OHIO BOARD OF BUILDING STANDARDS
BUILDING ON THE CODE

Fire Alarm Systems and Smoke Alarm Requirements for Residential Occupancies

April 28, 2014

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WHAT ARE WE TALKING ABOUT???

- LIFE SAFETY OF HUMAN BEINGS
- ENFORCE THE CODE REQUIREMENTS
- APPLY THE PROPER STANDARDS
- GET THE PROPER PERMIT
- INSPECTION
FACTS

- When a fire breaks out, you have only seconds to escape its heat, black smoke and deadly gases.
- You can dramatically increase the chances of surviving a fire simply by installing and maintaining working smoke alarms in your home.

FACTS

- About 3,400 Americans die each year in fires and about 17,500 are injured.
- Smoke alarms have been and still are the cornerstone of fire safety technology in the home.
- Smoke alarms and home escape planning are still a vital part of survival from fire
- A fifty percent reduction in fire fatalities since the introduction of smoke alarms into the home
FACTS

- Although 90% of all residences have smoke alarms today, no smoke alarms were present in 42% of residential structure fires where fatalities occurred.
- Smoke alarms were present in 58% of fatal residential structure fires, but only operational in 37% of those fatal fires.
- Most often where smoke alarms are present in a fatal fire, the smoke alarm is nonfunctional due to dead or missing batteries.

FACTS

- Need for home escape planning
- Smoke alarms are a tool in the planning process
- Hold a fire drill at night (activate your alarm) while your children are sleeping so that you and they can determine the appropriate response to a smoke alarm.
Fire in Ohio

- In 2010 the fire death rate was 13.9 per 1 million residents
- The relative risk of dying in a fire was 1.2
Residential Fire Basics

- Most residential fires occur during the winter months of December, January, and February
- Reported home fires peak during the dinner hours of 5 PM to 8 PM
- Cooking equipment is the leading cause of reported fires
- Smoking materials cause the largest number of fatalities
- Most fire deaths resulted in environments with no smoke alarm

Conditions that affect response to fires

- Intoxication
  - Alcohol contributes to about 40% of residential fire deaths
- Sleeping
  - Half of all home fire deaths resulted from incidents reported between 11 PM and 7 AM
- Home Vacancy
  - Fire spread beyond building of origin in 10% of vacant comes, compared to 3% of home fires overall
- Physical, Mental, or Sensory Disability
Populations at Risk

- People 65 and older
- Men
- African Americans and American Indians
  - Residents of the American South
  - Low socioeconomic status

http://www.usfa.fema.gov/statistics/
Residential Building Fire Dollar Loss
Adjusted to 2011 Dollars

http://www.usfa.fema.gov/statistics/
Typical Stages of Compartment Fire Development

- Incipient Phase
- Growth
- Fully Developed
- Decay
Incipient Stage

- A fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers or a small hoseline without the need for protective clothing or breathing apparatus.
- The initial stage when oxygen, heat, and a fuel source combine with a chemical reaction to cause a fire.

http://cfbt-us.com/wordpress/?p=890
Growth Stage

- During this stage the structure and oxygen are used as fuel for the fire
  - Shortest of the four stages
  - When “flashover” can occur and trap individuals and firefighters

http://cfht-us.com/wordpress/?p=905
Fully Developed Stage

- When energy release is at its greatest
- The hottest and most dangerous stage
- Flames showing from doors or windows
Decay Stage

- May result from reduction in available fuel or due to limited oxygen
- Characterized by decreasing heat production

http://cfht-us.com/wordpress/?p=957
Smoke movement

- Hot Smoke Zone
  - When the temperature of the smoke is high enough that the natural buoyancy of the smoke lifts the smoke, as less polluted air is drawn in through the lower portion of space.

- Cool Smoke Zone
  - The buoyancy of the smoke is reduced and the movement of the smoke is controlled by primarily by other factors.

Smoke Movement

- Stack Effect
  - characterized by a strong draft from the ground floor to the roof of a tall building
  - modified by floors and partitions

- Flow Through Openings
  - For a crack, gap, or other opening with a pressure difference across it, a flow will result from the higher pressure to the lower pressure
Smoke Movement

Wind Effects
- Wind velocity: The higher the wind velocity, the greater the effects of the following:
- Ground effect: the friction and turbulence as air moves over the ground generally results in the lowest velocity at ground level and increases with height
- Structures: Manmade and natural features can produce localized effects that can alter the direction of wind forces

Smoke Movement

Smoke Plumes
- The plumes rise above a fire
- At the ceiling, smoke flows away from the point of impact in a radial direction, forming a ceiling jet
- At a wall, the smoke flow goes around and under the ceiling jet.
- The ceiling jet depth is about 10 percent of the floor-to-ceiling height.
- The smoke flow under the ceiling jet is about 10 percent of the floor-to-ceiling height.
- Smoke may descend lower than this minimum smoke-layer depth.

Smoke Movement

- Dead Air Space Locations
  - corners between walls
  - between a wall and ceiling
  - at the apex of a sloping ceiling

![Smoke Movement Diagram]


Fire Behavior

- Fire burning is an example of combustion
- Fire is caused by a combination of fuel, heat, oxygen, and chemical reaction
- Oxygen is a catalyst for a combustion reaction
- Once a fire begins, it will grow in a self-sustaining manner
- Fire is an exothermic reaction
Burning Behavior of Fabrics

- Heavy, tight weave fabrics will burn more slowly than loose weave, light fabrics
- Untreated natural fibers burn more readily than wool
- Most synthetic fabrics resist ignition, but once ignited the fabrics melt
- Fabrics with long, loose, fluffy pile will ignite more readily than those with a tight surface
- Flame retardant products are available

Why should I have a working smoke alarm?

A properly installed and maintained smoke alarm is the only thing in your home that can alert you and your family to a fire 24 hours a day, seven days a week. Whether you’re awake or asleep, a working smoke alarm is constantly on alert, scanning the air for fire and smoke.
Why should I have a working smoke alarm?

- Two-thirds of home fire deaths resulted from fires in properties without working smoke alarms.
- A working smoke alarm significantly increases your chances of surviving a deadly home fire.

What types of smoke alarms are available?

- There are many different brands of smoke alarms available on the market, but they fall under two basic types:
  - Ionization
    - use an ionization chamber and a source of ionizing radiation to detect smoke.
    - is more responsive to invisible particles produced by flaming fires
  - Photoelectric
    - use a beam of light to detect the presence or absence particles produced by fires
    - is more responsive to the visible particles produced by smoldering fires.
What types of smoke alarms are available?

- Neither the OBC nor the RCO prescribe a specific type of smoke detector or smoke alarm.
- Either are acceptable per code.
- Because it is nearly impossible to predict the type of fire that will occur, the NFPA, UL, and the USFA recommend that the owner of every residence and place where people sleep install both.

What types of smoke alarms are available?

- In addition to the basic types of alarms, there are alarms made to meet the needs of people with hearing disabilities. These alarms may use strobe lights that flash and/or vibrate to assist in alerting those who are unable to hear standard smoke alarms when they sound.
What powers a smoke alarm?

- Smoke alarms are powered by battery or they are hardwired into the home’s electrical system. If the smoke alarm is powered by battery, it runs on either a disposable 9-volt battery or a non-replaceable 10-year lithium (“long-life”) battery. A backup battery is usually present on hardwired alarms and may need to be replaced.

What powers a smoke alarm?

- These batteries must be tested on a regular basis and, in most cases, should be replaced at least once each year (except for lithium batteries).
Are smoke alarms expensive?

- Smoke alarms are not expensive and are worth the lives they can help save. Ionization and photoelectric smoke alarms cost between $6 and $20. Dual sensor smoke alarms cost between $24 and $40.

Install smoke alarms in key areas of your home

- Since smoke and many deadly gases rise, installing your smoke alarms at the proper level will provide you with the earliest warning possible. Always follow the manufacturer’s installation instructions.
- Per code:
  - Inside and outside bedroom
  - On all levels, including the basement
Install smoke alarms in key areas of your home

- Many fatal fires begin late at night or early in the morning
- Hardwired smoke alarms must be installed by a qualified electrician.

WARNING

- Never disable a smoke alarm while cooking
- Disabling a smoke alarm or removing the battery can be a deadly mistake.

OPTIONS:

- Open a window or door and press the “hush” button,
- Wave a towel at the alarm to clear the air,
- Move the entire alarm several feet away from the location.
Smoke alarm maintenance

- Smoke alarm powered by a 9-volt battery
  - Test the alarm monthly.
  - Replace the batteries at least once per year.
  - The entire smoke alarm unit should be replaced every 8-10 years.

Smoke Detectors vs. Smoke Alarms

- Smoke alarms
  - UL 217
  - Connected to 120V
  - Alarm integral to detection device
- Smoke detectors
  - UL 268
  - Low voltage
  - Connected to a fire alarm panel
  - Alarm sound produced independently of detection device
Smoke Detectors

- In 1890 the first smoke detector was invented by Francis Robbins Upton. Since then, smoke detectors have been helping home and business owners protect themselves and their possessions from fire-related disaster.

SMOKE DETECTORS

- The most common type of automatic fire detector is a smoke detector. The building (OHIO) and life safety codes tell you where smoke detectors are required; NFPA 72 tells you how to install and test them. Some of the more common locations for smoke detectors are in corridors, elevator lobbies and machine rooms, and sleeping rooms.
Smoke Detectors

- It is vitally important to understand how smoke detectors operate for two reasons:
  - One reason is to reduce nuisance alarms caused by environmental conditions or occupant activities. NFPA 72 has very good explanatory information in Annex A that describes these conditions.
  - The second reason is to allow the detector to activate in the earliest amount of time. Smoke detectors are used where early warning is necessary to give occupants more time to safely exit a building.

Smoke detectors

- There are basically three types of smoke detectors:
  - Ionization,
  - Photoelectric and
  - Air sampling.
IONIZATION DETECTORS

- An ionization detector uses a very small amount of a radioactive material to ionize air between two charged plates, causing a current flow. When smoke enters the ionization chamber, the smoke is attracted to the ionized particles and that will reduce the current flow. Once the current drops to a pre-determined level, the detector will alarm. Some sources of potential problems for ionization detectors are excessive air velocity or gusts of wind, most types of fumes and vapors, such as cooking fumes, engine exhaust and chemical fumes.

Photoelectric detectors

- Photoelectric detectors come in two types: area or spot-type, and projected beam smoke detectors. Spot-type detectors are often referred to as light-scattering smoke detectors because there is a light source in the chamber (usually a pulsed infrared LED) that shines into the detection chamber. If there is smoke (or steam, dust or insects) in the chamber, the light will reflect onto a photosensitive sensor, causing an alarm. To reduce nuisance alarms, care must be taken to avoid using photoelectric smoke detectors in steamy or dirty environments.
Air sampling smoke detectors

- Air sampling smoke detectors are very early warning detectors used in data processing centers or similar environments. These operate by having a piping network with sampling ports installed in the area to be protected. Air is drawn through this piping network back into the detection chamber where a laser typically is used to look for a certain number of smoke particles in a given amount of time. These detectors can be set up to be very sensitive and are often used as a first warning of a potential problem.

DETECTORS

- Smoke detectors do not have a listed spacing. They have a recommended spacing of 30 feet between detectors. However, smoke detectors can be installed up to 41 feet apart in corridors up to 10 feet wide. The main fact to remember is that all points on the ceiling must be within 21 feet of the detector.
DETECTORS

- One of the more common installation problems with smoke detectors is installing them too close to air vents. NFPA 72 recommends that they should not be installed closer than 3 feet from any supply air diffuser or return vent. If they are too close to the supply, smoke may not reach the detector. Also, the air coming out of the vent contains dust and dirt, which can settle in the detector and cause nuisance alarms. Air turbulence can affect detector response when located too close to the return vents. Smoke detectors should never be installed within 4 inches of a ceiling or side wall. This is considered dead air space, and again may affect the activation time of the detector.

DETECTORS

- When testing smoke detectors, be sure you use an aerosol or canned smoke that is acceptable to the manufacturer. NFPA 72 requires that you test the detectors in place to ensure smoke entry into the chamber and an alarm response. Testing with a magnet does not meet this requirement. You must use this testing method for the acceptance test and the annual tests required by NFPA 72. You can use a magnet any other time, but not during those two times.
DETECTORS

- Projected beam smoke detectors are used in applications where it is not practical to use spot-type detectors. Common applications include use in high ceiling areas such as atriums. NFPA 72 states that all fire alarm devices must be accessible for servicing and testing. It is much easier and more cost effective to service a beam detector located on the wall of an atrium than it is to service the spot-type detectors located on the ceiling. Other common applications include use in barns, warehouses, stadiums and ballrooms.

- One advantage of using beam detectors is that some are listed to operate at a temperature of about 20 degrees (F) below zero, unlike spot-type detectors which only are listed down to 32 degrees (F).
DUCT SMOKE DETECTORS

- Duct smoke detectors are used to help prevent smoke from spreading from the fire area to other parts of the building by shutting down the HVAC system. They also may be used to help protect the air handling equipment by shutting down the system if the fan or filter should start burning.

VIDEO

- http://www.ask.com/youtube?q=smoke+detector+regulations&author=eHow&v=KvOMk1IINu0
2013 RCO

CHAPTER ONE

- 107.2 Application for plan approval process
- 107.6 Plan review, items of noncompliance
- 107.5.1 Residential building official approval
- 108 Inspection process
2013 RCO

Chapter two

Definitions:

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

- **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.
2013 RCO

- SECTION 314 SMOKE ALARMS
  - 314.1 Smoke detection and notification. All smoke alarms shall be listed in accordance with UL 217 and installed in accordance with the provisions of this code and the household fire warning equipment provisions of NFPA 72.

- 314.2 Smoke detection systems: Household fire alarm systems installed in accordance with NFPA 72 that include smoke alarms, or a combination of smoke detector and audible notification device installed as required by this section for smoke alarms, shall be permitted. The household fire alarm system shall provide the same level of smoke detection and alarm as required by this section for smoke alarms. Where a household fire warning system is installed using a combination of smoke detector and audible notification device(s), it shall become a permanent fixture of the occupancy and owned by the homeowner. The system shall be maintained in accordance with NFPA 72.
  
  **Exception**: Where smoke alarms are provided meeting the requirements of Section 314.4.
2013 RCO

314.3 Location: Smoke alarms shall be installed in the following locations:

1. In each sleeping room.

2. Outside each separate sleeping area in the immediate vicinity of the sleeping rooms.

3. On each additional story of the dwelling, including basements and habitable attics 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.

When more than one smoke alarm is required to be installed within an individual dwelling unit the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit.

2013 RCO

314.3.1 Alterations, repairs and additions. When alterations, repairs or additions requiring an approval are made to the spaces described in items 1 and 2 of Section 314.3, smoke alarms shall be provided in those spaces as required for a new dwelling. When one or more sleeping rooms are added or created in existing dwellings, the new sleeping rooms and the immediate vicinity outside each sleeping room shall be equipped with smoke alarms as required for new dwellings.
2013 RCO

- Exceptions: to 314.3.1

  1. Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck are exempt from the requirements of this section.

  2. Installation or alteration of plumbing or mechanical systems are exempt from the requirements of this section.

2013 RCO

- 314.4 Power source: Smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection. Smoke alarms shall be interconnected.

  - Exceptions:

    - 1. Smoke alarms shall be permitted to be battery operated when installed in buildings without commercial power.

    - 2. Interconnection and hard-wiring of smoke alarms in existing areas shall not be required where the 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 hard wiring and interconnection without the removal of interior finishes.
PROPOSED 2014 RCO

314.1 SMOKE ALARMS

314.3 LOCATION

2. Outside each separate sleeping area, such as in the corridors in the immediate vicinity of the sleeping rooms.

314.3.1 ALTERATIONS, REPAIRS AND ADDITIONS

Eliminated

314.3.1

New section to deal with new dwelling units

314.3.2

New section to deal with existing dwelling units

314.4 POWER SOURCE

Rewritten

Listed conventional battery operated smoke alarms or listed battery operated low-power radio (wireless) alarms are permitted to be installed in the existing finished areas.

314.5 INTERCONNECTION

Rewritten
2011 OBC

102.5 Referenced codes and standards.

- When a reference is made within the building, mechanical, or plumbing codes to a federal statutory provision, an industry consensus standard, or any other technical publication, the specific date and title of the publication as well as the name and address of the promulgating agency are listed in Chapter 35 of the building code, Chapter 15 of the mechanical code, or Chapter 13 of the plumbing code.

- The codes and standards referenced in the building, mechanical, and plumbing codes shall be considered part of the requirements of these codes as though the text were printed in this code, to the prescribed extent of each such reference. *Where differences occur between provisions of these codes and the referenced standards, the provisions of these codes shall apply.*

Ohio Building Code Definitions

- **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.

- **Automatic smoke detection system:**
  - A fire alarm system that has initiation devices that utilize smoke detectors for protection of an area such as a room or space with detectors to provide early warning of fire.

- **Average ambient sound level:**
  - The root mean square, A-weighted sound pressure level measured over a 24-hour period, or the time any person is present, whichever time period is less.
OBC Definitions

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

- **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.

OBC Definitions, cont’d.

- **Heat detector:**
  A fire detector that senses heat—either abnormally high temperature or rate of rise, or both.

- **Manual Fire Alarm Box:**
  A manually operated device used to initiate an alarm signal.

- **Multiple-Station Smoke Alarm**
  Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes the appropriate alarm signal to operate in all interconnected alarms.
OBC Definition, cont’d.

- 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.

- 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.

OBC Definitions

- Smoke alarm
  - A single- or multiple-station alarm responsive to smoke.

- Smoke detector
  - A listed device that senses visible or invisible particles of combustion.

- Wireless Protection system
  - A system or a part of a system that can transmit and receive signals without the aid of wire.
2011 OBC

- 106.1.1.1 Fire protection system drawings.

- Construction documents shall be approved prior to the start of system installation. Related listing information shall be provided and drawings shall contain all information as required by the installation standards referenced in Chapter 9. The individual installing the fire protection systems, who shall be certified by the state fire marshal pursuant to Section 3737.65 of the Revised Code, shall be identified on the drawings. In the event that the listing information is not known or the certified installer is not known at the time of plan examination, conditional plan approval shall be granted subject to subsequent submission of the listing information and the name of the certified installer prior to installation of any part of the fire protection systems.

106.2.1 Seal requirements.

Exception: The seal of a registered design professional is not required on construction documents for:

- 3. Fire protection system designs submitted under the signature of an individual certified in accordance with Section 107.4.4;
2011 OBC

107.4.4 Fire protection system construction documents.

Construction documents for fire protection systems authorized to be submitted by individuals certified pursuant to Chapter 4101:2-87 of the Administrative Code shall:

1. When submitted under the signature of an individual certified under Section 3781.105 of the Revised Code, be processed in the same manner as construction documents submitted under the signature of a registered design professional. Any statistical data, reports, explanations, plan description, or information that would not also be required for a similar submission by a registered design professional need not be submitted by a certified designer.

2. If certified by a registered design professional or individual certified under Section 3781.105 of the Revised Code as conforming to requirements of the rules of the board pertaining to design loads, stresses, strength, stability, or other requirements involving technical analysis, be examined by the building department official only to the extent necessary to determine conformity of such construction documents with other requirements adopted by the board under Chapters 3781. and 3791. of the Revised Code.
2011 OBC

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.

2011 OBC

907.1.1 Construction documents.

Construction documents for fire alarm systems shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code, and relevant laws, ordinances, rules and regulations, as determined by the building official.
907.1.2 Fire alarm shop drawings: Shop drawings for fire alarm systems shall be submitted for review and approval prior to system installation, and shall include, but not be limited to, all of the following:

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

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

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

Exceptions:
1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contiguous attic and crawl spaces to those units are separated from each other and public or common areas by at least 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required throughout the building when all of the following conditions are met:
   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. The notification appliances will activate upon sprinkler water flow; and
   3. At least one manual fire alarm box is installed at an approved location.
2011 OBC

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

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

2011 OBC

× 907.2.8.3 Smoke alarms.
  × Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.
2011 OBC

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

2011 OBC

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

• 907.2.11 Single- and multiple-station smoke alarms: Listed single- and multiple-station smoke alarms complying with UL 217 shall be installed in accordance with Sections 907.2.11.1 through 907.2.11.4 and NFPA 72.
2011 OBC

907.2.11.1 Group R-1 and "SRO" Occupancies (as defined in Section 310.2).

Single-or multiple-station smoke alarms shall be installed in all of the following locations in Group R-1 and "SRO" occupancies:
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.

2011 OBC

907.2.11.2 Groups R-2 (except "SRO" occupancies as defined in Section 310.2), R-3, R-4 and I-1.

Single-or multiple-station smoke alarms shall be installed and maintained in Groups R-2 (except "SRO" occupancies as defined in Section 310.2), 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.

Exception: Single- or multiple-station smoke alarms in Group I-1 occupancies shall not be required where smoke detectors are provided in the sleeping rooms as part of an automatic smoke detection system. In every 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.
2011 OBC

- 907.2.11.3 Interconnection:
  - Where more than one smoke alarm is required to be installed within an individual dwelling unit or sleeping unit in Group R-1, R-2, R-3 or R-4, 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.

2011 OBC

- 907.2.11.4 Power source: In new construction, required smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system. 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.
NFPA 72-2010
× CHAPTER 17
× INITIATING DEVICES
NFPA 72-2010

- CHAPTER 18
  - NOTIFICATION APPLIANCES

NFPA 72-2010

- CHAPTER 29
  - SINGLE- AND MULTIPLE-STATION ALARM AND HOUSEHOLD FIRE ALARM SYSTEMS: 11 SECTIONS
    - APPLICATION
    - PURPOSE
    - BASIC REQUIREMENTS
    - ASSUMPTIONS
    - DETECTION AND NOTIFICATION
    - POWER SUPPLIES
    - EQUIPMENT PERFORMANCE
    - INSTALLATION
    - OPTIONAL FUNCTIONS
    - MAINTENANCE AND TESTS
    - MARKINGS AND INSTRUCTIONS
New Language

- NFPA 72 – 2010, Section 18.4.5.3 requires a new low frequency range for sleeping areas.
  - Prior to the effective date, this language only appeared in Chapter 29 of the code for sleeping areas in households. This requirement now covers both residential and commercial occupancies where sleeping occurs.

Smoke Detector Spacing

- Smoke detectors next to air diffusers
- Smoke detectors should not be located in a direct airflow or closer than 36 inches from an air supply diffuser or return air opening.
- NFPA 72 (2010) A17.7.4.1
Notification Appliance Mounting

- Incorrect mounting of devices
- Equipment installed shall be listed for the purpose for which it is used.
- NFPA 72 (2010) 10.3.1

Synchronization

- Visible notification devices not synchronized
- High flash rates of strobes may pose a risk of seizure to people with photosensitive epilepsy. Visible appliances in the same field of view should be synchronized.
- NFPA 72 (2010) A.18.5.4.3.2(3)
**Fire Alarm Control Panel**

- Smoke detectors above FACP
- Where not continuously occupied, smoke detectors shall be provided at the location of each FACP, NAC power extender, and supervising station transmitting equipment.
- NFPA 72 (2010) 10.15

**LOCATION**

- Incorrect mounting height
- Operable part of manual fire alarm box shall be not less than 42 inches and not more than 48 inches above the floor level.
- NFPA 72 (2010) 17.14.4
LOCATION

• Smoke alarms and smoke detector shall not be installed:
  • (1) where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacture
  • (2) within unfinished attics or garages or in other spaces where temperatures can fall below 4°C (40°F) or exceed 38°C (100°F)
  • (3) where the mounting surface could become considerably warmer or cooler than the room
  • (4) within an area of exclusion determined by a 10 ft (3.0 m) radial distance along a horizontal flow path from a stationary or fixed cooking appliance
  • (5) within a 914 mm (36 in) horizontal path from a door to a bathroom containing a shower or tub
  • (6) within a 914-mm (36 in) horizontal path from the supply registers of a forced air heating or cooling system
  • (7) within a 914 mm (36 in) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan

• Smoke alarms and smoke detectors shall be installed:
  • (8) where stairs lead to other occupied levels
  • (9) for stairways leading up from a basement

• NFPA 72: 29.8.3.4 Specific Location Requirements

LOCATIONS

[Images of smoke detectors and wiring]
SMOKE DETECTORS

Combination Fire Alarm/Security Systems

- Unlike security, fire systems must comply with codes and standards
- There are different variations on integrating fire and security systems
- Fire system installation should take precedence to security
Manufacturer’s listing and installation instructions

- Listing
  - Products covered under a company’s security and signaling requirements

- Spacing
  - Example: “A row of detectors shall be spaced and located within 3 ft (0.9m) of the peak of the ceiling measured horizontally”
  - Example: “For large rooms, one smoke alarm is recommended for every 500 square feet of floor space.”
Manufacturer’s listing and installation instructions

- Location
  - Example: “Install Smoke Alarms on tray-shaped ceilings (coffered ceilings) on the highest portion of the ceiling or on the sloped portion of the ceiling within 12” (305mm) vertically down from the highest point”

Manufacturer’s listing and installation instructions

- Replacement
  - Example: “A fresh battery should last for one year under normal operating conditions. This alarm has a low battery monitor circuit which will cause the alarm to “chirp” approximately every 30 - 40 seconds for a minimum of seven (7) days when the battery gets low. Replace the battery when this condition occurs.”
PLANS REVIEW

× SEAL LAW-NON RESIDENTIAL
× BBS CERTIFIED FIRE PROTECTION SYSTEM DESIGNER-FIRE ALARM SYSTEMS
× PLANS TO BE ADEQUATE
  × 106.1.1.1-2011 OBC
  × 907.7-2011 OBC
  × 106.1.3.1-2013 RCO
  × NFPA72: 10.18

PLANS EXAM

× REVIEW PLANS NOT MINDS
× PLANS:
  × “FIRE ALARM PER CODE”????? IS IT ACCEPTABLE??
  × RCO:
  × SHOW ON PLANS
  × INSIDE BEDROOM
  × OUTSIDE BEDROOM
  × ALL LEVELS
  × POWER
  × OBC:
  × SECTION 907.1.1
  × 13 ITEMS
PLANS EXAM

- NFPA 72-2010
  - WHERE
  - HOW
  - WHAT
  - TEST

INSPECTION

- 108.8 Testing of building service equipment.
  - Building service equipment shall be tested as required in the applicable code or referenced standard. Advanced notice of the test schedule shall be given to the building official. The building official may require that the tests be conducted in the presence of the building official or certified inspector. Testing and inspection records shall be made available to the building official or inspector, upon request, at all times during the fabrication of the systems and the erection of the building.
INSPECTION

× 907.7 Acceptance tests and completion.
  × Upon completion of the installation, the fire alarm system and all
    fire alarm components shall be tested in accordance with NFPA
    72
  × 907.7.1 Single- and multiple-station alarm devices.
    × When the installation of the alarm devices is complete, each device and
      interconnecting wiring for multiple-station alarm devices shall be tested
      in accordance with the smoke alarm provisions of NFPA 72.

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

INSPECTION

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

- 907.8 Inspection, testing and maintenance.
  - The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with Section 907.9 of the fire code.

INSPECTION

- BUILDING INSPECTOR
- FIRE OFFICIAL
  - LOCATION PER APPROVED PLANS
  - DEVICES PER APPROVED PLANS
  - TEST THE SYSTEM PER CODE
Device Maintenance

- System components shall be installed, tested, and maintained in accordance with manufacturer's published instructions and the Code.
- NFPA 72 (2010) 10.3.2

SUMMARY

- FIRE ALARM SYSTEM IN BUILDINGS WHICH TYPICALLY INCLUDE MANUAL FIRE ALARM SYSTEMS AND AUTOMATIC SMOKE DETECTION SYSTEMS MUST BE INSTALLED IN ACCORDANCE WITH THE BUILDING CODE AND NFPA 72. For existing buildings refer to building code and fire Code

- GOAL:
  - LIMIT FIRE CASUALTIES AND PROPERTY LOSES
  - NOTIFY THE OCCUPANTS OF EMERGENCY- TIME IS IMPORTANT- EARLY WARNING
  - FIRE DEPARTMENTS ARE NOTIFIED
SUMMARY

- THE DETECTION SYSTEM IS A SYSTEM OF DEVICES AND ASSOCIATED HARDWARE THAT ACTIVATE THE ALARM SYSTEM.

- ALL TEAM PLAYERS, OWNER, DESIGNER, BUILDING OFFICIAL, PLANS EXAMINER, INSPECTOR, FIRE OFFICIAL, CONTRACTOR, AND SUPPLIER MUST WORK TOGETHER SO THAT WE CAN SAVE LIVES.

FINAL

- LET US ALL WORK TOGETHER SO THAT THE REQUIREMENTS OF THE CODES AND STANDARDS ARE UNDERSTOOD BY ALL

- LET US KEEP IN MIND THAT WE NEED TO WORK HARD SO THAT WE CAN PREVENT AN ACCIDENT FROM HAPPENING.
THANK YOU

Questions?

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