic, or manual and automatic fire alarm system shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.23. Where automatic sprinkler protection installed in accordance with Section 903.3.1.1 or 903.3.1.2 is provided and connected to the building fire alarm system, automatic heat detection required by this section shall not be required.

An approved automatic fire detection system shall be installed in accordance with the provisions of this code and NFPA 72. Devices, combinations of devices, appliances and equipment shall comply with Section 907.1.2. The automatic fire detectors shall be smoke detectors, except that an approved alternative type of detector shall be installed in spaces such as boiler rooms where,

during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.

**907.2.1 Group A.** A manual fire alarm system shall be installed in accordance with NFPA 72 in Group A occupancies having an occupant load of 300 or more. 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 and the alarm notification appliances will activate 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 NFPA 72.

**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 power.** Emergency voice/alarm communications systems shall be provided with an approved emergency power source.

**907.2.2 Group B.** A manual fire alarm system shall be installed in Group B occupancies having an occupant load of 500 or more persons or more than 100 persons 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 and the alarm notification appliances will activate upon sprinkler water flow.

**907.2.3 Group E.** A manual fire alarm system 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. Group E occupancies with an occupant load of less than 50.
2. Manual fire alarm boxes are not required in Group E occupancies where all the following apply:
  - 2.1. Interior corridors are protected by smoke detectors with alarm verification.
  - 2.2. Auditoriums, cafeterias, gymnasiums and the like are protected by heat detectors or other approved detection devices.
  - 2.3. Shops and laboratories involving dusts or vapors are protected by heat detectors or other approved detection devices.
  - 2.4. Off-premises monitoring is provided.
  - 2.5. The capability to activate the evacuation signal from a central point is provided.

2.6. In buildings where normally occupied spaces are provided with a two-way communication system between such spaces and a constantly attended receiving station from where a general evacuation alarm can be sounded, except in locations specifically designated by the fire code official.

**907.2.4 Group F.** A manual fire alarm system shall be installed in Group F occupancies that are two or more stories in height and have an 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 and the alarm notification appliances will activate upon sprinkler water flow.

**907.2.5 Group H.** A manual fire alarm system 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 in spaces containing highly toxic gases, organic peroxides and oxidizers in accordance with Chapters 37, 39 and 40, respectively.

**907.2.6 Group I.** A manual fire alarm system and an automatic fire smoke detection system shall be installed in Group I occupancies. An electrically supervised, automatic smoke detection system shall be provided in waiting areas that are open to corridors.

**Exception:** Manual fire alarm boxes in patient sleeping areas of Group I-1 and I-2 occupancies shall not be required at exits if located at all nurses' control stations or other constantly attended staff locations, provided such stations are visible and continuously accessible and that travel distances required in Section 907.4.1 are not exceeded.

**907.2.6.1 Group I-2.** Corridors in nursing homes (both intermediate care and skilled nursing facilities), detoxification facilities and spaces open to the corridors shall be equipped with an automatic fire smoke detection system.

**Exceptions:**

1. Corridor smoke detection is not required in smoke compartments that contain patient sleeping rooms where patient sleeping units are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each patient sleeping unit and shall provide an audible and visual alarm at the nursing station attending each unit.
2. Corridor smoke detection is not required in smoke compartments that contain patient sleeping rooms where patient 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.

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

**907.2.6.2.1 System initiation.** Actuation of an automatic fire-extinguishing system, a manual fire alarm box or a fire detector shall initiate an approved fire alarm signal which automatically notifies staff. Presignal systems shall not be used.

**907.2.6.2.2 Manual fire alarm boxes.** Manual fire alarm boxes are not required to be located in accordance with Section 907.4 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted.

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.

**907.2.6.2.3 Smoke detectors.** An approved automatic smoke detection system shall be installed throughout resident housing areas, including sleeping areas 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.
3. Smoke detectors are not required in sleeping units with four or fewer occupants in smoke compartments that are equipped throughout with an approved automatic sprinkler system.

**907.2.7 Group M.** A manual fire alarm system shall be installed in Group M occupancies, other than covered mall buildings complying with Section 402 of the *International Building Code*, having an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge. See Section 907.2.20 for covered mall building fire alarm requirements.

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

**907.2.7.1 Occupant notification.** ~~During times that the building is occupied, in lieu of the automatic activation of alarm notification appliances, the manual fire alarm system shall be allowed to activate an alarm signal at a constantly attended location from which evacuation instructions shall be initiated over an emergency~~

~~voice/alarm communication system installed in accordance with Section 907.2.12.2.~~

~~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.~~

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

**907.2.8.1 Manual and automatic fire alarm system.** A manual fire alarm system 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 guestrooms and contiguous attic and crawl spaces are separated from each other and public or common areas by at least 1-hour fire partitions and each individual guestroom has an exit directly to a public way, exit court or yard.
2. Manual fire alarm boxes are not required throughout the building when 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; and
  - 2.3. At least one manual fire alarm box is installed at an approved location.

**907.2.8.1.12 Automatic fire alarm detection system.** ~~An automatic fire alarm system~~ smoke detectors shall be installed throughout all interior corridors serving guestrooms. Automatic heat detectors shall be provided in any unsprinklered interior areas outside guestrooms other than attics and crawl spaces.

**Exception:** An automatic fire detection system is Smoke detectors are not required in buildings that do not have interior corridors serving guestrooms and each guestroom has a means of egress door opening directly to an exterior exit access that leads directly to an exit.

**907.2.8.1.23 Smoke alarms.** Smoke alarms shall be installed as required by Section 907.2.10. In buildings that are not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the smoke alarms in guestrooms shall be connected to an emergency electrical system and shall be annunciated by guestroom at a constantly attended location from which the fire alarm system is capable of being manually activated.

**907.2.9 Group R-2.** Except in townhouses meeting the requirements of Section 907.2.9.2, A manual and automatic fire alarm system shall be installed in Group R-2 occupancies where:

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; or
3. The building contains more than 16 dwelling units or sleeping units.

**Exceptions:**

1. A fire alarm system is not required in buildings containing more than 16 dwelling units or sleeping units 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 at least 1-hour fire partitions and each dwelling unit or sleeping unit has an exit directly to a public way, exit court or yard.
2. ~~Manual fire alarm boxes are not required throughout the building when the following conditions are met:~~
  - 2.1. ~~The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or Section 903.3.1.2;~~
  - 2.2. ~~The notification appliances will activate upon sprinkler flow; and~~
  - 2.3. ~~At least one manual fire alarm box is installed at an approved location.~~
- 3.2. A fire alarm system is not required in buildings containing more than 16 dwelling units or sleeping units that do not have interior corridors serving dwelling units and are protected by an approved automatic sprinkler system installed in accordance with Sections 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 1022.6, Exception 4.

**907.2.9.1 Automatic detection.** Automatic heat detectors shall be provided in any unsprinklered interior areas outside dwelling units other than attics and crawl spaces.

**907.2.9.2 Townhouses.** Where a fire alarm system is required in accordance with Section 907.2.9, a fire alarm system is not required for townhouse structures meeting all of the following criteria:

1. Each unit has its own exit to a public way.
2. No unit is located above any other unit or common space.
3. Each unit and contiguous attic and crawl spaces are separated from other units by at least a 1-hour fire partition.
4. Each unit is provided with an interconnected smoke alarm system that includes heat detectors in the garage.
5. The sprinkler waterflow switch activates the interconnected smoke alarm and heat detection system within the affected unit.

**907.2.10 Single- and multiple-station smoke alarms.** Listed single- and multiple-station smoke alarms shall be in-

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stalled in accordance with the provisions of this code and the household fire-warning equipment provisions of NFPA 72.

**907.2.10.1 Where required.** Single- or multiple-station smoke alarms shall be installed in the locations described in Sections 907.2.10.1.1 through 907.2.10.1.3.

**907.2.10.1.1 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.

**907.2.10.1.2 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.

**907.2.10.1.3 Group I-1.** Single- or multiple-station smoke alarms shall be installed and maintained in sleeping areas in occupancies in Group I-1. Single- or multiple-station smoke alarms shall not be required where the building is equipped throughout with an automatic fire detection system in accordance with Section 907.2.6.

**907.2.10.2 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 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 in Group R-1 where they are connected to an emergency electrical system.

**907.2.10.3 Interconnection.** Where more than one smoke alarm is required to be installed within an individual dwelling unit or sleeping unit in Group R-2, R-3 or R-4, or within an individual sleeping unit in Group R-1, 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. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

**907.2.10.4 Acceptance testing.** When the installation of the alarm devices is complete, each detector and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the household fire warning equipment provisions of NFPA 72.

**907.2.11 Special amusement buildings.** An approved automatic smoke detection system shall be provided in special amusement buildings in accordance with this section.

**Exception:** In areas where ambient conditions will cause a smoke detection system to alarm, an approved alternative type of automatic detector shall be installed.

**907.2.11.1 Alarm.** Activation of any single smoke detector, the automatic sprinkler system or any other automatic fire detection device shall immediately sound an 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 907.2.11.2.

**907.2.11.2 System response.** The activation of two or more smoke detectors, a single smoke detector with alarm verification, the automatic sprinkler system or other approved fire detection device shall automatically:

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; and
3. Activate an approved directional exit marking that will become apparent in an emergency.

Such system response shall also include activation of a prerecorded message, clearly 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 which is distinctive from other sounds used during normal operation.

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

**907.2.11.3 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 NFPA 72 and be audible throughout the entire special amusement building.

**907.2.12 High-rise buildings.** Buildings having floors used for human occupancy located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall be provided with an automatic fire alarm system and an emergency voice/alarm communication system in accordance with Section 907.2.12.2.

**Exceptions:**

1. Airport traffic control towers in accordance with Section 907.2.22 and Section 412 of the *International Building Code*.
2. Open parking garages in accordance with Section 406.3 of the *International Building Code*.

3. Buildings with an occupancy in Group A-5 in accordance with Section 303.1 of the *International Building Code*.
4. Low-hazard special occupancies in accordance with Section 503.1.2 of the *International Building Code*.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with Section 415 of the *International Building Code*.

**907.2.12.1 Automatic fire smoke detection.** 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 operate the emergency voice/alarm communication system. Smoke detectors shall be located as follows:

1. In each ~~mechanical equipment~~, electrical, transformer, telephone equipment or similar room which is not provided with sprinkler protection, elevator machine rooms, and in elevator lobbies.
2. 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.
3. 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 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.
4. Within 5 feet (1524 mm) of doors exiting into stairways that are smokeproof enclosures or are pressurized stairways.

**907.2.12.2 Emergency voice/alarm communication system.** The operation of any automatic fire detector, sprinkler water-flow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving approved information and directions on a general or selective basis to ~~the following terminal~~ all areas on a minimum of the alarming floor, the floor above, and the floor below in accordance with the building's fire safety and evacuation plans required by Section 404. The system shall provide the capability for manual voice messages to be announced throughout the building, or selectively to each individual floor and each individual required stairway.

1. Elevator lobbies.
2. Corridors.
3. Rooms and tenant spaces exceeding 1,000 square feet (93 m<sup>2</sup>) in area.
4. Dwelling units and sleeping units in Group R-2 occupancies.
5. Sleeping units in Group R-1 occupancies.
6. Areas of refuge as defined in Section 1002.

**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.

**907.2.12.2.1 Manual override.** A manual override for emergency voice communication shall be provided for all paging zones.

**907.2.12.2.2 Live voice messages.** The emergency voice/alarm communication system shall also have the capability to broadcast live voice messages through speakers located in elevators, exit stairways, and throughout a selected floor or floors.

**907.2.12.2.3 Standard.** The emergency voice/alarm communication system shall be designed and installed in accordance with NFPA 72.

**907.2.12.3 Fire department communication system.**

An approved two-way, fire department communication system designed and installed in accordance with NFPA 72 shall be provided for fire department use. It shall operate between a fire command center complying with Section 509 and elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways. The fire department communication device shall be provided at each floor level within the enclosed exit stairway. Eight portable handsets for the communication system shall be provided in the fire command center.

**Exception:** Fire department radio systems where approved by the fire department.

**907.2.13 Atriums connecting more than two stories.** A fire alarm system shall be installed in occupancies with an atrium that connects more than two stories. The system shall be activated in accordance with Section 907.7. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of Section 907.2.12.2.

**907.2.14 High-piled combustible storage areas.** An automatic fire detection system shall be installed throughout high-piled combustible storage areas where required by Section 2306.5.

**907.2.15 Delayed egress locks.** Where delayed egress locks are installed on means of egress doors in accordance with Section 1008.1.8.6, an automatic smoke or heat detection system shall be installed as required by that section.

**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 this code.

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

**907.2.18 Underground buildings with smoke exhaust systems.** Where a smoke exhaust system is installed in an underground building in accordance with the *International Building Code*, automatic fire detectors shall be provided in accordance with this section.

**907.2.18.1 Smoke detectors.** A minimum of one smoke detector listed for the intended purpose shall be installed in 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.
5. Within 5 feet (1524 mm) of doors exiting into stairways that are smokeproof enclosures or are pressurized stairways.

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

**907.2.19 Underground buildings.** Where the lowest level of a structure is more than 60 feet (18 288 mm) below 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 907.2.12.2.

**907.2.19.1 Public address system.** Where a fire alarm system is not required by Section 907.2, a public address system shall be provided which shall be capable of transmitting voice communications to the highest level of exit discharge serving the underground portions of the structure and all levels below.

**907.2.20 Covered mall buildings.** Covered mall buildings exceeding 50,000 square feet (4645 m<sup>2</sup>) in total floor area shall be provided with an emergency voice/alarm communication system. An emergency voice/alarm communication system serving a mall, required or otherwise, shall be accessible to the fire department. The system shall be provided in accordance with Section 907.2.12.2.

**907.2.21 Residential aircraft hangars.** A minimum of one listed smoke alarm shall be installed within a residential aircraft hangar as defined in the *International Building Code* and shall be interconnected into the residential smoke alarm or other sounding device to provide an alarm which will be audible in all sleeping areas of the dwelling.

**907.2.22 Airport traffic control towers.** An automatic fire detection system shall be provided in airport traffic control towers.

**907.2.23 Battery rooms.** An approved automatic smoke detection system shall be installed in areas containing stationary lead-acid battery systems having a liquid capacity of

more than 50 gallons (189 L). The detection system shall be supervised by an approved central, proprietary, or remote station service or a local alarm which will sound an audible signal at a constantly attended location.

**907.2.24 Group I.C.** Fire alarm systems shall be installed in Group I.C. occupancies that are three or more stories above grade plane in height or have more than 16 clients. The alarm system shall include manual pull stations at every exit from every level and smoke detectors throughout exit paths.

**907.3 Where required—retroactive in existing buildings and structures.** An approved manual, automatic or manual and automatic fire alarm system shall be installed in existing buildings and structures in accordance with Sections 907.3.1 through 907.3.1.8. Where automatic sprinkler protection is provided in accordance with Section 903.3.1.1 or 903.3.1.2 and connected to the building fire alarm system, automatic heat detection required by this section shall not be required.

An approved automatic fire detection system shall be installed in accordance with the provisions of this code and NFPA 72. Devices, combinations of devices, appliances and equipment shall be approved. The automatic fire detectors shall be smoke detectors, except an approved alternative type of detector shall be installed in spaces such as boiler rooms where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.

**907.3.1 Occupancy requirements.** A fire alarm system shall be installed in accordance with Sections 907.3.1.1 through 907.3.1.8.

**Exception:** Occupancies with an existing, previously approved fire alarm system.

**907.3.1.1 Group E.** A fire alarm system shall be installed in existing Group E occupancies in accordance with Section 907.2.3.

**Exceptions:**

1. A building with a maximum area of 1,000 square feet (93 m<sup>2</sup>) that contains a single classroom and is located no closer than 50 feet (15 240 mm) from another building.
2. Group E with an occupant load less than 50.

**907.3.1.2 Group I-1.** A fire alarm system shall be installed in existing Group I-1 residential care/assisted living facilities.

**Exception:** Where each sleeping room has a means of egress door opening directly to an exterior egress balcony that leads directly to the exits in accordance with Section 1013.5, and the building is not more than three stories in height.

**907.3.1.3 Group I-2.** A fire alarm system shall be installed in existing Group I-2 occupancies in accordance with Section 907.2.6.

**907.3.1.4 Group I-3.** A fire alarm system shall be installed in existing Group I-3 occupancies in accordance with Section 907.2.6.1.

**907.3.1.5 Group R-1 hotels and motels.** A fire alarm system shall be installed in existing Group R-1 hotels and

motels more than three stories or with more than 20 guestrooms.

**Exception:** Buildings less than two stories in height where all guestrooms, attics and crawl spaces are separated by 1-hour fire-resistance-rated construction and each guestroom has direct access to a public way, exit court or yard.

**907.3.1.6 Group R-1 boarding and rooming houses.** A fire alarm system shall be installed in existing Group R-1 boarding and rooming houses.

**Exception:** Buildings that have single-station smoke alarms meeting or exceeding the requirements of Section 907.2.10.1 and where the fire alarm system includes at least one manual fire alarm box per floor arranged to initiate the alarm.

**907.3.1.7 Group R-2.** A fire alarm system shall be installed in existing Group R-2 occupancies more than three stories in height or with more than 16 dwelling units or sleeping units.

**Exceptions:**

1. Where each living unit is separated from other contiguous living units by fire barriers having a fire-resistance rating of not less than 0.75 hour, and where each living unit has either its own independent exit or its own independent stairway or ramp discharging at grade.
2. A separate fire alarm system is not required in buildings that are equipped throughout with an approved supervised automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and having a local alarm to notify all occupants.
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 Sections 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 1022.6, Exception 4.

**907.3.1.8 Group R-4.** A fire alarm system shall be installed in existing Group R-4 residential care/assisted living facilities.

**Exceptions:**

1. Where there are interconnected smoke alarms meeting the requirements of Section 907.2.10 and there is at least one manual fire alarm box per floor arranged to sound continuously the smoke alarms.
2. Other manually activated, continuously sounding alarms approved by the fire code official.

**907.3.2 Single- and multiple-station smoke alarms.** Single- and multiple-station smoke alarms shall be installed in

existing Group R occupancies in accordance with Sections 907.3.2.1 through 907.3.2.3.

**907.3.2.1 General.** Existing Group R occupancies not already provided with single-station smoke alarms shall be provided with approved single-station smoke alarms. Installation shall be in accordance with Section 907.2.10, except as provided in Sections 907.3.2.2 and 907.3.2.3.

**907.3.2.2 Interconnection.** Where more than one smoke alarm is required to be installed within an individual dwelling unit in Group R-2, R-3 or R-4, or within an individual sleeping unit in Group R-1, 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. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

**Exceptions:**

1. Interconnection is not required in buildings that are not undergoing alterations, repairs or construction of any kind.
2. Smoke alarms in existing areas are not required to be interconnected where alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for interconnection without the removal of interior finishes.

**907.3.2.3 Power source.** In Group R occupancies, single-station smoke alarms shall receive their primary power from the building wiring provided that such wiring is served from a commercial source and shall be equipped with a battery backup. 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 permitted to be solely battery operated: in existing buildings where no construction is taking place; in buildings that are not served from a commercial power source; and in existing areas of buildings undergoing alterations or repairs that do not result in the removal of interior walls or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for building wiring without the removal of interior finishes.

**907.4 Manual fire alarm boxes.** Manual fire alarm boxes shall be installed in accordance with Sections 907.4.1 through 907.4.5.

**907.4.1 Location.** Manual fire alarm boxes shall be located not more than 5 feet (1524 mm) from the entrance to each exit at every floor level. Additional manual fire alarm boxes shall be located so that travel distance to the nearest box does not exceed 200 feet (60 960 mm).

**Exception:** Manual fire alarm boxes are not required on sprinklered floors of Group F, M, S and B occupancies.

~~other than Group B laboratory facilities, shall not be required in Group E occupancies where the building is equipped throughout with an approved automatic sprinkler system, the notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.~~

**907.4.2 Height.** The height of the manual fire alarm boxes shall be a minimum of 42 inches (1067 mm) and a maximum of 48 inches (1372 mm) measured vertically, from the floor level to the activating handle or lever of the box.

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

**907.4.4 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.

**907.4.5 Protective covers.** The fire code official is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or 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.

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

**907.6 Wiring.** Wiring shall comply with the requirements of the ICC *Electrical Code* 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.

**907.7 Activation.** Where an alarm notification system is required by another section of this code, it shall be activated by:

1. ~~Required automatic fire alarm system.~~ Automatic heat and smoke detectors, other than duct detectors, and dwelling unit smoke alarms.
2. Sprinkler water-flow devices.
3. ~~Required m~~Manual fire alarm boxes.
4. Any other fire suppression system installed within the building, except for laboratory fume hood suppression systems.

**907.8 Presignal system.** Presignal systems shall not be installed unless approved by the fire code official and the fire department. Where a presignal system is installed, 24-hour personnel supervision shall be provided at a location approved by the fire department, in order that the alarm signal can be actuated in the event of fire or other emergency.

**907.9 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.

**907.9.1 Annunciator panel. Zoning indicator panel.** A zoning indicator panel and the associated controls shall be provided in an approved location. ~~Annunciator panels shall be located inside the building at the main entrance. The fire code official may approve exterior annunciator panels designed specifically for that purpose. Graphic annunciators, when provided, shall be mounted to maintain the viewer's directional orientation. 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.~~

Alarm panels and annunciators shall not be installed where they would obstruct exiting. The required exit width plus 12 inches (305 mm) shall be provided when the panel is located in a means of egress. Alarm panels shall not be installed in an exit enclosure providing the sole exit from any space.

**907.9.2 High-rise buildings.** In buildings that have floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access that are occupied for human occupancy, a separate zone by floor shall be provided for all of the following types of alarm-initiating devices where provided:

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

**907.10 Alarm notification appliances.** Alarm notification appliances shall be provided and shall be listed for their purpose.

**907.10.1 Visible alarms.** Visible alarm notification appliances shall be provided in accordance with Sections 907.10.1.1 through 907.10.1.4.

**Exceptions:**

1. Visible alarm notification appliances are not required in alterations, except where 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 Section 1002.1.

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

**907.10.1.2 Employee work areas.** Where employee work areas have audible alarm coverage, the wiring system shall be designed so that visible alarm notification appliances can be integrated into the alarm system.

**907.10.1.3 Groups I-1 and R-1.** Group I-1 and R-1 sleeping units in accordance with Table 907.10.1.3 shall be provided with a visible alarm notification appliance, activated by both the in-room smoke alarm and the building fire alarm system.

**907.10.1.4 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 ICC A117.1.

**TABLE 907.10.1.3  
VISIBLE AND AUDIBLE ALARMS**

NUMBER OF SLEEPING UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE AND AUDIBLE ALARMS
6 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

**907.10.2 Audible alarms.** Audible alarm notification appliances shall be provided and sound a distinctive sound that is not to be used for any purpose other than that of a fire alarm. 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 at least 60 seconds, whichever is greater, in every occupied space within the building, or in the case of nonrequired partial fire alarm systems, throughout the space that is being provided with the fire alarm system. The minimum sound pressure levels shall be: 70 dBA in occupancies in Groups R and I-1; 90 dBA in mechanical equipment rooms; and 60 dBA in other occupancies. The maximum sound pressure level for audible alarm notification appliances shall be 120 dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 105 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required. In assembly facilities with high sound levels such as nightclubs, bars, etc., an interface shall be provided between the fire alarm system and noise source to reduce the noise level upon activation of the fire alarm system.

**Exceptions:**

1. Visible alarm notification appliances shall be allowed in lieu of audible alarm notification appliances in critical care areas of Group I-2 occupancies.
2. Audibility is not required for fire detection systems monitored by an approved central station.

**907.10.2.1 Audible alarms in existing buildings.** Required fire alarm systems in existing residential buildings shall provide a sound level of 60 dBA minimum or 15 dBA above ambient noise levels in sleeping rooms.

**907.11 Fire safety functions.** Automatic fire detectors utilized for the purpose of performing fire safety functions shall be con-

nected to the building’s fire alarm control panel 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 required to be 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.

**907.12 Duct smoke detectors.** Duct smoke detectors shall be connected to the building’s fire alarm control panel as a supervisory signal when a fire alarm system is provided. Duct detectors shall not activate a fire alarm signal. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a constantly attended location. Duct smoke detectors 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 are monitored by a central station alarm service 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.

**907.13 Access.** Access shall be provided to each detector for periodic inspection, maintenance and testing.

**907.14 Fire-extinguishing systems.** Automatic fire-extinguishing systems shall be connected to the building fire alarm system where a fire alarm system is required by another section of this code or is otherwise installed.

**907.15 Monitoring.** Where required by this chapter or by the *International Building Code*, an approved supervising station in accordance with NFPA 72 shall monitor fire alarm systems.

**Exception:** Supervisory service is not required for:

1. Single- and multiple-station smoke alarms required by Section 907.2.10.
2. Smoke detectors in Group I-3 occupancies.
3. Nonrequired automatic sprinkler systems in one- and two-family dwellings.

**907.16 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 fire chief.

**907.17 Acceptance tests.** Upon completion of the installation of the fire alarm system and after the electrical inspector has signed off on the installation, alarm notification appliances and circuits, alarm-initiating devices and circuits, supervisory-signal initiating devices and circuits, signaling line circuits, and primary and secondary power supplies shall be tested in accordance with NFPA 72 in the presence of the fire code official, by individuals who possess the proper certificate from the fire

code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment.

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

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

**907.20 Inspection, testing and maintenance.** The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with this section and Chapter 7 of NFPA 72. The systems shall be worked on only by individuals who possess the proper certificate from the fire code official in accordance with Administrative Rule 9.01.04, Certification for Installing, Maintaining and Testing Life Safety Systems and Equipment. Documentation of testing shall be forwarded to the fire code official in accordance with Administrative Rule 9.02.04, Confidence Test Requirements for Life Safety Systems.

**907.20.1 Maintenance required.** Whenever or wherever any device, equipment, system, condition, arrangement, level of protection or any other feature is required for compliance with the provisions of this code, such device, equipment, system, condition, arrangement, level of protection or other feature shall thereafter be continuously maintained in accordance with applicable NFPA requirements or as directed by the fire code official.

**907.20.2 Testing.** Testing shall be performed in accordance with the schedules in Chapter 7 of NFPA 72 or more frequently where required by the fire code official. Where automatic testing is performed at least weekly by a remotely monitored fire alarm control unit specifically listed for the application, the manual testing frequency shall be permitted to be extended to annual.

**Exception:** Devices or equipment that are inaccessible for safety considerations shall be tested during scheduled shutdowns where approved by the fire code official, but not less than every 18 months.

**907.20.3 Detector sensitivity.** Detector sensitivity shall be checked within 1 year after installation and every alternate year thereafter. After the second calibration test, where sensitivity tests indicate that the detector has remained within its listed and marked sensitivity range (or 4-percent obscuration light grey smoke, if not marked), the length of time between calibration tests shall be permitted to be extended to a maximum of 5 years. Where the frequency is extended, records of detector-caused nuisance alarms and subsequent trends of these alarms shall be maintained. In zones or areas where nuisance alarms show any increase over the previous year, calibration tests shall be performed.

**907.20.4 Method.** To ensure that each smoke detector is within its listed and marked sensitivity range, it shall be tested using either a calibrated test method, the manufacturer’s calibrated sensitivity test instrument, listed control equipment arranged for the purpose, a smoke detector/con-

trol unit arrangement whereby the detector causes a signal at the control unit where its sensitivity is outside its acceptable sensitivity range or other calibrated sensitivity test method acceptable to the fire code official. Detectors found to have a sensitivity outside the listed and marked sensitivity range shall be cleaned and recalibrated or replaced.

**Exceptions:**

1. Detectors listed as field adjustable shall be permitted to be either adjusted within the listed and marked sensitivity range and cleaned and recalibrated or they shall be replaced.
2. This requirement shall not apply to single-station smoke alarms.

**907.20.4.1 Testing device.** Detector sensitivity shall not be tested or measured using a device that administers an unmeasured concentration of smoke or other aerosol into the detector.

**907.20.5 Maintenance, inspection and testing.** The building owner shall be responsible for ensuring that the fire and life safety systems are maintained in an operable condition at all times. Service personnel shall meet the qualification requirements of NFPA 72 for maintaining, inspecting and testing such systems. A written record shall be maintained and shall be made available to the fire code official.

**907.21 Fire alarm equipment.** Alarm-initiating devices, alarm-signaling devices and annunciators shall not be concealed, obstructed, deactivated or impaired.

**Exception:** When authorized by the fire code official.

Fire alarm equipment shall not be reset upon activation unless authorized by the fire code official.

**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 as required in Chapter 27.

**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 1803.12. A continuous gas detection system shall be provided for HPM gases in accordance with Section 1803.13.

**908.3 Highly toxic and toxic materials.** Where required by Section 3704.2.2.10, a gas detection system shall be provided for indoor storage and use of highly toxic and toxic compressed gases.

**908.4 Ozone gas-generator rooms.** A gas detection system shall be provided in ozone gas-generator rooms in accordance with Section 3705.3.2.

**908.5 Repair garages.** A flammable-gas detection system shall be provided in repair garages for vehicles fueled by non-odorized gases in accordance with Section 2211.7.2.

**908.6 Refrigeration systems.** Refrigeration system machinery rooms shall be provided with a refrigerant detector in accordance with Section 606.8.

## SECTION 909 SMOKE CONTROL SYSTEMS

**[B] 909.1 Scope and purpose.** This section applies to mechanical or passive smoke control systems when they are required for new buildings or portions thereof by provisions of the *International Building Code* or 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 *International Mechanical Code*.

**[B] 909.2 General design requirements.** Buildings, structures, or parts thereof required by the *International Building Code* or 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 describe adequately the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied with sufficient information and analysis to demonstrate compliance with these provisions.

**Code Alternate CA909:** Smoke control systems complying with the following in lieu of Sections 909.6, 909.7, 909.8 and 909.18.6 may be approved for high-rise buildings.

**1. Building ventilation.** Natural or mechanical ventilation for the removal of products of combustion shall be provided in every story and basement in accordance with either Item 1.1, 1.2 or 1.3.

1.1. Manually operable windows or panels shall be distributed around the perimeter of the building at not more than 50-foot (15 240 mm) intervals, and shall be aligned vertically. The operable area of the windows or panels shall not be less than 20 square feet (1.9 m<sup>2</sup>) per 50 linear feet (15 240 mm) of perimeter. The windows shall be identified with a white dot 2 inches (51 mm) in diameter located in the bottom one-third of the window.

**Exceptions:**

1. In Group R, Division 1 hotel occupancies, each guest room or suite having an exterior wall may be provided with 2 square feet (.19 m<sup>2</sup>) of venting area in lieu of the area specified above.

2. Windows may be of fixed tempered glass, provided that no coating or film is applied which will modify the natural breaking characteristics of the glass.

1.2. The mechanical air-handling equipment may be designed to accomplish smoke removal in lieu of the requirements of Item 1.1 above. Under fire conditions,

the return and exhaust air shall be moved directly to the outside without recirculation to other sections of the building. The air-handling system shall provide a minimum of one exhaust air change each 10 minutes for the area involved.

1.3. Any other approved design which will produce equivalent results.

**2. Shaft pressurization.** Shafts shall be protected by a shaft pressurization system complying with following:

2.1. All elevator shafts shall be pressurized to 0.10 inch of water column. Enclosed stairways shall be pressurized to 0.15 inch of water column. Exit passageways connecting pressurized stairways to the exterior shall be pressurized to 0.15 inches of water column. Other vertical shafts may be required to be pressurized as determined by the building official at the predesign conference. The pressure difference shall be measured between the shaft and the main occupied area on each floor.

**Exception:** Subject to the approval of the building official, pressurization may be omitted for elevators and enclosed stairways less than 75 feet (22 860 mm) in height.

2.2. Shaft pressurization shall be activated by a fire alarm system on each floor located in a manner approved by the building official and the fire chief. The fire alarm system shall include a smoke detector installed outside the enclosure and within 15 feet (4572 mm) of shaft enclosure doors.

2.3. Areas separated by 2-hour enclosure walls served by common ventilation equipment shall have automatic-closing dampers to prevent loss of pressurization.

2.4. Pressurization equipment and its duct work located within the building shall be separated from other portions of the building by a minimum of 2-hour fire-resistant construction. Duct work shall be constructed of noncombustible materials conforming to the requirements of the *Seattle Mechanical Code*.

2.5. Air for stairway pressurization shall be supplied near the bottom of the shaft and at intervals sufficient to maintain the required pressure throughout the shaft.

**Note:** The performance goal for Item 2.5 is compliance with minimum and maximum pressures at all levels of the shaft, and to ensure upward flow of air and smoke.

2.6. Shaft pressurization air intakes shall be located at the exterior of the building.

**Exception:** Intakes for elevator shaft pressurization may be located within the building provided they are located no more than 20 feet (6096 mm) from major openings in the building exterior such as loading docks and vehicular entrances. Such intake shall be provided with smoke detectors which shall deactivate the pressurization system for that shaft.

2.7. Whenever shaft pressurization is activated, all horizontal exit doors which have hold-open devices shall be automatically released to close.

2.8. Other measures to prevent loss of pressurization shall be provided in the design and construction of shafts, such as quality of workmanship and caulking of penetrations and joints.

2.9. Exit enclosures shall be equipped with a barometric dampered relief opening at the top, and a motorized damper as required by the *Washington State Energy Code with Seattle Amendments*. The motorized damper shall be of the normally open type (open with the power off). The enclosure shall be supplied mechanically with sufficient air to discharge a minimum of 2,500 cubic feet per minute (1.2 m<sup>3</sup>/s) through the relief opening while maintaining a minimum positive pressure of 0.15-inch water column in the shaft relative to atmospheric pressure with all doors closed. Supply air ducts shall be enclosed in construction at least equivalent to that of the exit enclosure between the exterior of the building and the exit enclosure. Activation of the mechanical equipment shall be initiated by the building fire alarm system. Such equipment shall also be activated by actuation of the automatic sprinkler system.

**[B] 909.3 Special inspection and test requirements.** In addition to the ordinary inspection and test requirements to which 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 as in the *International Building Code*.

**[B] 909.4 Analysis.** A rational analysis supporting the types of smoke control systems to be employed, the methods of their operations, the systems supporting them, and the methods of construction to be utilized shall accompany the construction documents submission and include, but not be limited to, the items indicated in Sections 909.4.1 through 909.4.6.

**[B] 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.

**[B] 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.

**[B] 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 the *International Building Code*.

**[B] 909.4.4 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 heating, ventilating and air-conditioning systems.

**[B] 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.

**[B] 909.4.6 Duration of operation.** All portions of active or passive smoke control systems shall be capable of continued operation after detection of the fire event for not less than 20 minutes.

**[B] 909.5 Smoke barrier construction.** Smoke barriers shall comply with the *International Building Code*. Smoke barriers shall be constructed and sealed to limit leakage areas exclusive of protected openings. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls:  $A/A_w = 0.001\ 00$
2. Exit enclosures:  $A/A_w = 0.00035$
3. 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<sup>2</sup>).

$A_F$  = Unit floor or roof area of barrier, square feet (m<sup>2</sup>).

$A_w$  = Unit wall area of barrier, square feet (m<sup>2</sup>).

The leakage area ratios shown do not include openings due to doors, operable windows or similar gaps. These shall be included in calculating the total leakage area.

**[B] 909.5.1 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 and operable windows. Compliance 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. Passive smoke control systems tested using other approved means such as door fan testing shall be as approved by the fire code official.

**[B] 909.5.2 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 door assemblies complying with the requirements of the *International Building Code* for doors in smoke barriers.

**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 907.11.

2. Fixed openings between smoke zones which are protected utilizing the airflow method.
3. In Group I-2, where such doors are installed across corridors, a pair of opposite-swinging doors without a center mullion shall be installed having vision panels with approved fire-rated glazing materials in approved fire-rated frames, the area of which shall not exceed that tested. The doors shall be close fitting within operational tolerances, and shall not have undercuts, louvers or grilles. The doors shall have head and jamb stops, astragals or rabbets at meeting edges, and automatic-closing devices. Positive-latching devices are not required.
4. Group I-3.
5. 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.

**[B] 909.5.2.1 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 the *International Building Code*.

**[B] 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.

**[B] 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 allowed to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences at least two times the maximum calculated pressure difference produced by the design fire.

**[B] 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 1008.1.2. 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).

**[B] 909.7 Airflow design method** When approved by the fire code 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.

**[B] 909.7.1 Velocity.** The minimum average velocity through a fixed opening shall not be less than:

$$v = 217.2 [h (T_f - T_o)/(T_f + 460)]^{1/2} \quad \text{(Equation 9-2)}$$

For SI:  $v = 119.9 [h (T_f - T_o)/T_f]^{1/2}$

where:

- h = Height of opening, feet (m).
- T<sub>f</sub> = Temperature of smoke, °F (K).
- T<sub>o</sub> = Temperature of ambient air, °F (K).
- v = Air velocity, feet per minute (m/minute).

**[B] 909.7.2 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 formula in Section 909.7.1 requires airflows to exceed this limit, the airflow method shall not be used.

**[B] 909.8 Exhaust method.** When approved by the fire code official, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. The design exhaust volumes shall be in accordance with this section.

**[B] 909.8.1 Exhaust rate.** The height of the lowest horizontal surface of the accumulating smoke layer shall be maintained at least 10 feet (3048 mm) above any walking surface which forms a portion of a required egress system within the smoke zone. The required exhaust rate for the zone shall be the largest of the calculated plume mass flow rates for the possible plume configurations. Provisions shall be made for natural or mechanical supply of air from outside or adjacent smoke zones to make up for the air exhausted. Makeup airflow rates, when measured at the potential fire location, shall not exceed 200 feet per minute (60 960 mm per minute) toward the fire. The temperature of the makeup air shall be such that it does not expose temperature-sensitive fire protection systems beyond their limits.

**[B] 909.8.2 Axisymmetric plumes.** The plume mass flow rate (*m<sub>p</sub>*), in pounds per second (kg/s), shall be determined by placing the design fire center on the axis of the space being analyzed. The limiting flame height shall be determined by:

$$z_l = 0.533Q_c^{2/5} \quad \text{(Equation 9-3)}$$

For SI:  $z_l = 0.166Q_c^{2/5}$

where:

- m<sub>p</sub>* = Plume mass flow rate, pounds per second (kg/s).
- Q = Total heat output.

- $Q_c$  = Convective heat output, British thermal units per second (kW). (The value of  $Q_c$  shall not be taken as less than 0.70  $Q_c$ .)
- $z$  = Height from top of fuel surface to bottom of smoke layer, feet (m).
- $z_l$  = Limiting flame height, feet (m). The  $z_l$  value must be greater than the fuel equivalent diameter (see Section 909.9).

for  $z > z_l$

$$m_p = 0.022Q_c^{1/3}z^{5/3} + 0.0042Q_c$$

For SI:  $m_p = 0.071 Q_c^{1/3}z^{5/3} + 0.0018Q_c$

for  $z = z_l$

$$m_p = 0.011 Q_c$$

For SI:  $m_p = 0.035Q_c$

for  $z < z_l$

$$m_p = 0.0208Q_c^{3/5}z$$

For SI:  $m_p = 0.032Q_c^{3/5}z$

To convert  $m_p$  from pounds per second of mass flow to a volumetric rate, the following formula shall be used:

$$V = 60 m_p / \rho \tag{Equation 9-4}$$

where:

- $V$  = Volumetric flow rate, cubic feet per minute ( $m^3/s$ ).
- $\rho$  = Density of air at the temperature of the smoke layer, pounds per cubic feet ( $T$ : in °F) [ $kg/m^3$  ( $T$ : in °C)].

**[B] 909.8.3 Balcony spill plumes.** The plume mass flow rate ( $m_p$ ) for spill plumes shall be determined using the geometrically probable width based on architectural elements and projections in the following equation:

$$m_p = 0.124(QW^2)^{1/3}(z_b + 0.25H) \tag{Equation 9-5}$$

For SI:  $m_p = 0.36(QW^2)^{1/3}(z_b + 0.25H)$

where:

- $H$  = Height above fire to underside of balcony, feet (m).
- $m_p$  = Plume mass flow rate, pounds per second (kg/s).
- $Q$  = Total heat output.
- $W$  = Plume width at point of spill, feet (m).
- $z_b$  = Height from balcony, feet (m).

**[B] 909.8.4 Window plumes.** The plume mass flow rate ( $m_p$ ) shall be determined from:

$$m_p = 0.077(A_w H_w^{1/2})^{1/3}(z_w + a)^{5/3} + 0.18A_w H_w^{1/2} \tag{Equation 9-6}$$

For SI:  $m_p = 0.68(A_w H_w^{1/2})^{1/3}(z_w + a)^{5/3} + 1.5A_w H_w^{1/2}$

where:

- $A_w$  = Area of the opening, square feet ( $m^2$ ).
- $H_w$  = Height of the opening, feet (m).
- $m_p$  = Plume mass flow rate, pounds per second (kg/s).
- $z_w$  = Height from the top of the window or opening to the bottom of the smoke layer, feet (m).
- $a$  =  $2.4A_w^{2/5}H_w^{1/5} - 2.1H_w$

**[B] 909.8.5 Plume contact with walls.** When a plume contacts one or more of the surrounding walls, the mass flow rate shall be adjusted for the reduced entrainment resulting from the contact provided that the contact remains constant. Use of this provision requires calculation of the plume diameter, that shall be calculated by:

$$d = 0.48 [(T_c + 460)/(T_a + 460)]^{1/2}z \tag{Equation 9-7}$$

For SI:  $d = 0.48 (T_c/T_a)^{1/2}z$

where:

- $d$  = Plume diameter, feet (m).
- $T_a$  = Ambient air temperature, °F (K).
- $T_c$  = Plume centerline temperature, °F (K).  
=  $0.60 (T_a + 460) Q_c^{2/3} z^{-5/3} + T_a$
- $z$  = Height at which  $T_c$  is determined, feet (m).

For SI:  $T_c = 0.08 T_a Q_c^{2/3} z^{-5/3} + T_a$

**[B] 909.9 Design fire.** The design fire shall be based on a  $Q$  of not less than 5,000 Btu/s (5275 kW) unless a rational analysis is performed by the registered design professional and approved by the fire code official. The design fire shall be based on the analysis in accordance with Section 909.4 and this section.

**[B] 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.

**[B] 909.9.2 Separation distance.** Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration. The ratio of the separation distance to the fuel equivalent radius shall not be less than 4. The fuel equivalent radius shall be the radius of a circle of equal area to floor area of the fuel package. The design fire shall be increased if other combustibles are within the separation distance as determined by:

$$R = [Q/(12\pi q'')]^{1/2} \tag{Equation 9-8}$$

where:

- $q''$  = Incident radiant heat flux required for nonpiloted ignition, Btu/ft<sup>2</sup> · s ( $W/m^2$ ).
- $Q$  = Heat release from fire, Btu/s (kW).
- $R$  = Separation distance from target to center of fuel package, feet (m).

**[B] 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.

**[B] 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.

**[B] 909.10 Equipment.** Equipment such as, but not limited to, fans, ducts, automatic dampers and balance dampers, shall be suitable for their intended use, suitable for the probable exposure temperatures that the rational analysis indicates, and as approved by the fire code official.

**[B] 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:

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

where:

$c$  = Specific heat of smoke at smokelayer 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.

**[B] 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 *International 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 *International Mechanical Code* and which are constructed of approved fire-resistance-rated materials.

**[B] 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.

**[B] 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 approved recognized standards.

**[B] 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 structural design requirements of Chapter 16 of the *International Building Code*. 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.

**[B] 909.11 Power systems.** The smoke control system shall be supplied with two sources of power. Primary power shall be the normal building power systems. Secondary power shall be from an approved standby emergency power source complying with the *ICC Seattle Electrical Code*. The standby emergency power source and its transfer switches shall be in a separate room from the normal power transformers and switch gear and shall be enclosed in a room constructed of not less than 1-hour fire-resistance-rated fire barriers, ventilated directly to and from the exterior. Power distribution from the two sources shall be by independent routes. Transfer to full standby emergency power shall be automatic and within 60 seconds of failure of the primary power. The systems shall comply with the *ICC Seattle Electrical Code*.

**Exception:** Standby power sources, including tap ahead of the main disconnect may be used to comply with *Seattle Building Code*, Section 716.5.3.1, Exception 2, paragraph 2.1. 06  
06  
06

**[B] 909.11.1 Power sources and power surges.** Elements of the smoke management system relying on volatile memories or the like shall be supplied with uninterruptible power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke management system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

**[B] 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.

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

**[B] 909.12.1 Wiring.** In addition to meeting requirements of the *ICC Electrical Code*, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

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

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

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

**909.12.23 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 the engineering analysis.

**[B] 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.

**[B] 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 B 16.22. 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 BCuP5 brazing alloy with solidus above 1,100°F (593°C) and liquidus 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. Tubing shall be listed by an approved agency for flame and smoke characteristics.
2. Tubing and the connected device shall be completely enclosed within a galvanized or paint-grade steel enclosure of not less than 0.030 inch (0.76 mm) (No. 22 galvanized sheet gage) thickness. 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 enclosure. Tubing bridging cabinet and door or moveable device 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.

**[B] 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.

**[B] 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.

**[B] 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 fire code official, the fire department and in the fire command center in format and manner approved by the fire chief.

**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 509 and 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 fire-fighter's control panel actions shall be as follows:

1. ON-OFF, 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, no automatic or manual control from any other control point within the building shall 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 (i.e., duct freezestats, 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. In no case shall control actions require the smoke control system to assume more than one configuration at any one time.

**Exception:** Power disconnects required by the ICC *Electrical Code*.

2. Only the AUTO position of each three-position fire-fighter'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 above. When 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. In no case shall control actions 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. When 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 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 Special inspections for smoke control.** Smoke control systems shall be tested by a special inspector.

**909.18.8.1 Scope of testing.** Special inspections 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.** Special inspection agencies for smoke control 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 special inspector or special inspection 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 seal, sign and date the report.

**909.18.8.3.1 Report filing.** A copy of the final report shall be filed with the fire code 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 their 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 fire code 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.

**Exception:** In buildings of phased construction, a temporary certificate of occupancy, as approved by the fire code official, shall be permitted 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.

**[B] 909.20 Underground building smoke exhaust system.** Where required by the *International Building Code* for underground buildings, a smoke exhaust system shall be provided in accordance with this section.

**[B] 909.20.1 Exhaust capability.** Where compartmentation is required, each compartment shall have an independent, automatically activated smoke exhaust system capable of manual operation. The system shall have an air supply and smoke exhaust capability that will provide a minimum of six air changes per hour.

**909.20.2 Operation.** The smoke exhaust system shall be operated in the compartment of origin by the following, independently of each other:

1. Two cross-zoned smoke detectors within a single protected area or a single smoke detector monitored by an alarm verification zone or an approved equivalent method.
2. The automatic sprinkler system.
3. Manual controls that are readily accessible to the fire department.

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

**909.21 Maintenance.** Smoke control systems shall be maintained to ensure to a reasonable degree that the system is capable of controlling smoke for the duration required. The system shall be maintained in accordance with the manufacturer's instructions and Sections 909.21.1 through 909.21.5.

**909.21.1 Schedule.** A routine maintenance and operational testing program shall be initiated immediately after the smoke control system has passed the acceptance tests. A written schedule for routine maintenance and operational testing shall be established.

**909.21.2 Written record.** A written record of smoke control system testing and maintenance shall be maintained on the premises. The written record shall include the date of the maintenance, identification of the servicing personnel and notification of any unsatisfactory condition and the corrective action taken, including parts replaced.

**909.21.3 Testing.** Operational testing of the smoke control system shall include all equipment such as initiating devices, fans, dampers, controls, doors and windows.

**909.21.4 Dedicated smoke control systems.** Dedicated smoke control systems shall be operated for each control sequence semiannually. The system shall also be tested under standby power conditions.

**909.21.5 Nondedicated smoke control systems.** Nondedicated smoke control systems shall be operated for each control sequence annually. The system shall also be tested under standby power conditions.

**909.22 Pressurization for low-rise buildings.** Where elevator or stairway shaft pressurization is provided in accordance with Exception 5 to Section 707.14.1 or Exception 4 of Section 1018.2, the pressurization system shall comply with the following:

1. Shafts shall be pressurized to 0.15 inch of water column relative to the main occupied area on each floor.

**Exception:** Elevator shafts in buildings that are protected throughout with an automatic sprinkler system may be pressurized to not less than 0.10 inch of water column.

Stairway pressurization shall be measured with all stairway doors closed. Elevator pressurization shall be measured with elevator cars at the designated recall level with the doors in the open position.

2. The shaft pressurization shall be activated by smoke detectors in the corridors located near the shaft on each floor as approved by the building official and the fire chief. If the building has a fire alarm panel, smoke detectors shall be connected to it, with power supplied by it.
3. Pressurization equipment and its duct work located within the building shall be separated from other portions of the building by construction equal to that required for the shaft.
4. Air intakes for shafts other than elevators shall be located at the exterior of the building. Intakes for elevator shaft pressurization may be located within the building provided they are located no more than 20 feet (6096 mm) from major openings in the building exterior, such as loading docks and vehicular entrances. Such intake shall be provided with smoke detectors which shall deactivate the pressurization system for that shaft.
5. An emergency source of power shall be provided for the fire alarm system.
6. A standby source of power shall be provided for the pressurization system according to *Seattle Electrical Code* Section 701.11. A connection ahead of the service disconnecting means shall be permitted as the sole source of power to the pressurization system.
7. Other measures to prevent loss of pressurization shall be provided in the design and construction of shafts, such as quality of workmanship and caulking of penetrations and joints.

## SECTION 910 SMOKE AND HEAT VENTS

**910.1 General.** Where required by this code or otherwise installed, smoke and heat vents, or mechanical smoke exhaust

systems, and draft curtains shall conform to the requirements of this section.

**Exception:** Frozen food warehouses used solely for storage of Class I and Class II commodities where protected by an approved automatic sprinkler system.

**910.2 Where required.** Approved smoke and heat vents shall be installed in the roofs of one-story buildings or portions thereof occupied for the uses set forth in Sections 910.2.1 through 910.2.4.

**910.2.1 Groups F-1 or S-1.** 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.

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

**910.2.2 Group H.** Buildings and portions thereof used as a Group H occupancy as follows:

1. In occupancies classified as Group H-2 or H-3, any of which are more than 15,000 square feet (1394 m<sup>2</sup>) in single floor area.

**Exception:** Buildings of noncombustible construction containing only noncombustible materials.

2. In areas of buildings in Group H used for storing Class 2, 3 and 4 liquid and solid oxidizers, Class 1 and unclassified detonable organic peroxides, Class 3 and 4 unstable (reactive) materials, or Class 2 or 3 water-re-

active materials as required for a high-hazard commodity classification.

**Exception:** Buildings of noncombustible construction containing only noncombustible materials.

**910.2.3 High-piled combustible storage.** Buildings and portions thereof containing high-piled combustible stock or rack storage in any occupancy group when required by Section 2306.7.

**910.2.4 Exit access travel distance increase.** Buildings and portions thereof used as a Group F-1 or S-1 occupancy where the maximum exit access travel distance is increased with Section 1015.2.

**910.3 Design and installation.** The design and installation of smoke and heat vents and draft curtains shall be as specified in this section and Table 910.3.

**910.3.1 Vent operation.** Smoke and heat vents shall be approved and labeled and shall be capable of being operated by approved automatic and manual means. Automatic operation of smoke and heat vents shall conform to the provisions of this section.

**910.3.1.1 Gravity-operated drop out vents.** Automatic smoke and heat vents containing heat-sensitive glazing designed to shrink and drop out of the vent opening when exposed to fire shall fully open within 5 minutes after the vent cavity is exposed to a simulated fire represented by a

**TABLE 910.3**  
**REQUIREMENTS FOR DRAFT CURTAINS AND SMOKE AND HEAT VENTS<sup>a</sup>**

OCCUPANCY GROUP AND COMMODITY CLASSIFICATION	DESIGNATED STORAGE HEIGHT (feet)	MINIMUM DRAFT CURTAIN DEPTH (feet)	MAXIMUM AREA FORMED BY DRAFT CURTAINS (square feet)	VENT AREA TO FLOOR AREA RATIO	MAXIMUM SPACING OF VENT CENTERS (feet)	MAXIMUM DISTANCE TO VENTS FROM WALL OR DRAFT CURTAIN <sup>b</sup> (feet)
Group F-1	—	0.2 × H but ≥ 4	50,000	1:100	120	60
Group S-1 I-IV (Option 1)	≤ 20	6	10,000	1:100	100	60
	> 20 ≤ 40	6	8,000	1:75	100	55
Group S-1 I-IV (Option 2)	≤ 20	4	3,000	1:75	100	55
	> 20 ≤ 40	4	3,000	1:50	100	50
Group S-1 High hazard (Option 1)	≤ 20	6	6,000	1:50	100	50
	> 20 ≤ 30	6	6,000	1:40	90	45
Group S-1 High hazard (Option 2)	≤ 20	4	4,000	1:50	100	50
	> 20 ≤ 30	4	2,000	1:30	75	40

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

- a. Requirements for rack storage heights in excess of those indicated shall be in accordance with Chapter 23. For solid-piled storage heights in excess of those indicated, an approved engineered design shall be used.
- b. The distance specified is the maximum distance from any vent in a particular draft curtained area to walls or draft curtains which form the perimeter of the draft curtained area.

time-temperature gradient that reaches an air temperature of 500°F (260°C) within 5 minutes.

**910.3.1.2 Sprinklered buildings.** Where installed in buildings equipped with an approved automatic sprinkler system, smoke and heat vents shall be designed to operate automatically.

**910.3.1.3 Nonsprinklered buildings.** Where installed in buildings not equipped with an approved automatic sprinkler system, smoke and heat vents shall operate automatically by actuation of a heat-responsive device rated at between 100°F (56°C) and 220°F (122°C) above ambient.

**Exception:** Gravity-operated drop out vents complying with Section 910.3.1.1.

**910.3.2 Vent dimensions.** The effective venting area shall not be less than 16 square feet (1.5 m<sup>2</sup>) with no dimension less than 4 feet (1219 mm), excluding ribs or gutters having a total width not exceeding 6 inches (152 mm).

**910.3.3 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 barrier walls. Vents shall be uniformly located within the roof area above high-piled storage areas, with consideration given to roof pitch, draft curtain location, sprinkler location and structural members.

**910.3.4 Draft curtains.** Where required, draft curtains shall be provided in accordance with this section.

**Exception:** Where areas of buildings are equipped with early suppression fast-response (ESFR) sprinklers, draft curtains shall not be provided within these areas. Draft curtains shall only be provided at the separation between the ESFR sprinklers and the conventional sprinklers.

**910.3.4.1 Construction.** Draft curtains shall be constructed of sheet metal, lath and plaster, gypsum board or other approved materials that provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.

**910.3.4.2 Location and depth.** The location and minimum depth of draft curtains shall be in accordance with Table 910.3.

**910.4 Mechanical smoke exhaust.** Where approved by the fire code official, engineered mechanical smoke exhaust shall be an acceptable alternative to smoke and heat vents.

**910.4.1 Location.** Exhaust fans shall be uniformly spaced within each draft-curtained area and the maximum distance between fans shall not be greater than 100 feet (30 480 mm).

**910.4.2 Size.** Fans shall have a maximum individual capacity of 30,000 cfm (14.2 m<sup>3</sup>/s). The aggregate capacity of smoke exhaust fans shall be determined by the equation:

$$C = A \times 300 \quad \text{(Equation 9-10)}$$

where:

C = Capacity of mechanical ventilation required, in cubic feet per minute (m<sup>3</sup>/s).

A = Area of roof vents provided in square feet (m<sup>2</sup>) in accordance with Table 910.3.

**910.4.3 Operation.** Mechanical smoke exhaust fans shall be automatically activated by the automatic sprinkler system or by heat detectors having operating characteristics equivalent to those described in Section 910.3.1. Individual manual controls for each fan unit shall also be provided.

**910.4.4 Wiring and control.** Wiring for operation and control of smoke exhaust fans shall be connected ahead of the main disconnect and protected against exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes. Controls shall be located so as to be immediately accessible to the fire service from the exterior of the building and protected against interior fire exposure by fire barriers having a fire-resistance rating not less than 1 hour.

**910.4.5 Supply air.** Supply air for exhaust fans shall be provided at or near the floor level and shall be sized to provide a minimum of 50 percent of required exhaust. Openings for supply air shall be uniformly distributed around the periphery of the area served.

**910.4.6 Interlocks.** On combination comfort air-handling/smoke removal systems or independent comfort air-handling systems, fans shall be controlled to shut down in accordance with the approved smoke control sequence.

## SECTION 911 EXPLOSION CONTROL

**911.1 General.** Explosion control shall be provided in the following locations:

1. Where a structure, room or space is occupied for purposes involving explosion hazards as identified in Table 911.1.
2. Where quantities of hazardous materials specified in Table 911.1 exceed the maximum allowable quantities in Table 2703.1.1(1).

Such areas shall be provided with explosion (deflagration) venting, explosion (deflagration) prevention systems, or barricades in accordance with this section and NFPA 69, or NFPA 495 as applicable. Deflagration venting shall not be utilized as a means to protect buildings from detonation hazards.

**911.2 Required deflagration venting.** Areas that are required to be provided with deflagration venting shall comply with the following:

1. Walls, ceilings and roofs exposing surrounding areas shall be designed to resist a minimum internal pressure of 100 pounds per square foot (psf) (4788 Pa). The minimum internal design pressure shall not be less than five times the maximum internal relief pressure specified in Section 911.2, Item 5.
2. Deflagration venting shall be provided only in exterior walls and roofs.

**Exception:** Where sufficient exterior wall and roof venting cannot be provided because of inadequate exterior wall or roof area, deflagration venting shall be

- allowed by specially designed shafts vented to the exterior of the building.
3. Deflagration venting shall be designed to prevent unacceptable structural damage. Where relieving a deflagration, vent closures shall not produce projectiles of sufficient velocity and mass to cause life threatening injuries to the occupants or other persons on the property or adjacent public ways.
  4. The aggregate clear area of vents and venting devices shall be governed by the pressure resistance of the construction assemblies specified in Item 1 of this section and the maximum internal pressure allowed by Item 5 of this section.

5. Vents shall be designed to withstand loads in accordance with the *International Building Code*. Vents shall consist of any one or any combination of the following to relieve at a maximum internal pressure of 20 pounds per square foot (958 Pa), but not less than the loads required by the *International Building Code*:
  - 5.1. Exterior walls designed to release outward.
  - 5.2. Hatch covers.
  - 5.3. Outward swinging doors.
  - 5.4. Roofs designed to uplift.
  - 5.5. Venting devices listed for the purpose.

**TABLE 911.1  
EXPLOSION CONTROL REQUIREMENTS**

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems
<b>Hazard Category</b>			
Combustible dusts <sup>a</sup>	—	Not required	Required
Cryogenic fluids	Flammable	Not required	Required
Explosives	Division 1.1	Required	Not required
	Division 1.2	Required	Not required
	Division 1.3	Not required	Required
	Division 1.4	Not required	Required
	Division 1.5	Required	Not required
	Division 1.6	Required	Not required
Flammable gas	Gaseous	Not required	Required
	Liquefied	Not required	Required
Flammable liquids	IA <sup>b</sup>	Not required	Required
	IB <sup>c</sup>	Not required	Required
Organic peroxides	U	Required	Not permitted
	I	Required	Not permitted
Oxidizer liquids and solids	4	Required	Not permitted
Pyrophoric	Gases	Not required	Required
Unstable (reactive)	4	Required	Not permitted
	3 detonable	Required	Not permitted
	3 nondetonable	Not required	Required
Water-reactive liquids and solids	3	Not required	Required
	2 <sup>e</sup>	Not required	Required
<b>Special Uses</b>			
Acetylene generator rooms	—	Not required	Required
Grain processing	—	Not required	Required
Liquefied petroleum gas distribution facilities	—	Not required	Required
Where explosion hazards exist <sup>d</sup>	Detonation	Required	Not permitted
	Deflagration	Not required	Required

a. Combustible dusts that are generated during manufacturing or processing. See definition of Combustible Dust in Chapter 2.  
 b. Storage or use.  
 c. In open use or dispensing.  
 d. Rooms containing dispensing and use of hazardous materials when an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.  
 e. A method of explosion control shall be provided when Class 2 water-reactive materials can form potentially explosive mixtures.

6. Vents designed to release from the exterior walls or roofs of the building when venting a deflagration shall discharge directly to the exterior of the building where an unoccupied space not less than 50 feet (15 240 mm) in width is provided between the exterior walls of the building and the property line.

**Exception:** Vents complying with Item 7 of this section.

7. Vents designed to remain attached to the building when venting a deflagration shall be so located that the discharge opening shall not be less than 10 feet (3048 mm) vertically from window openings and exits in the building and 20 feet (6096 mm) horizontally from exits in the building, from window openings and exits in adjacent buildings on the same property, and from the property line.
8. Discharge from vents shall not be into the interior of the building.

**911.3 Explosion prevention systems.** Explosion prevention systems shall be of an approved type and installed in accordance with the provisions of this code and NFPA 69.

**911.4 Barricades.** Barricades shall be designed and installed in accordance with NFPA 495.

## 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.

**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 approved.

**912.2.1 Visible location.** Fire department connections shall be located on the street side of buildings, fully visible and recognizable from the street or nearest point of fire department vehicle access or as otherwise approved by the fire code official.

**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" at least 6 inches (152 mm) high and words in letters at least 2 inches (51 mm) high or an arrow to indicate the location. All such signs shall be subject to the approval of the fire code official.

**912.3 Access.** Immediate access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other object for a minimum of 3 feet (914 mm).

**912.3.1 Locking fire department connection caps.** The fire code official is authorized to require locking caps on fire department connections for water-based fire protection systems

where the responding fire department carries appropriate key wrenches for removal.

**912.4 Signs.** A metal sign with raised letters at least 1 inch (25 mm) in size shall be mounted on all fire department connections serving fire sprinklers, standpipes or fire pump connections. Such signs shall read: AUTOMATIC SPRINKLERS or STANDPIPES or TEST CONNECTION or a combination thereof as applicable.

**[P] 912.5 Backflow protection.** The potable water supply to automatic sprinkler and standpipe systems shall be protected against backflow as required by the *International Plumbing Code*.

**912.6 Inspection, testing and maintenance.** All fire department connections shall be periodically inspected, tested and maintained in accordance with NFPA 25.

## SECTION 913 FIRE PUMPS

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

**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.

**913.3 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 the 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 in the closed position.

**913.5 Testing and maintenance.** Fire pumps shall be inspected, tested and maintained in accordance with the requirements of this section and NFPA 25.

**913.5.1 Acceptance test.** Acceptance testing shall be done in accordance with the requirements of NFPA 20.

**913.5.2 Generator sets.** Engine generator sets supplying emergency or standby power to fire pump assemblies shall be periodically tested in accordance with NFPA 110.

**913.5.3 Transfer switches.** Automatic transfer switches shall be periodically tested in accordance with NFPA 110.

**913.5.4 Pump room environmental conditions.** Tests of pump room environmental conditions, including heating, ventilation and illumination shall be made to ensure proper manual or automatic operation of the associated equipment.

