Tennessee
Network of Security Integrators

TN Fire Certification Course

Student Manual

Introduction

Tennessee Network of Security Integrators
TN Fire Certification

WELCOME

to the

Tennessee Network of Security Integrators'
TN Fire Certification Course

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Goals of this Course

- Compliance with the law
  - Successful completion of this course will meet the state requirements
- Expand your knowledge
  - We will cover a broad scope of the alarm industry offering insight into how to design, install and service alarm systems
- Bring new industry members up to speed
  - Our goal will be to bring those new to the industry up to at least a minimal level of industry knowledge. We also hope to fill in areas of knowledge for experienced professionals
- Brush you up on codes & standards
  - Industry codes and standards are revised every 3 years to reflect new best practices and the latest technology

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Table of Contents

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Why you are here

- Improve your knowledge
- Enhance your value to your company
- Comply with state requirements

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Basic Class Rules

- Locate your Emergency Exits
- Understand your Emergency Evacuation plan
- Silence ALL electronic devices
- You must attend the entire course and pass the exam to fully complete the program
- Be Interactive

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What TNSI does for you	• Provides networking opportunities • Gives you information • We monitor and influence the state and local legislative process • We provide training at a discounted rate for members • Belonging gives your company credibility & exposure TNSI™ Tennessee Network of Security Integrators TN Fire Certification Course © TNSI 2019 **Slide 1-7**

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We need your involvement!	• You only get back – what you put in • This association is your voice to government • Speak up!  TN Fire Certification Course © TNSI 2019 **Slide 1-8**

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Fundamentals
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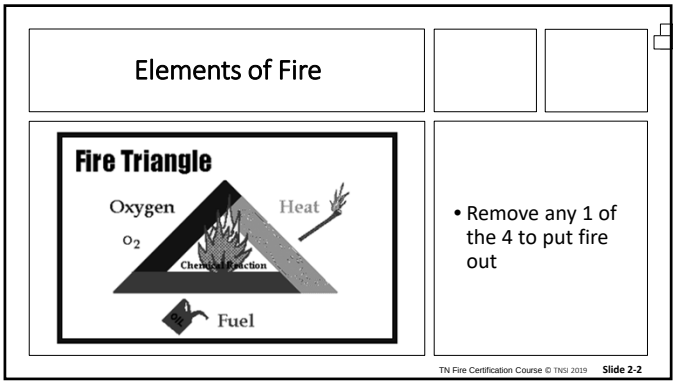
Elements of Fire
Fire Triangle
Oxygen
O_2
Heat
Chemical Reaction
Fuel
• Remove any 1 of the 4 to put fire out
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2


Fire Signatures
• Fire system design requires understanding of fire signatures
• Helps to know what the sensor is looking for
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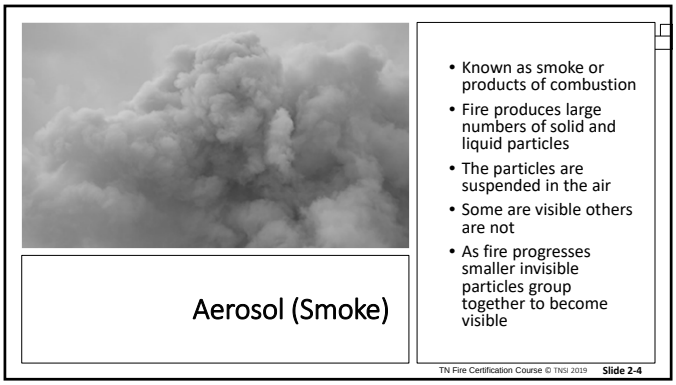
Aerosol (Smoke)
• Known as smoke or products of combustion
• Fire produces large numbers of solid and liquid particles
• The particles are suspended in the air
• Some are visible others are not
• As fire progresses smaller invisible particles group together to become visible
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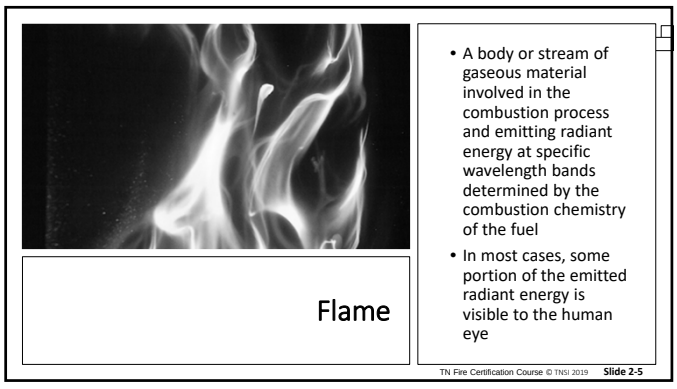
Flame
• A body or stream of gaseous material involved in the combustion process and emitting radiant energy at specific wavelength bands determined by the combustion chemistry of the fuel
• In most cases, some portion of the emitted radiant energy is visible to the human eye
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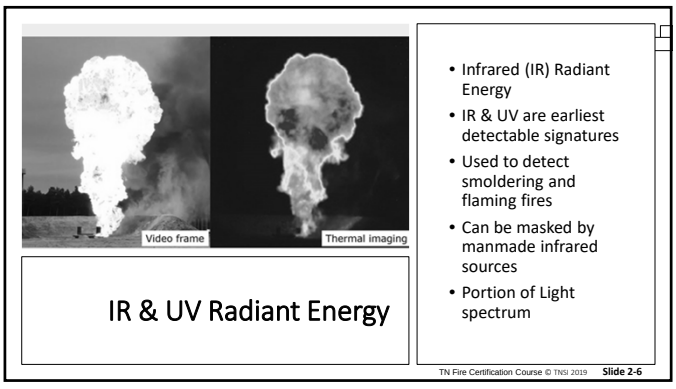
Video frame
Thermal imaging
IR & UV Radiant Energy
• Infrared (IR) Radiant Energy
• IR & UV are earliest detectable signatures
• Used to detect smoldering and flaming fires
• Can be masked by manmade infrared sources
• Portion of Light spectrum
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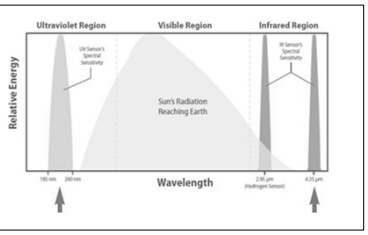

UV vs IR Radiant Energy

- UV sensors work by detecting the UV radiation emitted by the flame & are sensitive to a wide range of flammable fuels including hydrocarbons, sulfur, hydrazine & ammonia
- The main radiant emission band for hydrocarbon fueled fires ranges between 4.3 & 4.4 microns, it is an infrared emission that the IR sensors can detect with ease

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Thermal Energy

- Also known as Heat
- Increase in air temperature
- Time to produce detectable energy can range from minutes to hours
- Detectable energy often occurs after life threatening conditions are toxic

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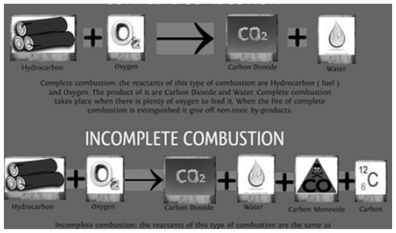

Gas

- Fire changes air near and far from source
- Depletes oxygen
- Production of gas is fuel specific
- Carbon Monoxide is present in almost all fires

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Particles of Combustion

Substances (products that either remain at the site of burning such as ash, or scatter as volatile products) resulting from the chemical process of a fire

Ember - A particle of solid material that emits radiant energy due either to its temperature or the process of combustion on its surface

Spark - A moving ember

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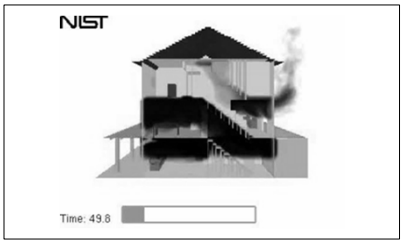
Fire Effects



- Fire produces a hostile environment
- The majority of fatalities are due to smoke inhalation
- The average person only has a few minutes to evacuate once smoke alarms sound

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4 Stages of Fire

- Ignition
- Growth
- Full Development
- Decay

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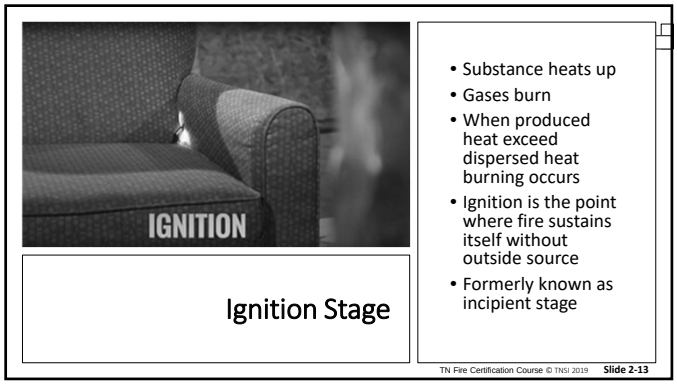

Ignition Stage

- Substance heats up
- Gases burn
- When produced heat exceed dispersed heat burning occurs
- Ignition is the point where fire sustains itself without outside source
- Formerly known as incipient stage

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Growth Stage

- Fire begins to grow
- Spark or small flame spreads to other flammables
- Fire increases in size
- Formerly known as smoldering stage

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Fully Developed Stage

- All contents with the perimeter of the fires area are burning
- Stage where flashover can occur

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Decay Stage

- When most fuel is consumed
- Flames disappear but glowing embers are visible

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Factors in Fire Growth

Oxygen supply	Limit oxygen to slow growth
Fuel	Size depends on available fuel
Container Size	Large area allows heat to disperse to slow growth
Insulation	Heat radiated back to fire speeds growth

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Rapid Fire Progress

- **Flashover**
  Flames flash over the entire surface of the area to ignite all flammable material
- **Rollover- Flameover**
  Fire travels across the upper layer of space
- **Backdraft**
  Fire dies out due to lack of oxygen Then New oxygen is introduced causes Fire violently bursts into flame

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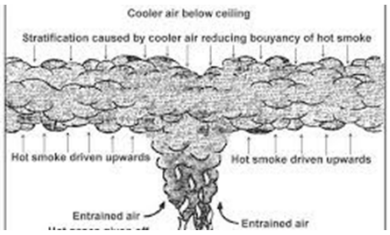

Thermal Layering-Stratification

- Smoke or other gases travel in layers at different levels within a room or duct
- Are not evenly distributed throughout
- Hottest gases rise to highest point
- Stratification- The phenomenon where the upward movement of smoke and gases ceases due to the loss of buoyancy

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Classes of Fire

A		Ordinary Combustibles	Wood, Paper, Cloth, Etc.
B		Flammable Liquids	Grease, Oil, Paint, Solvents
C		Live Electrical Equipment	Electrical Panel, Motor, Wiring, Etc.
D		Combustible Metal	Magnesium, Aluminum, Etc.
K		Commercial Cooking Equipment	Cooking Oils, Animal Fats, Vegetable Oils

- Based on substance burning
  - Class A- Ordinary, paper, wood, rubber, plastic
  - Class B- Liquid, Oil, Gases or Grease
  - Class C- Electrical
  - Class D- Metals
  - Class K- Cooking oils and fats

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Fire Rating

- The classification indicating in time (hours) the ability of a structure or component to withstand a standardized fire test
- This classification does not necessarily reflect performance of rated components in an actual fire

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1,318,500 fire responses in 2018

499,000 Structure Fires in 2018.

Fire Dept responds every 24 seconds in 2018

73% occurred in residential structures in 2018.

The Fire Threat - 2018

Fatalities in 2018

3,655 civilian deaths in 2018

74% of civilian deaths occurred in the home in 2018

- Source NFPA

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Fire Alarm Objectives

- Indicate and warn of abnormal conditions
- Provide sufficient warning to allow occupants to escape
- Summon appropriate aid
- Control facilities to control the fire
- Enhance the protection of life
- Reduce property loss and damage

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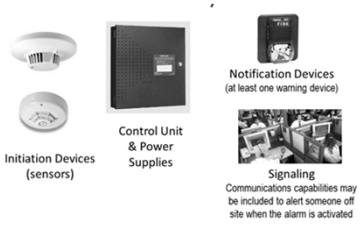

Fire Alarm Systems

- **Initiation Devices** (sensors)
- **Control Unit & Power Supplies**
- **Notification Devices** (at least one warning device)
- **Signaling** Communications capabilities may be included to alert someone off site when the alarm is activated

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Codes & Standards
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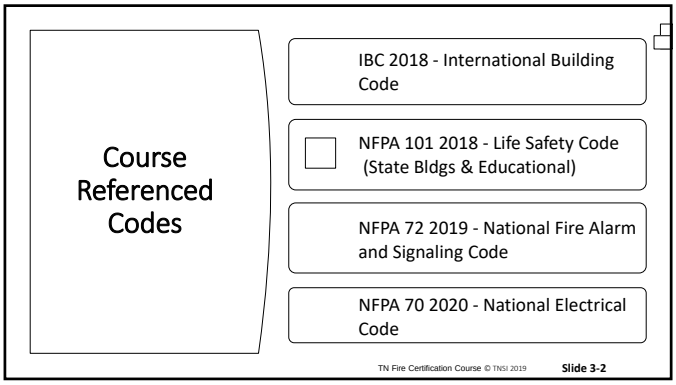
Course Referenced Codes
IBC 2018 - International Building Code
NFPA 101 2018 - Life Safety Code (State Bldgs & Educational)
NFPA 72 2019 - National Fire Alarm and Signaling Code
NFPA 70 2020 - National Electrical Code
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Tennessee Law & Rules
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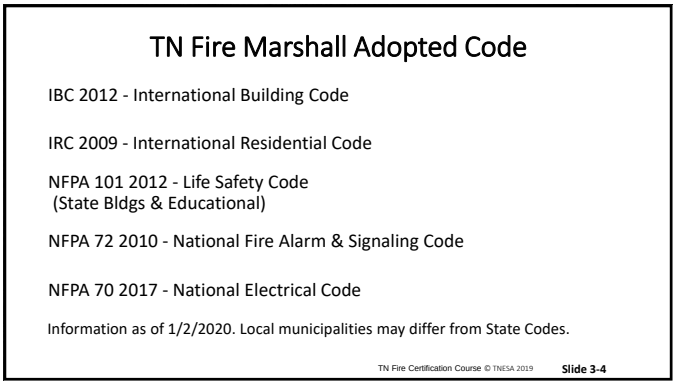
TN Fire Marshall Adopted Code
IBC 2012 - International Building Code
IRC 2009 - International Residential Code
NFPA 101 2012 - Life Safety Code (State Bldgs & Educational)
NFPA 72 2010 - National Fire Alarm & Signaling Code
NFPA 70 2017 - National Electrical Code
Information as of 1/2/2020. Local municipalities may differ from State Codes.
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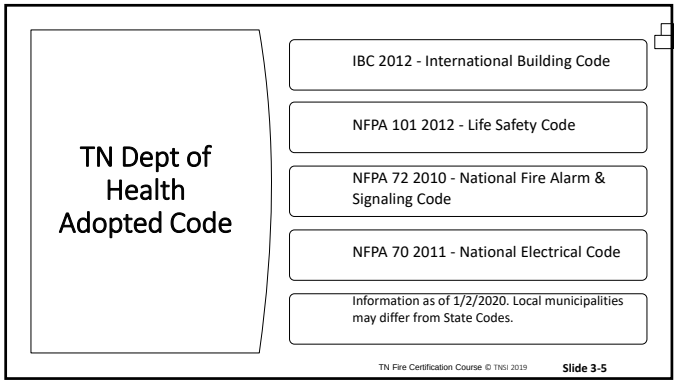
TN Dept of Health Adopted Code
IBC 2012 - International Building Code
NFPA 101 2012 - Life Safety Code
NFPA 72 2010 - National Fire Alarm & Signaling Code
NFPA 70 2011 - National Electrical Code
Information as of 1/2/2020. Local municipalities may differ from State Codes.
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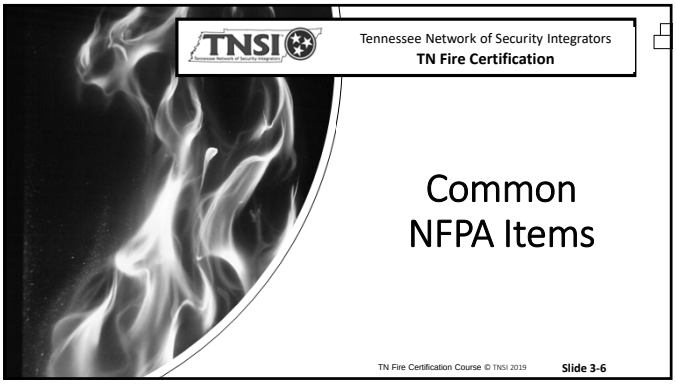
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Common NFPA Items
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What is NFPA?

The National Fire Protection Association (NFPA), is an international, nonprofit, membership organization to protect people, their property and the environment from destructive fire

For more info visit www.NFPA.org

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What is ICC?

The International Code Council (ICC) was established in 1994 as a non-profit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes.

Codes are adopted by local and state building officials and code administrators

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Overview of Code Documents

Organization and Structure

- Scope- what is covered
- Purpose- Objectives
- Application- Types of structures covered
- Referenced Publications
- Definitions
- Annex- Not Mandatory

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Overview of NFPA Documents

Numbering system

1.2.3.4.5

- Chapter (1)
  - Section (2)
    - Subsection (3)
      - Paragraph (4)
        - Subparagraph (5)

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Overview of ICC Documents

Numbering system

101.1.2.3

- Section (101)
  - Subsection (1)
    - Paragraph (2)
      - Subparagraph (3)

Chapter is the first number of the Section. Letters in brackets in front indicate the committee responsible for that section.

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Code Common Definitions

Code

- A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards
- NFPA 72 3.2.3 ['19]

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Code Common Definitions

Standard

- Document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context

[ISO/IEC Guide 2:2004, definition 3.2]

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Code Common Definitions

Authority Having Jurisdiction (AHJ)

- An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure
- NFPA 72 3.2.2 ['19]

Approved

- Acceptable to the AHJ
- NFPA 72 3.2.1 ['19]

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Code Common Definitions

Shall

- Indicates a mandatory requirement
- NFPA 72 3.2.6 ['19]

Should

- Indicates a recommendation or that which is advised but not required
- NFPA 72 3.2.7 ['19]

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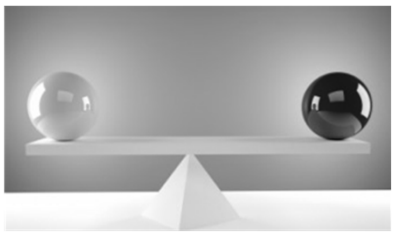

Equivalency

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

NFPA 72 1.5 ['19]

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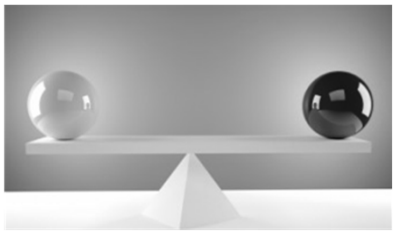

Equivalency

- Technical documentation shall be submitted to the AHJ to demonstrate equivalency
- NFPA 72 1.5.1 ['19]
- The system, method, or device shall be approved for the intended purpose by the AHJ
- NFPA 72 1.5.2 ['19]

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Labeled

- Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the AHJ and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacture indicates compliance with appropriate standards or performance in a specified manner.
- NFPA 72 3.2.4 ['19]

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Listed

- Equipment, materials, or services included in a list published by an organization that is acceptable to the AHJ and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and by whose listing states that either the equipment, material, or service meets appropriate, designated standards or has been tested and found suitable for a specified purpose.
- NFPA 72 3.2.5 ['19]

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Retroactivity

- The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued
- NFPA 72 1.4 ['19]
- Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive
- NFPA 72 1.4.1 ['19]

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Retroactivity

- In those cases where the AHJ determines that the existing situation presents an unacceptable degree of risk, the AHJ shall be permitted to apply retroactively any portions of this standard deemed appropriate
- NFPA 72 1.4.2 ['19]
- The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgement of the AHJ, and only where it is clearly evident that a reasonable degree of safety is provided
- NFPA 72 1.4.3 ['19]

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AHJ

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Who is the AHJ anyway?

- "The organization, office or individual responsible for approving equipment, installation or procedure"
- NFPA 72 3.2.2 ['19]
  - Fire Department: Chief, Fire Marshal
  - Department of Labor
  - Health Department
  - Insurers
  - Owners

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The AHJ can approve & accept products & procedures

"Approved" indicates they will certify and support those products, applications or procedures
NFPA 72 3.2.1 ['19]

"Listed" means that a product has met certain qualifications and testing criteria - U.L./F.M
NFPA 72 3.2.5 ['19]

"Accepted" means that the AHJ considers it "adequate or equivalent" to satisfy a requirement or standard
NFPA Glossary of terms

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AHJ

- AHJ shall determine whether the provisions of this Code are met
- Any requirements that are not specifically provided for by this Code shall be determined by the AHJ
- Any requirement shall be permitted to be modified if, in the judgment of the AHJ, its application would be hazardous under normal occupancy conditions

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IBC or NFPA 101- Life Safety Code

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Occupancies

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Group A			303	
Group B/Business	38	39	304	
Educational	14	15		
Group F			306	
Group H			307	
Group I			308	

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Occupancies

Rffxsdqf|	OVF0Qhz#Fkdswhu	OVF0H{lvwlqj# Fkdswhu	IEF	
Group M			309	
Group R			310	
Group S			311	
Group U			312	
High Rise Building			403	
Special Amusement Buildings			411	

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IBC Section 907.2

Occupancy Requirements
Fire Detection, Alarm, and Communication Systems

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Group A Assembly Occupancies

- IBC 907.2.1 ['18]
- A manual fire alarm system that activates occupant notification where occupant load is 300 or more or more than 100 above or below the lowest level of exit discharge
- Group A occupancies not separated by Fire Barriers (707.3.10) from each other shall be considered as single occupancy
- Exception: Manual fire boxes not required where building is provided throughout by an automatic sprinkler system that activates occupant notification
- Occupant load of 1000 or more shall have an Emergency Voice/Alarm Communication (EVAC) System

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Group B Business

Manual fire alarm required with any one of the following:

- Occupant load of all floors 500 or more
- Occupant load more than 100 above or below lowest level of exit discharge
- Fire Area contains an Ambulatory care facility

Exception: Manual fire boxes not required where building is provided throughout by an automatic sprinkler system that activates occupant notification

Automatic Occupant Notification not specifically mentioned for manual fire boxes, but mention in exception indicates it is required

Emergency Forces Notification required

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Group B Ambulatory Health Care Facilities

Fire Areas containing shall have smoke detection system within the ambulatory care facility and in public use areas outside tenant spaces including public corridors and elevator lobbies

- Exception: Buildings equipped throughout with an automatic sprinkler system that activate the occupant notification system

IBC 907.2.2.1 ['18]

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New Business - (State Buildings)

Fire alarm required with any one of the following:

- 3 or more stories
- 50 or more occupants above or below exit level
- 300 or more total occupants

Activations by 1 of the following

- Manual Pull stations
- Approved Fire Detection throughout the building
- Approved Sprinkler System throughout the building

Automatic Occupant Notification required

Positive alarm sequence allowed

Emergency Forces Notification required

NFPA 101 38.3.4 ['18]

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Existing Business (State Buildings)

Same as New Business

NFPA 101 39.3.4 ['18]

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New Educational

- Initiation by manual fire boxes. If provided, automatic sprinkler system shall automatically activate the fire alarm system.
- Shall not apply to buildings meeting all of the following criteria:
  - Buildings having an area not exceeding 1000 ft^2
  - Buildings containing a single classroom
  - Buildings located not less than 50 ft from another building
  - Initiation of the required fire alarm system shall be by manual means unless (See exceptions)
  - Occupant notification shall utilize an Emergency Voice/Alarm Communication (EVAC) System where occupant load is more than 100.
- Positive alarm sequence allowed
- Emergency Forces Notification required

NFPA 14.3.4 ['18]

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New Educational

Manual fire boxes can be eliminated if all conditions are met:

1. Interior corridors protected by smoke detectors
2. Auditoriums, cafeterias, and gymnasiums protected by heat detectors or other approved devices
3. Shop and laboratories involving dust or vapors are protected by heat detectors or other approved devices
4. Way to manually activate from central point the evacuation signal or to evacuate only affected area

Manual fire boxes can be eliminated if both conditions apply

1. Building protected throughout by automatic sprinkler system.
2. Way to manually activate from central point the evacuation signal or to evacuate only affected area

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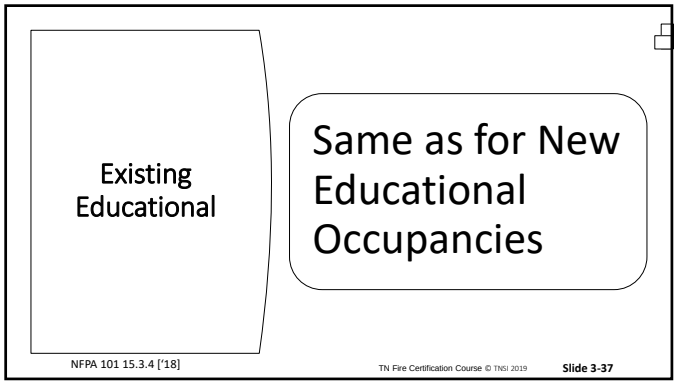

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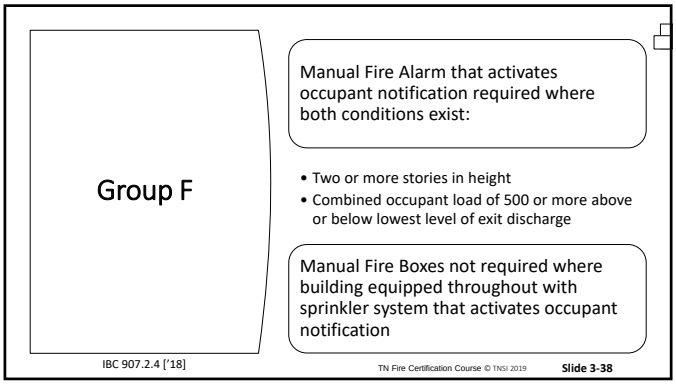

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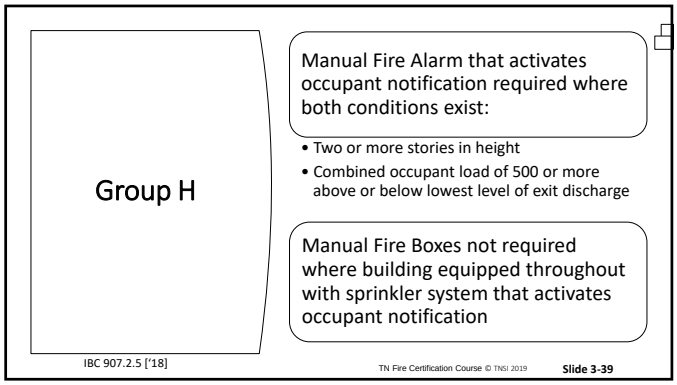

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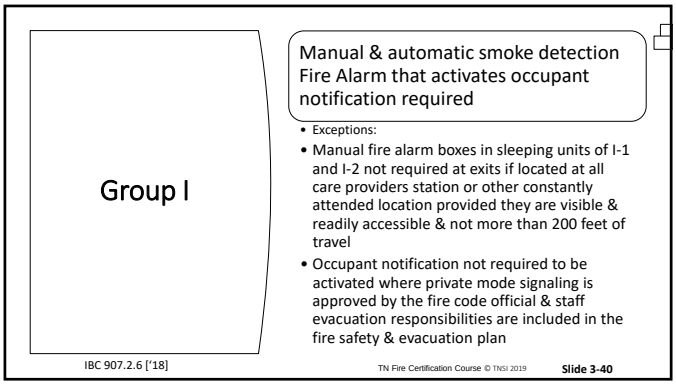

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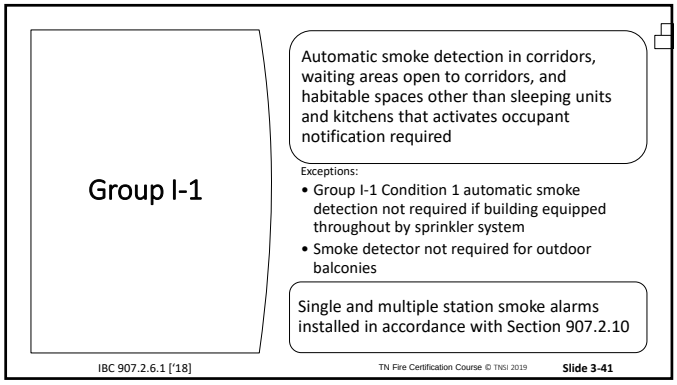

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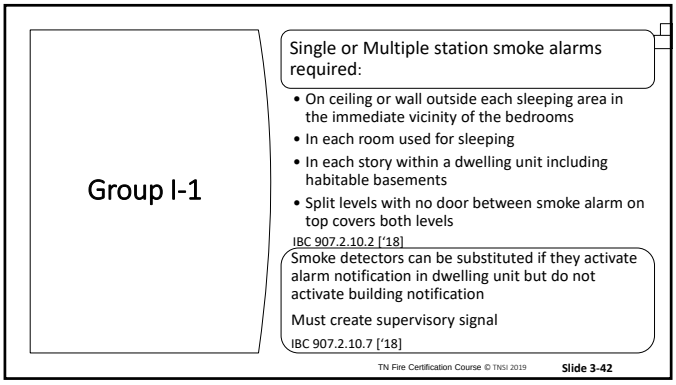

42

Group I-2

Smoke detectors installed in corridors in I-2 Condition 1 and spaces permitted to be open to corridors in Section 407.2

Group I-2 Condition 2 smoke detectors installed as required in Section 407

Exceptions:

1. Corridor smokes not required in smoke compartments that contain sleeping units equipped with smoke detectors that provide visual display on the corridor side & audible & visual alarm at the care providers' station

2. Corridor smokes not required in smoke compartment that contain sleeping units where the sleeping unit doors have automatic door closing devices with integral smoke detectors on the unit side provided they perform the required alerting function

IBC 907.2.6.2 ['18]

43

Group I-3

Equipped with manual fire boxes and automatic smoke detection to automatically alert staff

- Not required to be located in accordance with 907.4.2 if fire boxes provided at staff attended location having direct supervision over areas were the manual fire boxes are eliminated
- Fire boxes allowed to be locked in detainee areas provided staff is present and have keys readily available

Smoke detectors installed throughout resident areas including sleeping units, day rooms, group activity, and other common spaces open to residents.

Exceptions:

1. Approved smoke detection to prevent tampering or damage.

2. Sleeping units in Use Condition 2 and 3.

3. Smokes not required in sleeping units with 4 or fewer in smoke compartments equipped with sprinklers

IBC 907.2.6.3 ['18]

44

Group M

Manual fire alarm that activates occupant notification required in the following conditions:

- Combined occupant load of all floors is 500 or more
- Occupant load more than 100 persons above or below lowest level of exit

Exceptions:

1. Manual fire alarm not required in Covered or Open Mall Buildings complying with section 402

2. Manual fire alarm boxes not required if equipped throughout with sprinkler system that activates occupant notification

Initiation signal from manual fire box or waterflow permitted to annunciate at constantly attended location where instructions can be announced over EVAC system

IBC 907.2.7 ['18]

45

Group R-1

Manual fire alarm that activates occupant notification

- Exceptions:
- Not required if building not more than 2 stories, all sleeping units, contiguous attics, and crawl spaces separated by not less than 1 hour fire wall and each sleeping unit opens to public way
- Not required if building equipped throughout by sprinkler that activates occupant notification and one fire alarm box is installed at approved location

IBC 907.2.8 ['18]

46

Group R-1

Smoke detection system that activates occupant notification required throughout all interior corridors serving sleeping units

- Exceptions:
- Not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress opening directly to an exit or an exterior exit access

Single and multiple smoke alarms shall be installed in accordance with Section 907.2.10

IBC 907.2.8 ['18]

47

Group R-1

Single or Multiple station smoke alarms required:

- In sleeping areas.
- In every room in the path of egress from the sleeping room to the door leading from the sleeping unit
- In each story within the sleeping unit including habitable basements. Split levels with no door between smoke alarm on top covers both levels
- IBC 907.2.10.2 ['18]

Smoke detectors can be substituted if they activate alarm notification in dwelling unit but do not activate building notification.

Must create supervisory signal

IBC 907.2.10.7 ['18]

48

Group R-2

Manual fire alarm system that activates the occupant notification system required where any of the following apply:

- Any dwelling or sleeping unit is located three or more stories above the lowest level of exit discharge.
- Any dwelling or sleeping unit is located more than one story below the highest level of exit discharge.
- Building contains more than 16 dwelling or sleeping units.

IBC 907.2.9 ['18]

49

Group R-2

Exceptions:

- A fire alarm system is not required if building not more than 2 stories, all sleeping units, contiguous attics, and crawl spaces separated by not less than 1 hour fire wall and each sleeping unit opens to public way.
- Manual fire alarm boxes not required if building equipped throughout by sprinkler that activates occupant notification.
- Fire alarm system not required in buildings that do not have interior corridors serving dwelling or sleeping units and have throughout a sprinkler system , provided that dwelling units either have a means of egress directly to an exterior exit or served by open ended corridors.

Single and multiple smoke alarms shall be installed in accordance with Section 907.2.10

IBC 907.2.9 ['18]

50

Group R-2

Single or Multiple station smoke alarms required:

- On ceiling or wall outside each sleeping area in the immediate vicinity of the bedrooms.
- In each room used for sleeping.
- In each story within a dwelling unit including habitable basements. Split levels with no door between smoke alarm on top covers both levels.

IBC 907.2.10.7 ['18]

Smoke detectors can be substituted if they activate alarm notification in dwelling unit but do not activate building notification. Must create supervisory signal.

IBC 907.2.10.2 ['18]

51

Group R-2

College and university buildings used for student or staff housing require smoke detection system that activates occupant notification in all of the following locations:

- Common spaces outside dwelling or sleeping units
- Laundry rooms, mechanical equipment rooms, and storage rooms
- All interior corridors serving dwelling or sleeping units

Exception: Smoke detection system not required in buildings not having interior corridors serving dwelling or sleeping units and where each unit has a means of egress opening directly to an exterior exit access leading to an exit or open directly to an exit

IBC 907.2.9 ['18]

52

Group R-3 and R-4

Single or Multiple station smoke alarms required:

- On ceiling or wall outside each sleeping area in the immediate vicinity of the bedrooms
- In each room used for sleeping
- In each story within a dwelling unit including habitable basements. Split levels with no door between smoke alarm on top covers both levels
- IBC 907.2.10.2 ['18]

Smoke detectors can be substituted if they activate alarm notification in dwelling unit but do not activate building notification

Must create supervisory signal

IBC 907.2.10.7 ['18]

53

Special Amusement Buildings

Automatic smoke detection system required

Activation of any single smoke, sprinkler, or any other automatic fire detection device shall activate audible and visual annunciation at constantly attended location from which emergency action can be initiated

IBC 907.2.11 ['18]

54

Special Amusement Buildings

IBC 907.2.11 [‘18]

Activation of two or more smoke detectors, one smoke detector with an alarm verification feature, sprinkler system, or other approved fire detection device shall do all of the following:

1. Cause illumination of the means of egress with light no less than 1 footcandle at the walking surface.
2. Stop any conflicting or confusing sounds and visual distractions.
3. Activate an approved directional exit marking that will become apparent in an emergency.
4. Activate a prerecorded message, audible throughout the building, instructing patrons to proceed to the nearest exit. Alarm signals used must produce sound distinctive from other sounds.

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55

Special Amusement Buildings

An Emergency Voice/Alarm Communication (EVAC) system, which is allowed to serve as a public address system, shall be installed and audible throughout the building

IBC 907.2.11 [‘18]

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56

High-Rise Buildings

Automatic smoke detection, fire department communication system, and Emergency Voice/Alarm Communication (EVAC) system

Exceptions:

1. Airport control towers
2. Open parking garages
3. Buildings with an occupancy in Group A-5
4. Low-hazard special occupancies
5. Building with an occupancy in Groups H-1, H-2, or H-3.
6. In Group I-1 and Group I-2 the alarm shall sound at a constantly attended location and occupant notification shall be broadcast over the EVAC system

IBC 907.2.12 [‘18]

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57

High-Rise Buildings

Smoke detectors that activate the EVAC system will be installed according to the requirements of the building occupancy as listed in Section 907.1 through 907.9 plus the following:

- In each mechanical equipment, electrical, transformer, telephone equipment, or similar room that is not provided with sprinklers
- In each elevator machine room, machinery space, control room, and control space and in elevator lobbies

IBC 907.2.12 [‘18]

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58

High-Rise Buildings

Duct smoke detectors complying with Section 907.3.1 required as follows:

- In the main return air and exhaust air plenum of each air conditioning system having a capacity greater than 2000 cubic feet per minute. Located in a serviceable area downstream of the last duct inlet
- At each connection to a vertical duct or riser serving two or more stories. Group R-1 and R-2 smoke detector allowed in each air riser carrying not more than 5000 cfm and serving not more than 10 air-inlet openings

IBC 907.2.12 [‘18]

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59

High-Rise Buildings

Where wired communication system is approved in lieu of an emergency responder radio coverage, shall operate between fire command center and elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge, and inside interior exit stairs

- In buildings with an occupied floor more than 120 feet above lowest level of fire department vehicle access, EVAC system must be multiple channel system

IBC 907.2.12 [‘18]

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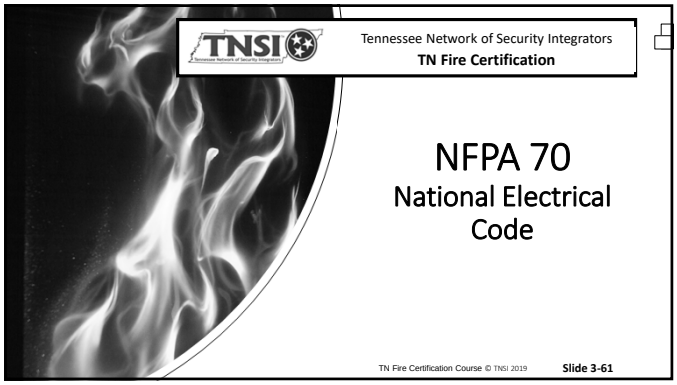
60



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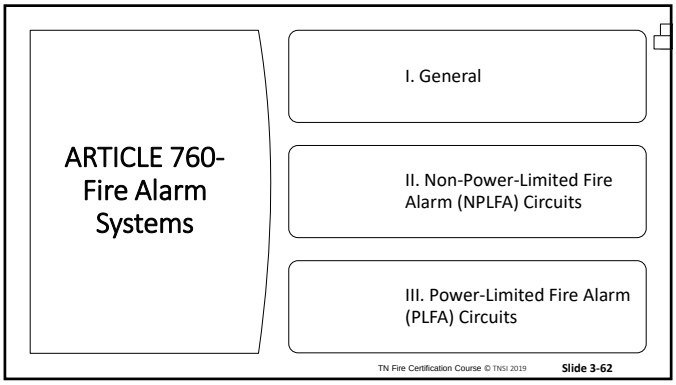

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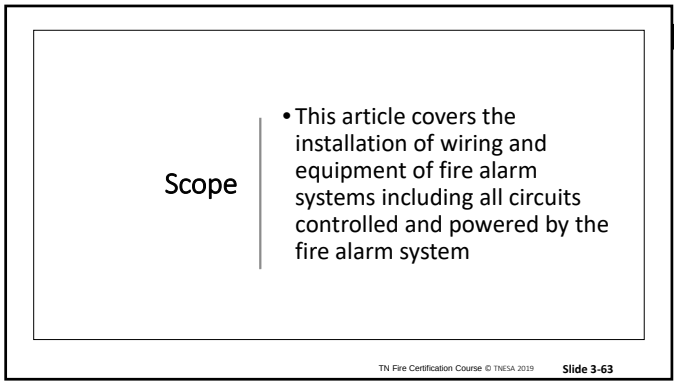

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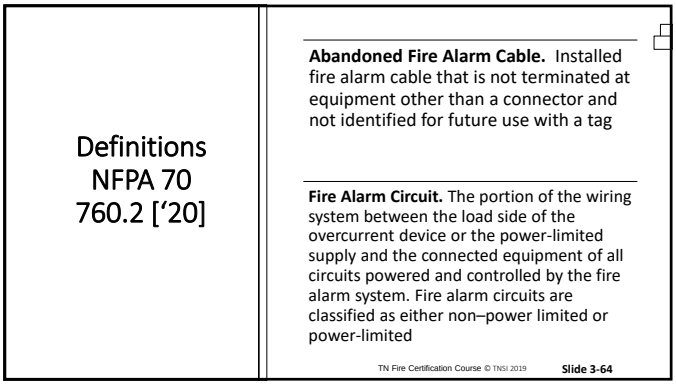

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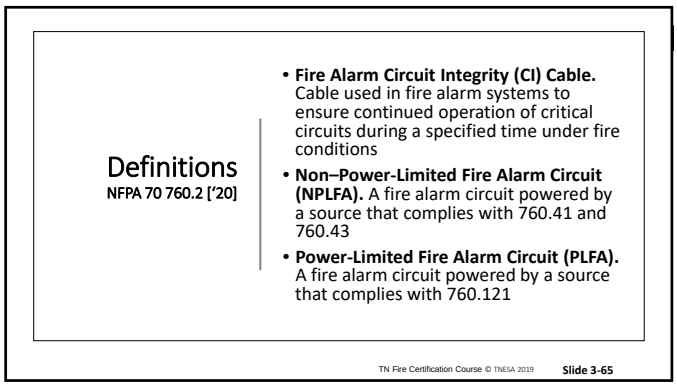

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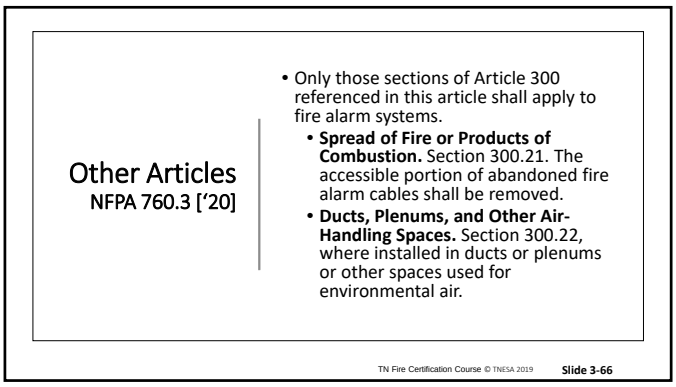

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Other Articles
NFPA 760.3 [‘20]

- **Hazardous (Classified) Locations**. Articles 500 through 516 and Article 517, Part IV, where installed in hazardous (classified) locations
- **Corrosive, Damp, or Wet Locations.** Sections 110.11, 300.5(B), 300.6, 300.9, and 310.10(F) where installed in corrosive, damp, or wet locations

67

Other Articles
NFPA 760.3 [‘20]

- **Building Control Circuits**. Article 725, where building control circuits (e.g. elevator capture, fan shutdown) are associated with the fire alarm system.
- **Optical Fiber Cables.** Installed in accordance with Article 770.
- **Installation of Conductors with Other Systems.** Shall comply with 300.8
- **Raceways or Sleeves Exposed to Different Temperatures.** Installed in accordance with Article 300.7(A).

68

Other Articles
NFPA 760.3 [‘20]

- **Vertical Support for Fire Rated Cables and Conductors**. Installed in accordance with 300.19..
- **Number and Size of Cables and Conductors in Raceway.** Shall comply with 300.17.
- **Bushing.** Shall be installed where cables emerge from raceway used for mechanical support or protection in accordance with 300.15(C).

69

Other Articles
NFPA 760.3 [‘20]

- **Cable Routing Assemblies**. Permitted in accordance with Table 800.154(C), listed in accordance with 800.182, and installed in accordance with 800.110(C) and 800.113.
- **Communications Raceways.** Permitted in accordance with Table 800.154(C), listed in accordance with 800.182, and installed in accordance with 800.113 and 362.24 through 362.56, where the requirements applicable to nonmetallic tubing apply.

70

Other Articles
NFPA 760.3 [‘20]

- **Temperature Limitations of Power-Limited and Non-Power-Limited Fire Alarm Cables**. Requirements of 310.14(A)(3) on temperature limitations of conductors shall apply to Power-Limited and Non –Power-Limited Cables.
- **Identification of Equipment Grounding Conductors.** Identified in accordance with 250.119.

Exception: Green insulation permitted as ungrounded signal conductors for Type FPLP, FPLR, FPL, and substitute in accordance with 760.154(A).

71

Access to Electrical Equipment Behind Panels Designed to Allow Access

- Access to electrical equipment shall not be denied by an accumulation of conductors and cables that prevents removal of panels, including suspended ceiling panels

NFPA 70 760.21 [‘20]

72

Panel Spacing

- You must be able to open all doors a full 90 degrees
- 30" in front, 36" to side
- Don't mount boxes (alarm controls, structured wiring boxes, etc.) behind other equipment
- NFPA 70 110.26 ['20]

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73

Mechanical Execution of Work

- Electrical equipment shall be installed in a neat workmanlike manner.
- Cables and conductors installed exposed on the surface of ceilings and sidewalls shall be supported by the building structure in such a manner that the cable will not be damaged by normal building use.
- Such cables shall be supported by straps, staples, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform with 300.4

NFPA 70 760.24 ['20]

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74

Abandoned Cables

- The accessible portion of abandoned fire alarm cables shall be removed
- Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved

NFPA 70 760.25 ['20]

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75

NFPA 70 760.30 ['20]

Fire Alarm Circuit Identification

- Fire alarm circuits shall be identified at terminal and junction locations in a manner that helps to prevent unintentional signals on fire alarm system circuit(s) during testing and servicing of other systems

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76

Fire Alarm Circuits Extending Beyond One Building

Non–power-limited and power-limited fire alarm circuits that extend beyond one building and run outdoors either shall meet the installation requirements of Parts II, III, and IV of Article 805 and shall meet the installation requirements of Part I of Article 300

NFPA 70 760.32 ['20]

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77

Fire Alarm Circuit Requirements

Non–Power-Limited Fire Alarm (NPLFA) Circuits.

- See Parts I and II.

Power-Limited Fire Alarm (PLFA) Circuits.

- See Parts I and III.

We will only cover PLFA

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78

Non-Power-Limited Fire Alarm (NPLFA) Circuits

Majority if not all Fire Alarm Systems Are power limited

Non - Power Limited Requirements are included for your information

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79

Power Sources for PLFA Circuits

The power source for a power-limited fire alarm circuit shall be:

- A listed PLFA or Class 3 transformer.
- A listed PLFA or Class 3 power supply.
- Listed equipment marked to identify the PLFA power source.
- NFPA 70 760.121(A) ['20]

Tables 12(A) and 12(B) in Chapter 9 provide the listing requirements for power-limited tire alarm circuit sources.

Exception for receptacles in dwelling-unit unfinished basements that supply power for fire alarm systems. NFPA 70 260.8(A)(5) ['20]

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80

Branch Circuit

The branch circuit shall supply no other loads, shall be permanatly identified at the fire alarm panel, circuit disconnect shall have red identification (shall not damage overcurrent device or obscure manufacturing markings), be accessable to only qualified personel, be identified as "Fire Alarm Circuit" shall not be supplied by ground-fault or arc-fault interrupters, shall be allowed to be secured on.

NFPA 70 760.121(B) ['20]

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81

Circuit Marking

- The equipment supplying PLFA circuits shall be durably marked where plainly visible to indicate each circuit that is a power-limited fire alarm circuit
  - Exception where a power limited circuit is to be reclassified as a non–power-limited circuit

NFPA 760.124 ['20]

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82

Wiring Methods on Supply Side of the PLFA Power Source

Conductors and equipment on the supply side of the power source shall be installed in accordance with the appropriate requirements of Part II and Chapters 1 through 4

Transformers or other devices supplied from power-supply conductors shall be protected by an overcurrent device rated not over 20 amperes

- *Exception: The input leads of a transformer or other power source supplying power-limited fire alarm circuits shall be permitted to be smaller than 14 AWG, but not smaller than 18 AWG, if they are not over 300 mm (12 in.) long and if they have insulation that complies with 760.27(B)*

NFPA 760.127 ['20]

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83

Wiring Methods and Materials on Load Side of the PLFA Power Source

- Fire alarm circuits on the load side of the power source shall be permitted to be installed using wiring methods and materials in accordance with 760.130(A), (B), or combination of (A) and (B).
  - (A) NPLFA Wiring Methods and Materials. Installation shall be in accordance with 760.46, and conductors shall be solid or stranded copper.
  - (B) PLFA Wiring Methods and Materials. Power-limited fire alarm conductors and cables described in 760.179 shall be installed as detailed in 760.130(B)(1), (B)(2), or (B)(3) of this section and 300.7. Devices shall be installed in accordance with 110.3(B), 300.11(A), and 300.15.

NFPA 70 760.130 ['20]

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84

Exposed or Fished in Concealed Spaces

NFPA 70 760.130(B)(1) [‘20]

Cable splices or terminations shall be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment

Exposed, cables shall be adequately supported and installed in such a way that maximum protection against physical damage is afforded by building construction such as baseboards, door frames, ledges, and so forth

Where located within 7 ft of the floor, cables shall be securely fastened in an approved manner at intervals of not more than 18 in

85

Passing Through a Floor or Wall

NFPA 70 760.130(B)(2) [‘20]

- Cables shall be installed in metal raceways or rigid nonmetallic conduit where passing through a floor or wall to a height of 7 feet above the floor, unless adequate protection can be afforded by building construction such as detailed in 760.130(B)(1), or unless an equivalent solid guard is provided.

86

In Hoistways

NFPA 70 760.130(B)(3) [‘20]

- Cables shall be installed in rigid metal conduit, rigid nonmetallic conduit, intermediate metal conduit, or electrical metallic tubing where installed in hoistways
  - *Exception: As provided for in 620.21 for elevators and similar equipment*

87

Installation of Conductors & Equipment

NFPA 70 760.136(A)(B)(C) [‘20]

- Power-limited fire alarm circuit cables and conductors shall not be placed in any cable, cable tray, compartment, enclosure, manhole, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, non-power-limited fire alarm circuits, and medium power network-powered broadband communications circuits unless:
  - Separated by Barriers
  - Installed in a raceway within the enclosure to separate them
  - If use to power fire alarm systems & separated by .25 in

88

Installation of Conductors & Equipment

NFPA 70 760.136(D) [‘20]

- Power-limited fire alarm circuit cables and conductors in compartments, enclosure, manhole, outlet box, device box, raceway, or similar fittings shall be allowed to installed with electric light, power, Class 1, non-power-limited fire alarm circuits, and medium power network-powered broadband communications circuits where they are there solely to connect to the PLFA equipment provided they comply with one:
  - Cables routed to maintain minimum 0.25 inch separation.
  - Circuit conductors 150 volts or less and PLFA cable FPL, FPLR, or FPLP (or permitted sub) and 0.25 inch separation or in nonconductive sleeve or PLFA cable install as non-PLFA circuit in accordance with 760.46.

89

Conductor Size

NFPA 70 760.142 [‘20]

- Conductors of 26 AWG shall be permitted only where spliced with a connector listed as suitable for 26 AWG to 24 AWG or larger conductors that are terminated on equipment or where the 26 AWG conductors are terminated on equipment listed as suitable for 26 AWG conductors
- Single conductors shall not be smaller than 18 AWG

90

Support of Conductors

- Power-limited fire alarm circuit conductors shall not be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support

NFPA 70 760.143 ['20]

91

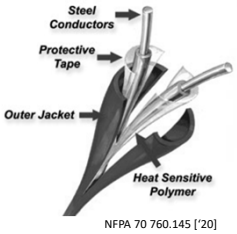
Support of Conductors

- Power-limited fire alarm circuit conductors shall not be attached to the ceiling assembly including the ceiling support wires
- Must provide independent means of support
- Includes Fire and Non-fire rated ceilings and floors

NFPA 70 300.11(B)(1)(2) ['20]

92

Current-Carrying Continuous Line-Type Fire Detectors



- **Application.** Listed continuous line-type fire detectors employed for both detection and carrying signaling currents shall be permitted to be used in power-limited circuits
- **Install** in accordance with 760.42 through 760.52 and 760.54

NFPA 70 760.145 ['20]

93

Wiring in Plenum Spaces

- Ducts specifically built to for environmental air only allowed for equipment associated with the HVAC.

NFPA 70 760.133(B) ['20]

- Allowed in spaces used for environmental air but not built for it (Plenum Ceilings) with proper cable or other approved manners.

NFPA 70 760.133(C) ['20]

94

Applications of Listed PLFA Cables

Plenum.

- Types FPLP, FPLR, FPL or FPLP-CI

Riser.

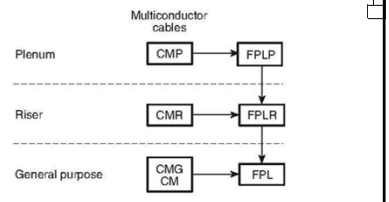
- FPLR,
- Cables installed in metal raceways or located in a fireproof shaft having firestops at each floor
- FPL cable in one and two family dwellings

Other Wiring Within Buildings

- FPL-CI, FPL, In raceways, less than 3 ft

95

Fire Alarm Cable Substitutions



Type CM—Communications wires and cables
Type FPL—Power-limited fire alarm cables

A → B Cable A shall be permitted to be used in place of Cable B. 26 AWG minimum

NFPA 70 Table 760.154(A) ['20}

96

Table 760.154 Cable Substitutions

Cable Type	References	Permitted Substitutions
FPLP	Table 760.154	CMP
FPLR	Table 760.154	CMP, FPLP, CMR
FPL	Table 760.154	CMP, FPLP, CMR, FPLR, CMG, CM

NFPA 70 Table 760.154 [‘20]

97

Fire Barriers

IBC 707.3.10 [‘18]

- Fire barriers, fire walls, or horizontal assemblies separating a single occupancy into separate fire areas or mixed occupancy shall follow Table 707.3.10:
  - 4-hour fire rating H1 & H-2
  - 3-hour fire rating F-1, H-3, & S-1
  - 2-hour fire rating A, B, E, F-2, H-4, H-5, I, M, R, & S-2
  - 1-hour fire rating U

98

Penetrations

IBC 714 [‘20]

- Penetrations of anything smoke or fire rated must be done with approved firestop assemblies Section 714 goes into detail on all types of fire or smoke barriers and individual requirements

99

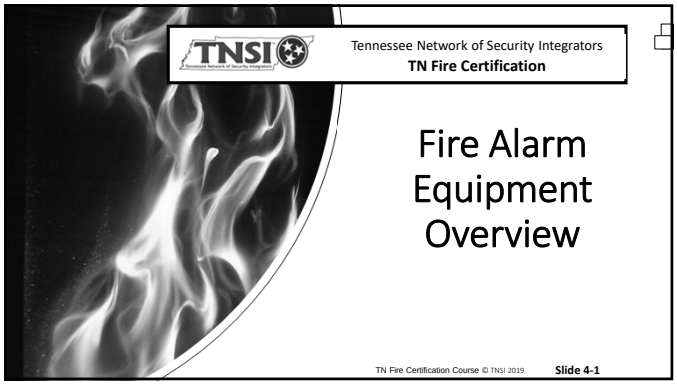
Firestop Systems and Devices Required

- Electrical installations in hollow spaces, vertical shafts, and ventilation or air-handling ducts shall be made so that the spread of fire or particles of combustion will not be increased
- Any penetration shall be firestopped using approved methods to maintain fire rating

NFPA 70 300.21 [‘20]

100

Fire Alarm Equipment Overview



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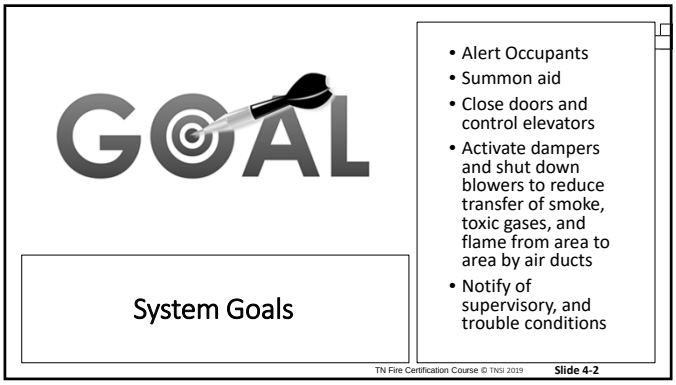

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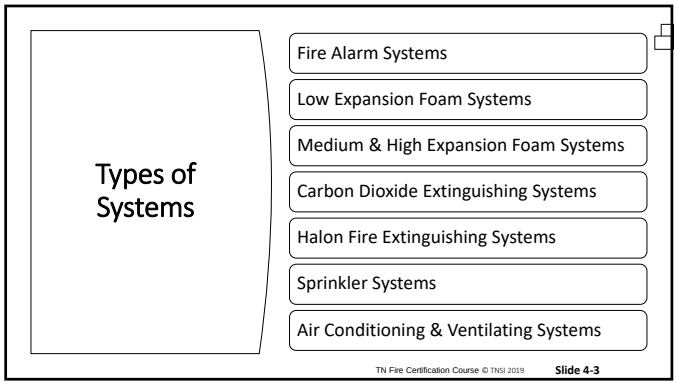

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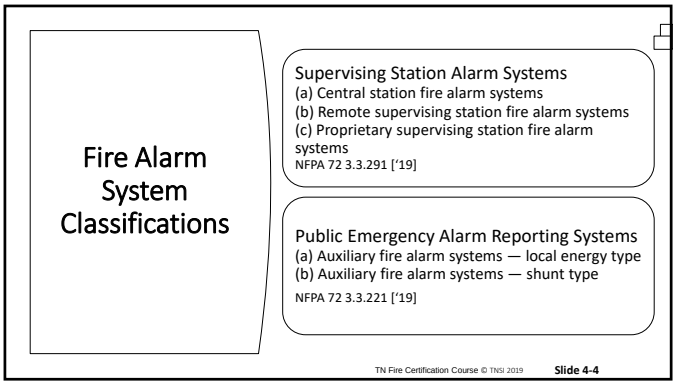

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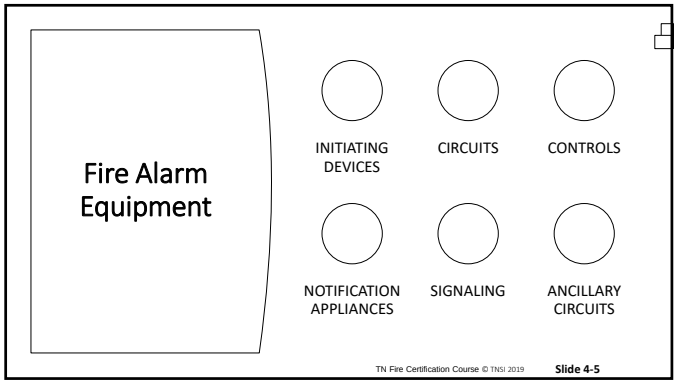

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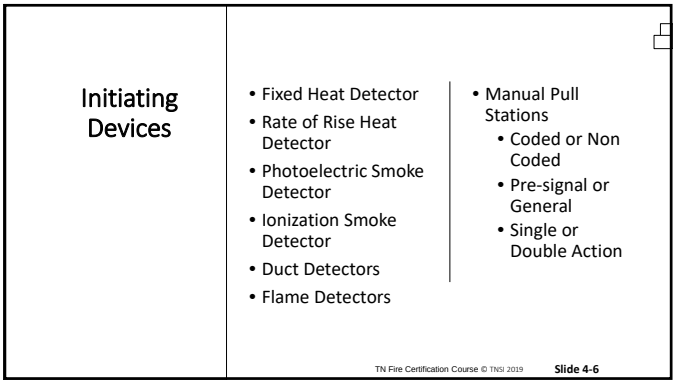

6

Fire Alarm Equipment Overview

Controls

- Receives inputs from automatic and manual fire alarm devices
- Might supply power to detection devices and to a transponder(s) or off-premises transmitter(s)
- Might also provide transfer of power to the notification appliances and transfer of condition to relays or devices connected to the control unit

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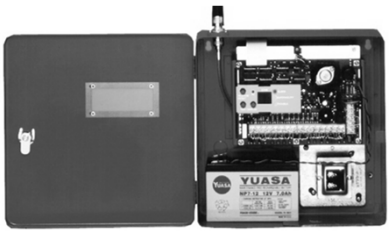
7

Notification Appliances

- Component such as a bell, horn, speaker, light, or text display that provides audible, tactile, or visible outputs, or any combination thereof

8



Signaling

- Communicating status remotely by electrical or other means
  - Digital Alarm Communicator System
  - Radio System
  - Performance Based

NFPA 72 26 ['19]

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9

Ancillary Circuits

CONTROLLED DOORS

DOOR CLOSERS

ELEVATOR RECALL

SMOKE MANAGEMENT

SMOKE DAMPERS

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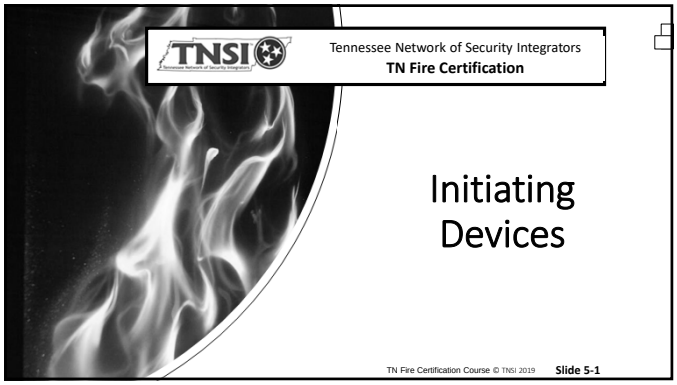
10

Initiating Devices



1

Applicable Standards

- NFPA 72- Chapter 17 [‘19]
- UL 38 - Manual Signaling Boxes for Fire Alarm Systems
- UL 217 - Single and Multiple Station Smoke Alarms
- UL 268 - Smoke Detectors for Fire Alarm Signaling Systems
- UL 521 - Heat Detectors for Fire Protective Signaling Systems
- UL 539 - Single and Multiple Station Heat Detectors
- UL 1730 - Smoke Detector Monitors and Accessories for Individual Living Units of Multifamily Residences and Hotel/Motel Rooms
- UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
- ADA- Americans with Disabilities Act

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2

General Requirements

- Where subject to mechanical damage, an initiating device shall be protected

NFPA 72 17.4.2.1 [‘19]

- Mechanical guards shall be listed for use with the detector

NFPA 72 17.4.2.2 [‘19]

- The protection shall not prevent the device from operating properly

NFPA 72 17.4.2.3 [‘19]

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3

Recessed Mounting

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

NFPA 72 17.5.1 [‘19]

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4

General Requirements

- Where required by other governing laws, codes, or standards, and unless otherwise modified by 17.5.3.1.1 through 17.5.3.1.5, total coverage of a building or a portion thereof, shall include all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, and other subdivisions and accessible spaces.
- NFPA 72 17.5.3.1 [‘19]

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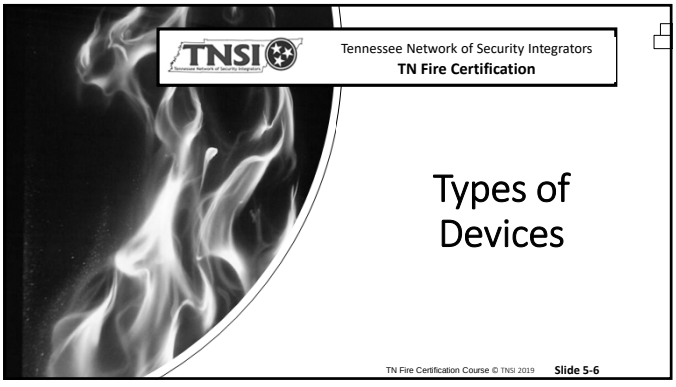


6

Single or Multiple Station Alarm Device

A device that senses a dangerous substances (i.e. smoke or CO) and alerts with a built in sounder. Does not rely on a control panel. It is either wired to the building power or is battery powered

If interconnected to other alarms to cause them to sound it is a Multiple Station Alarm

7

Analog Initiating vs Conventional Initiating Device

VS

- Analog initiating device that transmits a signal indicating varying degrees of condition. Smoke detector will show 'how much/how little' smoke is in the chamber
- Heat detectors and other detectors also available
- Conventional initiating device can only indicate an on–off condition

8

Combination Detector

- A device that either responds to more than one of the fire phenomenon or employs more than one operating principle to sense one of these phenomenon
- Typical examples are a combination of a heat detector with a smoke detector or a combination rate-of-rise and fixed-temperature heat detector
- Does **not** utilize a mathematical evaluation principle of signal processing more than a simple "or" function. i.e. Smoke **or** Heat will activate an alarm signal

9

Multi-Criteria Detector

- A device that contains multiple sensors that separately respond to physical stimulus such as heat, smoke, or fire gases, or employs more than one sensor to sense the same stimulus
- Uses microprocessor-based logic to process signals from both detectors
- **Both/all sensors must trip to activate an alarm**
- Sends a **single alarm** signal to the panel – not from each sensor in the detector
- The sensor output signal is mathematically evaluated (either at the device or at the panel) to determine when an alarm signal is warranted
- i.e. Smoke **and** Heat will generate a single alarm signal

10

Multi-Sensor Detector

A DEVICE THAT CONTAINS MULTIPLE SENSORS THAT SEPARATELY RESPOND TO PHYSICAL STIMULUS SUCH AS HEAT, SMOKE, OR FIRE GASES, OR EMPLOYS MORE THAN ONE SENSOR TO SENSE THE SAME STIMULUS

USES MICROPROCESSOR-BASED LOGIC TO PROCESS SIGNALS FROM BOTH DETECTORS

Capable of generating **multiple alarm signals** from any one of the sensors employed in the design, independently or in combination

THE SENSOR OUTPUT SIGNAL IS MATHEMATICALLY EVALUATED (EITHER AT THE DEVICE OR AT THE PANEL) TO DETERMINE WHEN AN ALARM SIGNAL IS WARRANTED

I.E. SMOKE SENDS AN ALARM SIGNAL, HEAT SENDS A SEPARATE ALARM SIGNAL, ETC.

11

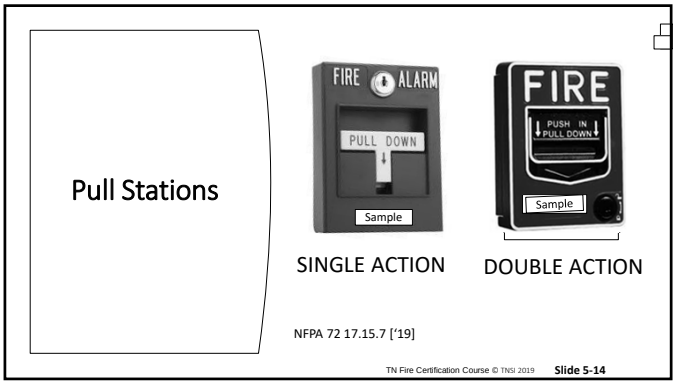
COMMENTARY TABLE 3.1 *Comparison of Combination, Multi-Criteria, and Multi-Sensor Detectors*

Detector Type	*Features*
Combination	• Multiple sensors • Does not utilize a mathematical evaluation principle, just a simple "or" function • Multiple listings
Multi-criteria	• Multiple sensors • Mathematically evaluated • Only one alarm signal • Single listing
Multi-sensor	• Multiple sensors • Mathematically evaluated • Capable of generating multiple alarm signals • Multiple listings

Combo vs Multi-Sensor vs Multi-Criteria

12

13



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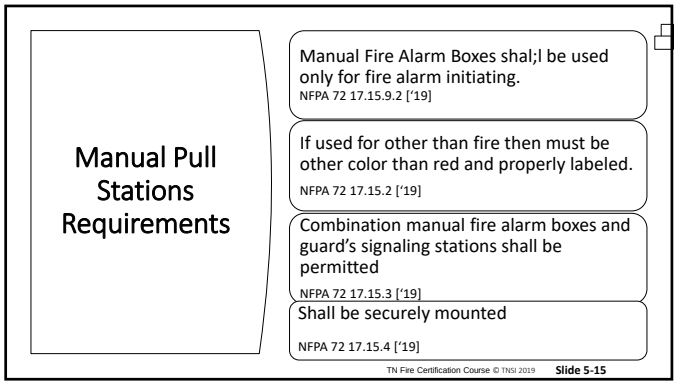

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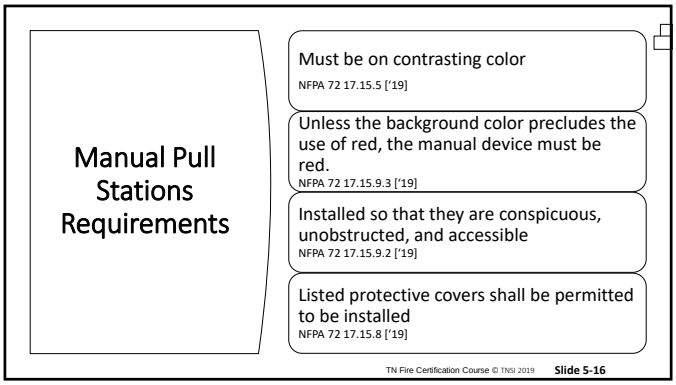

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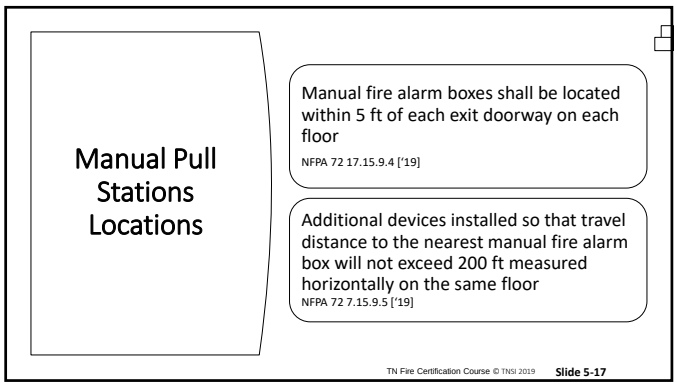

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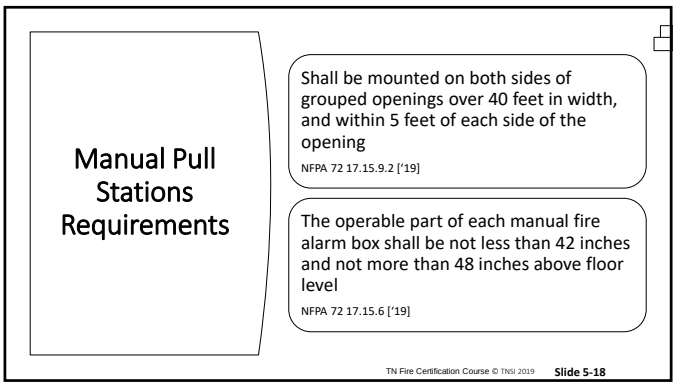

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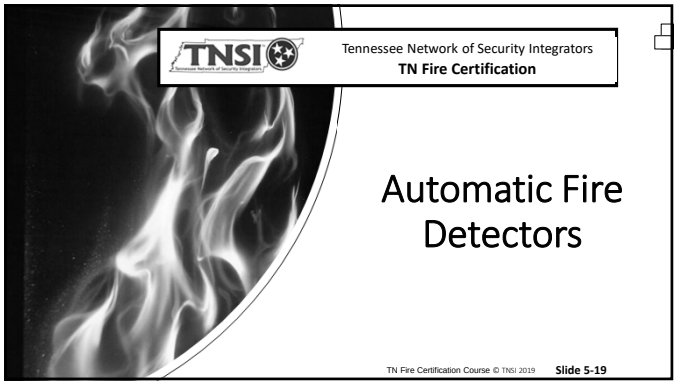

19

Detector Requirements

This section will cover general requirements that apply to both Smoke and Heat Detectors

Specific requirements for Heat Detectors and Smoke Detectors will be in their own sections

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20

Spacing Guidelines

Two ways to determine spacing: Prescriptive Performance Based

Prescriptive means you follow the guidelines in NFPA 72 Chapter 17

Performance based is developed by a Fire Engineer following the Guidelines in Annex B & signed off by the AHJ
NFPA 72 17.3 & 17.6.3.8 ['19]

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21

Partitions

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

NFPA 72 17.5.2 ['19]

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22

Smooth Ceiling

- A ceiling surface uninterrupted by continuous projections, such as solid joists, beams, or ducts, extending more than 4 in. below the ceiling surface

NFPA 72 3.3.40.3 ['19]

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23

Joist vs Beam Ceilings

Solid Joist	Beam
Solid members projecting down from the ceiling more than 4 inches and spaced 36 inches or less NFPA 72 3.3.40.4 ['19]	Solid members projecting down from the ceiling more than 4 inches and spaced more than 36 inches NFPA 72 3.3.40.1 ['19]

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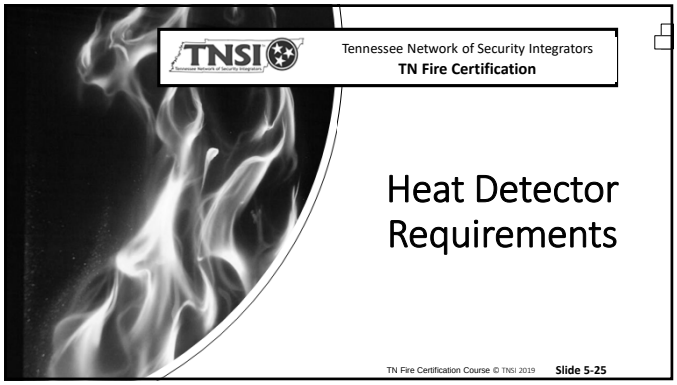
24



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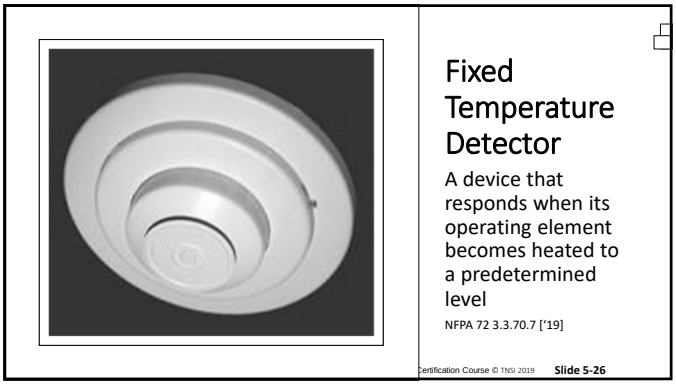

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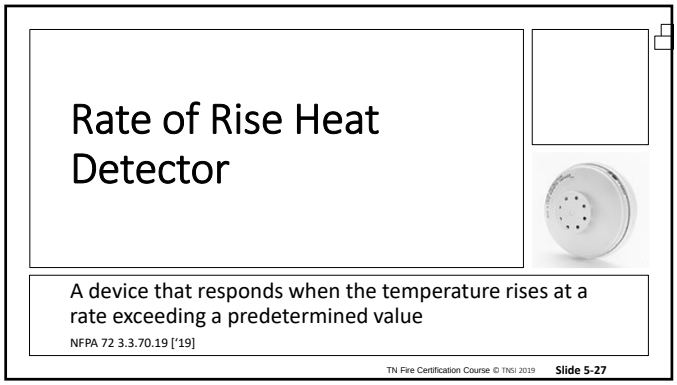

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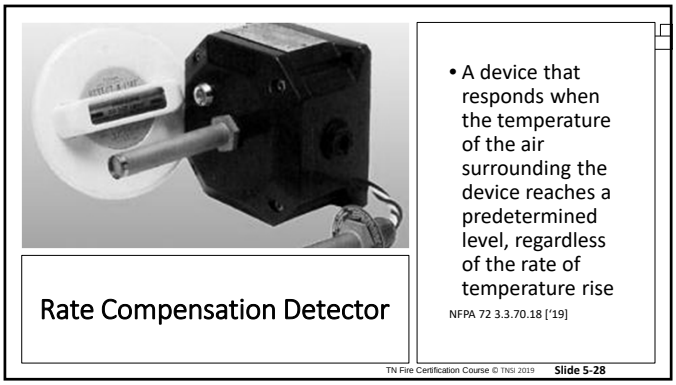

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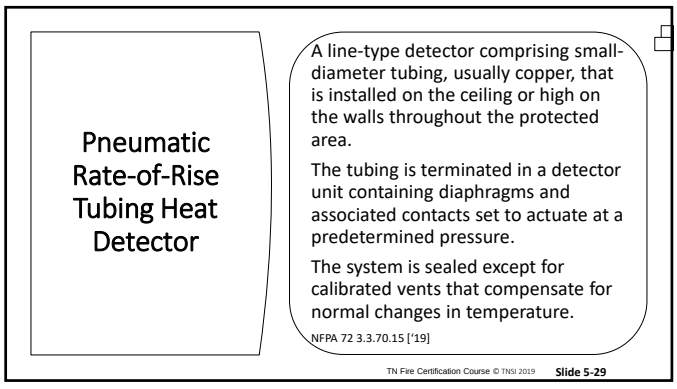

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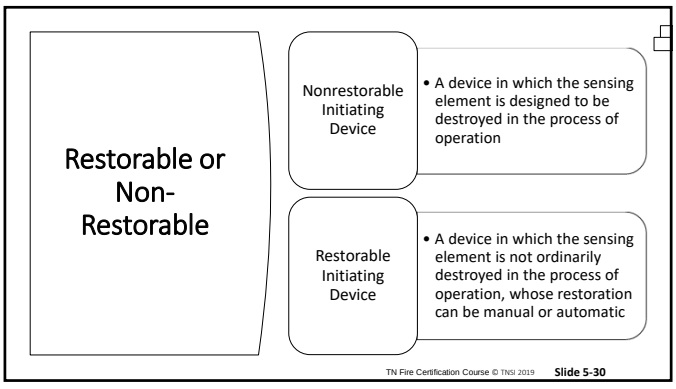


30

Heat Detector Temperature Color Coding

Heat-sensing fire detectors of the fixed-temperature or rate-compensated, spot-type shall be classified as to the temperature of operation and marked with a color code

- Ring on the surface of the detector
- Temperature rating in numerals at least 3⁄8 in. high

Exception: Heat-sensing fire detectors where the alarm threshold is field adjustable and that are marked with the temperature range

NFPA 72 17.6.2.2.1 ['19]

31

Heat Detector Temperature Color Code

Classification	Range °F	Max Ceiling Temp	Color Code
Low	100-134	80	none
Ordinary	135-174	115	none
Intermediate	175-249	155	White
High	250-324	230	Blue
Extra high	325-399	305	Red
Very extra high	400-499	380	Green
Ultra high	500-575	480	Orange

32

Smooth Ceiling Spacing

Listed	0.7 Rule
• Distance between detectors shall not exceed listed spacing • The first detector shall not be further than 1\2 the listed spacing from the wall	All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the listed spacing (0.7*S*)

NFPA 72 17.6.3.1.1 ['19]

33

Spot Type Detector Mounting

Spot type heat sensing detectors shall be on the ceiling more than 4 inches from the wall or on the wall between 4 inches and 12 inches below the ceiling.

NFPA 72 17.6.3.1.3.1 ['19]

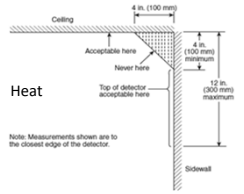


FIGURE A.17.6.3.1.3.1 Example of Proper Mounting for Heat Detectors.

34

Line-type Heat Detectors

Shall be located on the ceiling or on the sidewalls not more than 20 in. from the ceiling

NFPA 72 17.6.3.1.3.2 ['19]

35

Heat Detector High Ceilings

On ceilings 10 ft to 30 ft high, heat detector linear spacing shall be reduced in accordance with Table 17.6.3.5.1 prior to any additional reductions for beams, joists, or slope, where applicable

NFPA 72 17.6.3.5.1 ['19]

36

Table 17.6.3.5.1 Heat Detector Spacing Reduction Based on Ceiling Height

Ceiling Height Above	Up to and Including	Multiply Listed Spacing by	Ceiling Height Above	Up to and Including	Multiply Listed Spacing by
0	10	1.00	18	20	0.64
10	12	0.91	20	22	0.58
12	14	0.84	22	24	0.52
14	16	0.77	24	26	0.46
16	18	0.71	26	28	0.40
			28	30	0.34

37

High Ceiling Spacing Exceptions

Table 17.6.3.5.1 shall not apply to the following detectors, which rely on the integration effect:

- Line-type electrical conductivity detectors
- Pneumatic rate-of-rise tubing heat detectors

In these cases, the manufacturer's recommendations shall be followed for appropriate alarm point and spacing

NFPA 72 17.6.3.5.2 ['19]

38

Peak Spacing

First row must be placed at or within 36 inches of shed or peak
NFPA 72 17.6.3.4.2.1 ['19]

Slopes less than 30 degrees detectors space according to the height at the peak
NFPA 72 17.6.3.4.1.1 ['19]

Slopes 30 degrees or greater. First row spaced by that height
Subsequent rows may be spaced at average height of the ceiling
NFPA 72 17.6.3.4.1.2 ['19]

39

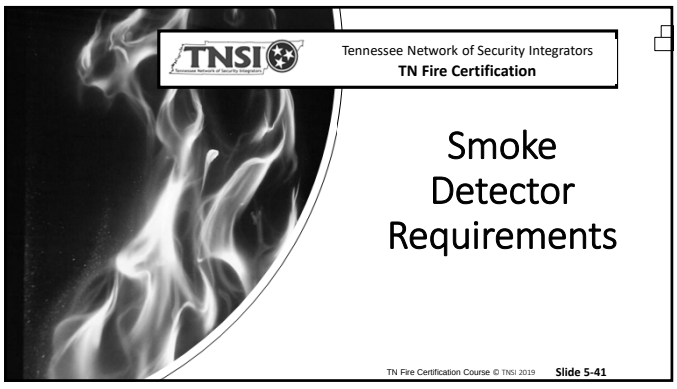
Joist & Beam Spacing

Joist
Reduce listed spacing by 50% running across the joist and mount on bottom of joist
NFPA 72 17.6.3.2 ['19]

Standard Beams
Reduce the listed spacing by 66% running across the beam. Nothing specified about where it has to be mounted
NFPA 72 17.6.3.3.1.2 ['19]

Beams more than 18 inches and more than 8 feet center to center treat each bay as separate area
NFPA 72 17.6.3.3.1.3 ['19]

40



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Smoke Detector Requirements

41

Prevent Smoke Detector Nuisance Alarms

- The selection and placement of smoke detectors shall take into account both the performance characteristics of the detector and the areas into which the detectors are to be installed to prevent nuisance and unintentional alarms or improper operation after installation

NFPA 72 17.7.1.7 ['19]

42

Smoke Detector Design Limitations

- Unless specifically designed and listed for the expected conditions, smoke detectors shall not be installed if any of the following ambient conditions exist:
  1. Temperature below 32°F
  2. Temperature above 100°F
  3. Relative humidity above 93 percent
  4. Air velocity greater than 300 ft/min

NFPA 72 17.4.1.8 ['19]

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43

Smoke Detectors & Construction Sites

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

NFPA 72 17.7.1.12.1 ['19]

Where detectors are installed but not operational during construction, they shall be protected from construction debris, dust, dirt, and damage according to manufacture's instructions and listed sensitivity verified or replaced before final acceptance test

NFPA 72 17.7.1.12.2 ['19]

Detectors shall not be installed until after the construction cleanup of all trades is complete and final

NFPA 72 17.7.1.12.2 ['19]

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44

Smoke Detector Design Considerations

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

NFPA 72 17.7.1.7 ['19]

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

NFPA 72 17.7.1.11 ['19]

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45

Locations to Avoid For Smoke Detectors

- Excessively Dusty or Dirty Areas
- Outdoors
- Wet or Excessively Humid Areas, or next to bathrooms with showers
- Over ashtrays or where people will smoke
- Extreme Cold or Hot Environments at temperatures above or below the operating range of the detector

- System Sensor System Smoke Application Guide

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46

Locations to Avoid For Smoke Detectors

- Areas with Combustion Particles- (ovens and burners; garages)
- Manufacturing Areas- battery rooms, or other areas where substantial quantities of vapors, gases, or fumes may be present
- Fluorescent Light Fixtures- Electrical noise generated by fluorescent light fixtures may cause unwanted alarms - Install detectors at least 1 foot away

System Sensor System Smoke Application Guide

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Smoke Detector Sensitivity

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

Spot type moke detectors that have provision for field adjustment of sensitivity shall have an adjustment range of not less than 0.6 percent per foot obscuration

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

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

NFPA 72 17.72 ['19]

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Smoke Detector Location & Spacing

- The location and spacing of smoke detectors shall be based upon
  - the anticipated smoke flows due to the plume and ceiling jet produced by the anticipated fire
  - as well as any pre-existing ambient air flows that could exist in the protected compartment

NFPA 72 17.7.3.1.1 ['19]

49

Smoke Detector Design Factors

- Ceiling shape and surface
- Ceiling height
- Configuration of contents in the protected area
- Combustion characteristics & probable equivalence ratio of the anticipated fires involving the fuel loads within the protected area
- Compartment ventilation
- Ambient temperature, pressure, altitude, humidity, and atmosphere

NFPA 72 17.7.3.1.2 ['19]

50

Locate Smoke Detector Near Hazard

If the intent is to protect against a specific hazard, the detector(s) shall be permitted to be installed closer to the hazard in a position where the detector can intercept the smoke

NFPA 72 17.7.3.1.3 ['19]

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Spot Smoke Detector Requirements

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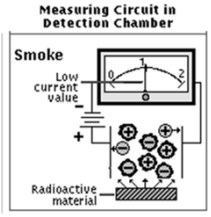
Ionization Smoke Detector

- A small amount of radioactive material is used to ionize the air between two differentially charged electrodes to sense the presence of smoke particles
- Smoke particles entering the ionization volume decrease the conductance of the air by reducing ion mobility
- The reduced conductance signal is processed and used to convey an alarm condition when it meets preset criteria

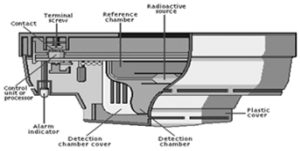
53

Ionization Smoke Detector Normal Situation

Measuring Circuit in Detection Chamber



Current Flows Thru Chamber



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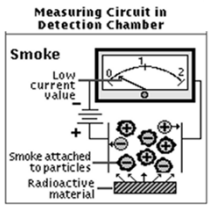
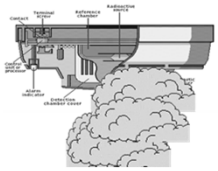
Current Blocked

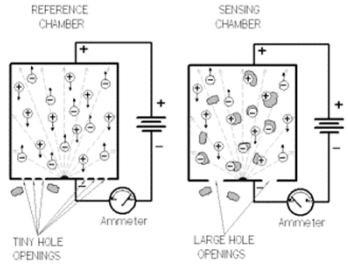




Ionization Smoke Detector
Normal Situation- Alarm

55

Ionization Smoke Detector Dual Chamber Detector

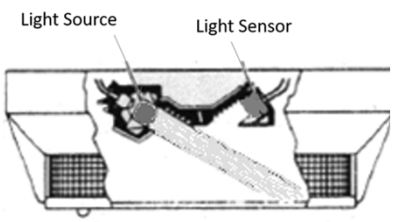


56

Photoelectric Chamber Detector

- A light source and a photosensitive sensor are arranged so that the rays from the light source do not normally fall onto the photosensitive sensor
- When smoke particles enter the light path, some of the light is scattered by reflection and refraction onto the sensor
- The light signal is processed and used to convey an alarm condition when it meets preset criteria

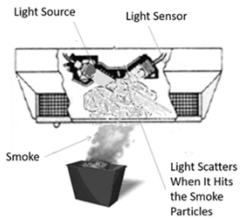
57



Photoelectric Smoke Detector
Normal Situation

- Pulsed Light is sent into Chamber
- The light normally avoids the sensor

58



Photoelectric Smoke Detector
Alarm Situation

- Smoke reflects light into the sensor
- The reflected light causes the detector to alarm

59

Proper Detector Mounting

Spot type smoke detectors shall be located anywhere on the ceiling or, if on the sidewall, between the ceiling and 12 inches down from the ceiling to the top of the detector.

NFPA 72 17.7.3.2.1 [‘19]

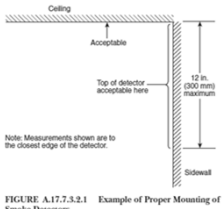


FIGURE A.17.7.3.2.1 Example of Proper Mounting of Smoke Detectors.

60

Detector Orientation

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

61

Special Considerations Spot-Type Detectors

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

NFPA 72 17.7.6.1.1 ['19]

62

Raised Floors and Suspended Ceilings

Spaces beneath raised floors and above suspended ceilings shall be treated as separate rooms for smoke detector spacing purposes

Detectors installed beneath raised floors or above suspended ceilings, or both, including raised floors and suspended ceilings used for environmental air, shall not be used in lieu of providing detection within the room

NFPA 72 17.7.3.5 ['19]

63

Smooth Ceiling Spacing

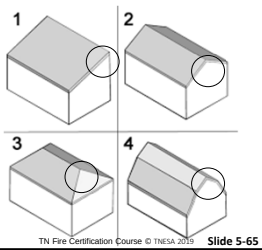
Prescriptive	0.7 Rule
• Distance between detectors shall not exceed listed spacing • The first detector shall not be further than 1\2 the listed spacing from the wall	All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the listed spacing (0.7*S*)

NFPA 72 17.6.3.1.1 ['19]

64

Peaked and Shed Type Ceilings

- Both Peaked and Shed type ceilings require a detector within 36 inches of the peak. Then follow standard spacing for that ceiling type.



Where is the smoke going to travel?

NFPA 72 17.7.3.3 & 17.7.3.4 ['19]

65

Joist and Beam Ceilings

For spot type smoke detectors - beams & joist are equivalent for spacing guidelines

NFPA 72 17.7.3.2.4.1 ['19]

The code gives specific rules for different types of beamed and joist ceilings, both flat and sloped

NFPA 72 17.7.3.2.4.2 through 17.7.3.2.4.6. ['19]

66

Smoke Detectors for Control of Smoke Spread

Shall be classified as:

- Area detectors that are installed in the related smoke compartments
- Detectors that are installed in the air duct systems
- Video image smoke detection that is installed in related smoke compartments

Shall not be used as a substitute for open area protection

NFPA 72 17.5.2 ['19]

67

Smoke Detectors for Door Release Service

Smoke detectors that are covering the room or corridor hall be permitted to be used for door release

NFPA 72 17.7.5.6.1 ['19]

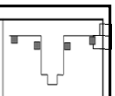
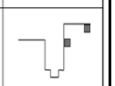
Where smoke door release is accomplished directly from the smoke detector(s), the detector(s) shall be listed for releasing service

NFPA 72 17.7.5.6.3 ['19]

68

Detector Location Requirements for Wall Sections Ceiling or Wall Mounted

Smoke Detectors For Door Release

Both Sides Even 0-24 inch deep	1 detector either side	
Over 24 inches deep one side only	1 detector higher side	
Over 24 inches on both sides	1 detector both sides	
Over 60 inches on either side	May require additional detectors	

NFPA 72 17.7.5.6.5.1 [19]

69

Smoke Detector High Air Movement Areas

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

Smoke detector spacing shall be in accordance with Table 17.7.6.3.3.2 or Figure 17.7.6.3.3.2

- *Exception: Air-sampling or projected beam smoke detectors installed in accordance with the manufacturer's documented instructions*

NFPA 72 17.7.6.3 ['19]

70

Smoke Detector Spacing Based on Air Movement

Table 17.7.6.3.3.2

Minutes per Air Change	Air Changes per Hour	Spacing per Detector ft²
1	60	125
2	30	250
3	20	375
4	15	500
5	12	625

Minutes per Air Change	Air Changes per Hour	Spacing per Detector ft²
6	10	750
7	8.6	875
8	7.5	900
9	6.7	900
10	6	900

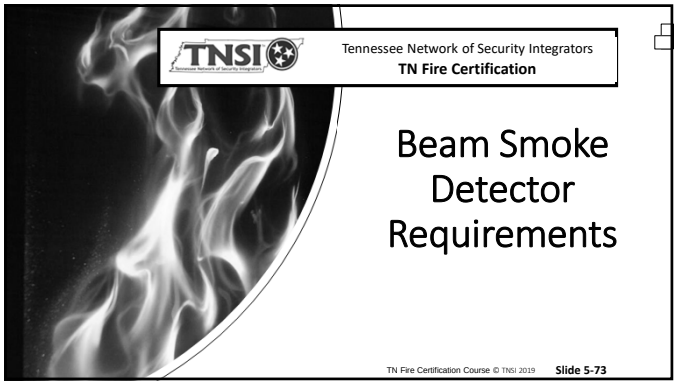
71

Smoke Detector HVAC Mechanical Rooms

Where HVAC mechanical rooms are used as an air plenum for return air, the spacings of smoke detectors shall not be required to be reduced based on the number of air changes

NFPA 72 17.7.6.3.4 ['19]

72



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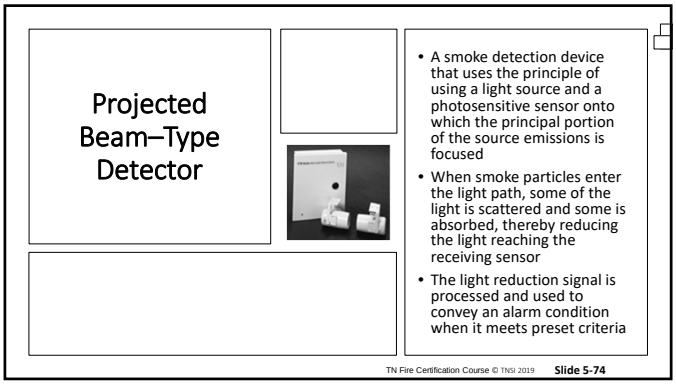

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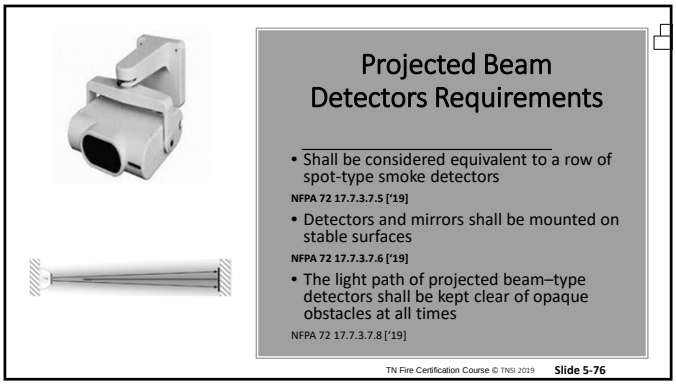

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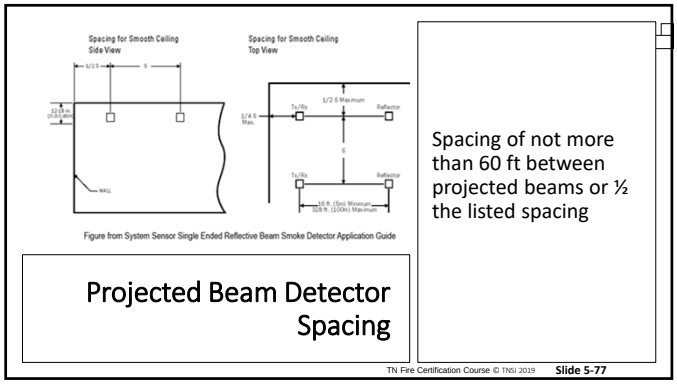

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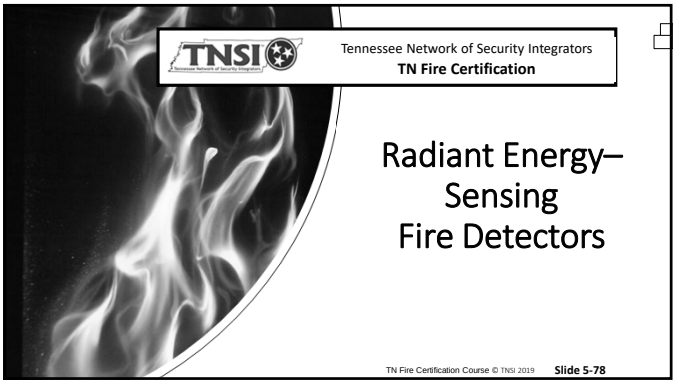


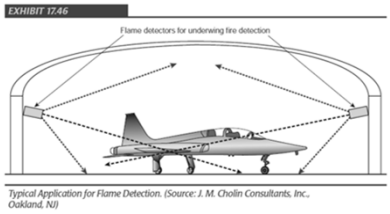
78

Radiant Energy–Sensing Fire Detectors

- The type and quantity of radiant energy–sensing fire detectors shall be determined based on the performance characteristics of the detector and an analysis of the hazard, including the burning characteristics of the fuel, the fire growth rate, the environment, the ambient conditions, and the capabilities of the extinguishing media and equipment

NFPA 72 17.8.2.1 ['19]

79



Detector Selection

- The selection of the radiant energy–sensing detectors shall be based on the following:
  1. Matching of the spectral response of the detector to the spectral emissions of the fire or fires to be detected
  2. Minimizing the possibility of spurious nuisance alarms from non-fire sources inherent to the hazard area
- i.e. What is the potential source of the fire?
- Diesel fuel? Gasoline? Wood products? Jet Fuel?

80

Flame & Ember/Spark Detectors

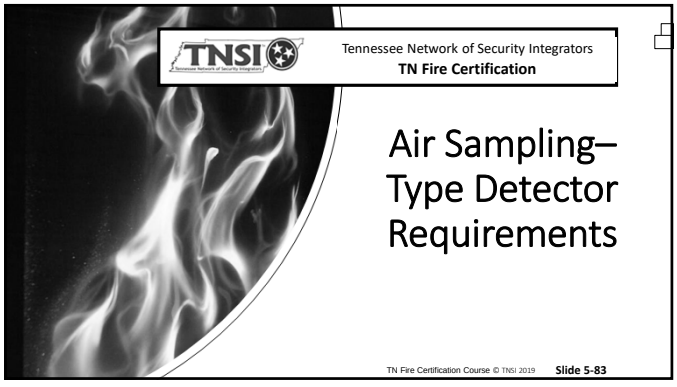
- The location and spacing of detectors shall be the result of an engineering evaluation that includes the following:
  - Size of the fire or ember that is to be detected
  - Fuel involved
  - Sensitivity of the detector
  - Field of view of the detector
  - Distance between the fire and the detector
  - Radiant energy absorption of the atmosphere
  - Presence of extraneous sources of radiant emissions
  - Purpose of the detection system
  - Response time required

NFPA 72 17.8.3.2.1 and 17.8.3.3.1 ['19]

81

IR/UV Detectors - Examples

82



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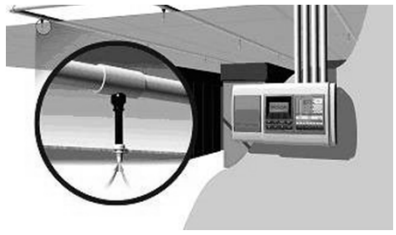
Air Sampling–Type Detector Requirements

83



Air Sampling–Type Detector

- A detector that consists of a piping or tubing distribution network that runs from the detector to the area(s) to be protected
- An aspiration fan in the detector housing draws air from the protected area back to the detector through air sampling ports, piping, or tubing
- At the detector, the air is analyzed for fire products

84

Air Sampling Detector

- Each **sampling port** of an air sampling–type smoke detector shall be treated as a **spot-type detector** for the purpose of location and spacing
- **NFPA 72 17.3.6.1.1 [‘19]**
- Maximum air sample transport time from the farthest sampling point shall not exceed **120 seconds**
- **NFPA 72 17.7.3.6.2.1 [‘19]**

85

Air Sampling Detector

- Sampling system piping shall be conspicuously identified as “SMOKE DETECTOR SAMPLING TUBE — DO NOT DISTURB,” as follows:
  1) At changes in direction or branches of piping
  2) At each side of penetrations of walls, floors, or other barriers
  3) At intervals on piping that provide visibility within the space, but no greater than 20 ft

NFPA 72 17.7.3.6.2.5 [‘19]

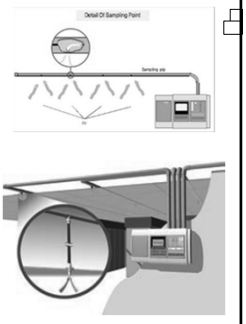
86

Air Sampling Detector

- Shall give a trouble signal if the airflow is outside the manufacturer’s specified range

  NFPA 72 17.7.3.6.1.2 [‘19]
- The sampling ports and in-line filter, if used, shall be kept clear in accordance with the manufacturer’s documented instructions

  NFPA 72 17.7.3.6.1.3 [‘19]



87

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Other Detector Requirements

88

Video Smoke or Flame Detection

- Based on the computer analysis of video images provided by standard CCTV cameras
- Identifies the particular motion patterns of smoke or flame

89

Video Image Flame Detection

This will be a Performance based design as the code doesn’t provide spacing guidelines

All components, hardware and software must be listed for this purpose

NFPA 72 17.8.5.1 [‘19]

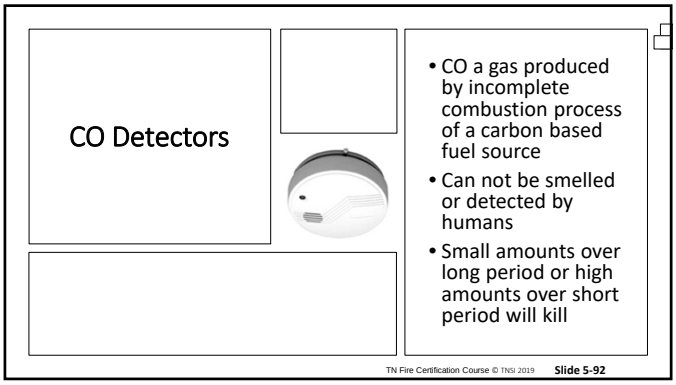
Video images from cameras part of the system shall be permitted to transmit to other systems

NFPA 72 17.8.5.3 [‘19]

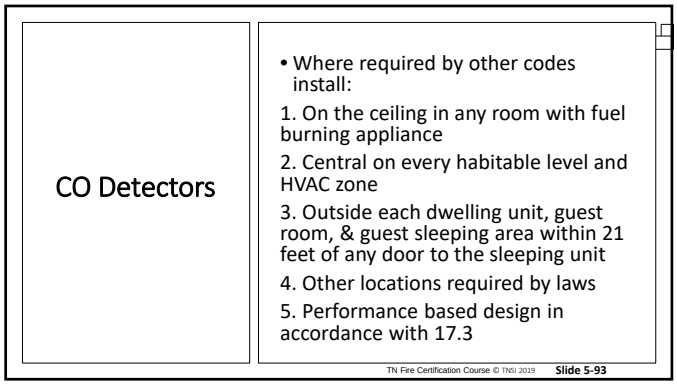
90


TNESA
Tennessee Electronic Security Association
TN Fire Certification
CO Detectors
TN Fire Certification Course © TNSI 2019
Slide 5-91

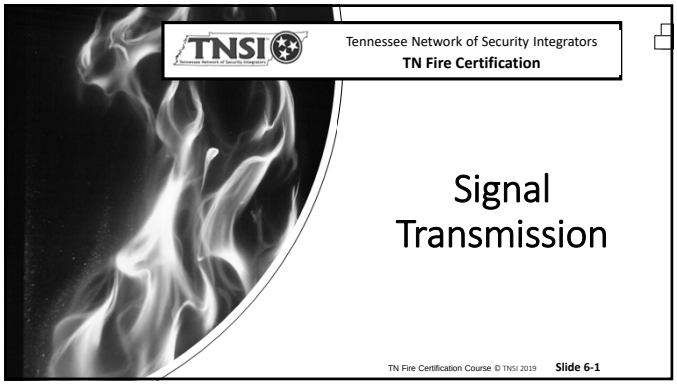
91


CO Detectors
• CO a gas produced by incomplete combustion process of a carbon based fuel source
• Can not be smelled or detected by humans
• Small amounts over long period or high amounts over short period will kill
TN Fire Certification Course © TNSI 2019
Slide 5-92

92


CO Detectors
• Where required by other codes install:
1. On the ceiling in any room with fuel burning appliance
2. Central on every habitable level and HVAC zone
3. Outside each dwelling unit, guest room, & guest sleeping area within 21 feet of any door to the sleeping unit
4. Other locations required by laws
5. Performance based design in accordance with 17.3
TN Fire Certification Course © TNSI 2019
Slide 5-93

93



1

Applicable Standards	• NFPA 72- Chapters 12 and 23 • NFPA Article 760 • UL 497B - Standard for Protectors for Data Communications and Fire-Alarm Circuits • UL 1424 - Cables for Power-Limited Fire-Alarm Circuits • UL 1425 - Cables for Non-Power-Limited Fire-Alarm Circuits

TN Fire Certification Course © TNSA 2019 **Slide 6-2**

2

Transmission Methods	**Initiating Device Circuits (IDC)**
	Multiplex/signaling line circuits (SLC)
	Notification Appliance Circuits (NAC)
	Low Power Radio

TN Fire Certification Course © TNSI 2019 **Slide 6-3**

3

Cabling Class	**Class A, B, C, D, E, N, & X** **NFPA 72 12.3 ['19]**
	Survivability Level 0 ,1 , 2, & 3 NFPA 72 12.4 ['19]
	Shared Pathway Level 0, 1, 2 ,& 3 NFPA 72 12.5 ['19]

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4

Integrity of Circuits	• Unless otherwise permitted or required by 12.3.1 through 12.3.7 and 12.6.3 through 12.6.13, all circuits shall be monitored for integrity so that a single open or ground fault will be indicated within 200 seconds
NFPA 72 12.6.1 ['19]	

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5

Grounding	• All systems shall test free of grounds. • *Exception: Parts of circuits or equipment that are intentionally and permanently grounded to provide ground-fault detection, noise suppression, emergency ground signaling, and circuit protection grounding shall be permitted*
NFPA 72 12.2.4 ['19]	

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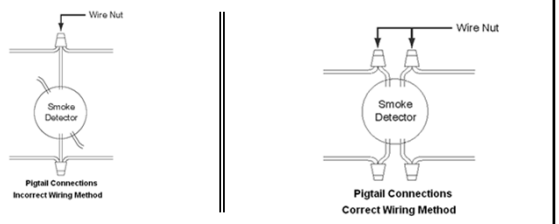
6

Device Wiring



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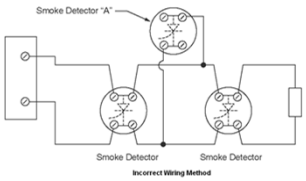
7

Device Wiring



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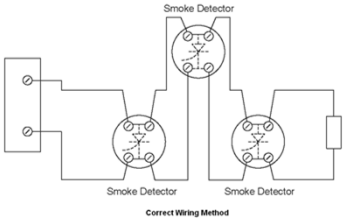
Device Wiring



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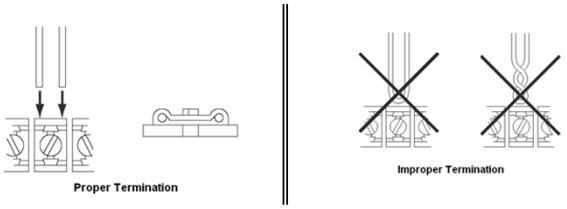
9

Proper Termination



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10

Minimize SLC Circuit Loss

On a SLC circuit a single fault on a pathway shall not cause the loss of the devices in more than one zone

NFPA 72 23.6.1 [‘19]

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11

Annunciation

An open or ground condition shall result in the annunciation of a trouble signal at the protected premise within 200 seconds

NFPA 72 12.6.2 [‘19]

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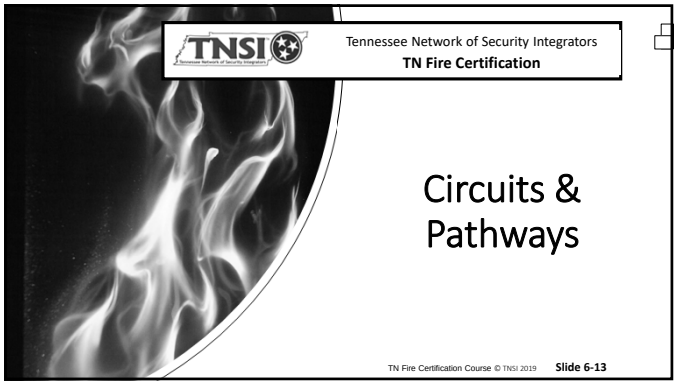
12



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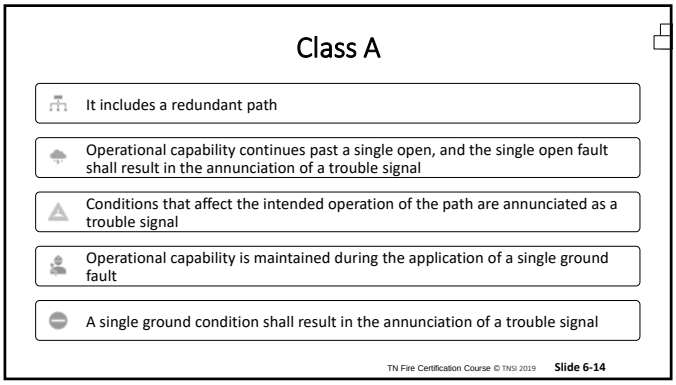

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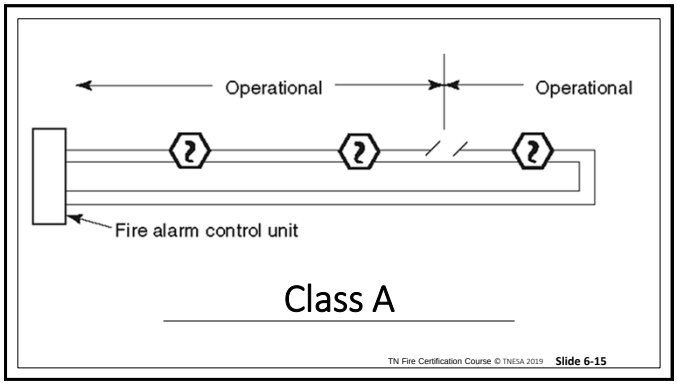

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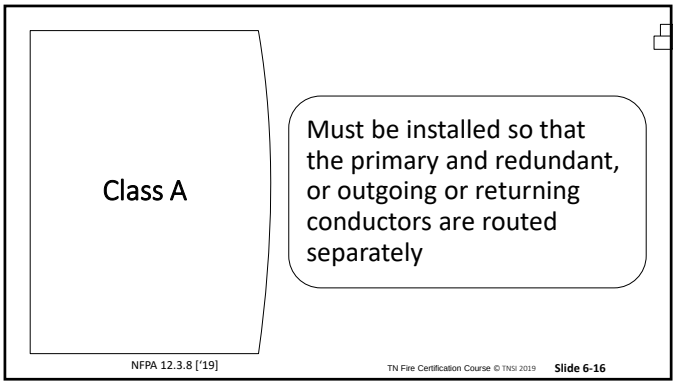

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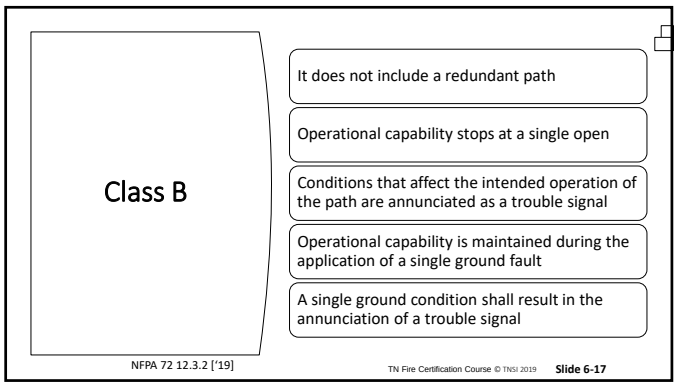

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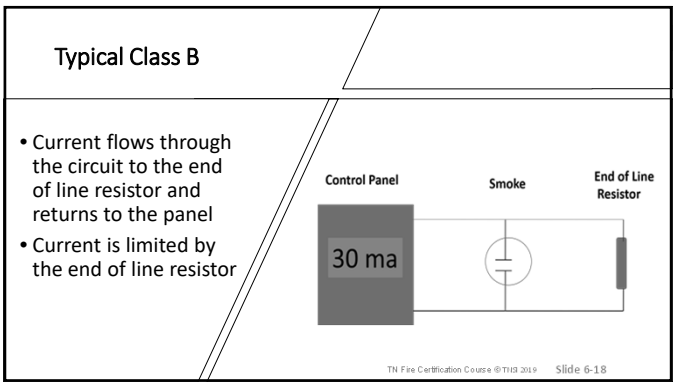


18

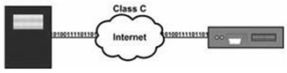
Class C

It includes one or more pathways where operational capability is verified via end-to-end communication, but the integrity of individual paths is not monitored

A loss of end-to-end communication is annunciated

NFPA 72 12.3.3 [‘19]

19



Class C Examples

Fire control unit or supervisory station connections to a wired or wireless LAN, WAN, or Internet

20

Class D

- A pathway shall be designated as Class D when it has **fail-safe operation**, where no fault is annunciated, but the intended operation is performed in the event of a pathway failure
  - Examples include circuits that provide power to door holders, where interruption of the power results in the door closing or that provide power to locking hardware that release upon an open circuit or contact operation within the FACU

NFPA 72 12.3.4 [‘19]

21

Class E

- A pathway shall be designated as Class E when it is not monitored for integrity
  - Example: Circuits that provide power to an air compressor jockey pump for a large dry sprinkler system

NFPA 72 12.3.5 [‘19]

22

Class N

Includes two or more pathways where primary and redundant path shall be verified through communications.

Loss of communications annunciated as trouble.

Single open, ground, short, or combination shall not affect other pathway.

Conditions that affect primary and redundant pathways annunciated as trouble.

Primary and redundant pathways shall not share traffic over same segment.

NFPA 72 12.3.6 [‘19]

23

Class N

When used as an SLC Loop there are many additional requirements listed in NFPA 72 12.6.2 [‘19].

Must be installed so that the primary and redundant, or outgoing or returning conductors are routed separately.

NFPA 12.3.8 [‘19]

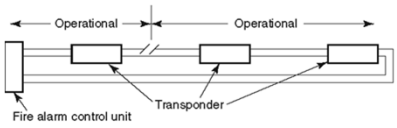
24

Class X

NFPA 72 12.3.7 [‘19]

- Includes a redundant path
- Operational capability continues past
  - a single open, and the single open fault shall result in the annunciation of a trouble signal
  - a single short-circuit, and the single short-circuit fault shall result in the annunciation of a trouble signal
  - a combination open fault and ground fault
- Conditions that affect the intended operation of the path are annunciated as a trouble signal
- Operational capability is maintained during the application of a single ground fault
- A single ground condition shall result in the annunciation of a trouble signal

25



- Example: Addressable fire alarm systems

Class X

26

Class X

NFPA 72 12.3.8 [‘19]

Must be installed so that the primary and redundant, or outgoing or returning onductors are routed separately

27

Pathway Survivability

NFPA 72 12.4 [‘19]

- Level 0 - None
- Level 1 - In sprinklered buildings with pathways in metal raceways
- Level 2 - one or more of the following:
  - 2-hour fire-rated circuit integrity (CI) cable
  - 2-hour fire-rated cable system
  - 2-hour fire-rated enclosure or protected area
  - 2-hour performance alternatives approved by the AHJ

28

Pathway Survivability

NFPA 72 12.4 [‘19]

- Level 3 - In sprinklered buildings with one or more of the following:
- Level 3 - In sprinklered buildings with one or more of the following:
- 2-hour fire-rated circuit integrity (CI) cable
- 2-hour fire-rated cable system
- 2-hour fire-rated enclosure or protected area
- 2-hour performance alternatives approved by the AHJ

29

Shared Pathway Designations

NFPA 72 12.5 [‘19]

- **Level 0 -** shall not be required to segregate or prioritize life safety data from non–life safety data
- **Level 1.** shall not be required to segregate life safety data from non–life safety data, but shall prioritize all life safety data over non–life safety data
- **Level 2.** shall segregate all life safety data from non–life safety data
- **Level 3.** shall use equipment that is dedicated to the life safety system

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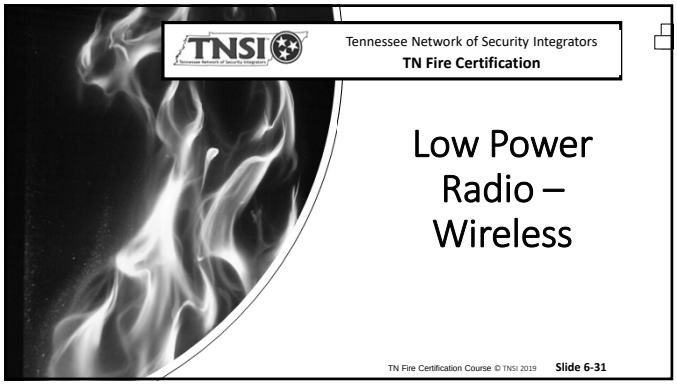

31

Low Power Radio – Wireless

- Any device that communicates with associated control/receiving equipment by low-power radio signals
- **Listing Requirements**
  - Compliance with Section 23.16 shall require the use of low-power radio equipment specifically listed for the purpose

NFPA 72 23.19.1 [‘19]

32

Low Power Radio – Power Supplies

NFPA 72 23.16.2.1 [‘19]

- A primary battery (dry cell) shall be permitted to be used as the sole power source of a low-power radio transmitter where all of the following conditions are met:
  - Each transmitter shall serve only one device and shall be individually identified at the receiver/control unit.
  - The battery shall be capable of operating the low-power radio transmitter and its associated device for not less than 1 year before the battery depletion threshold is reached.
  - Low battery signal must be transmitted before it cannot send 7 days of trouble signals plus one non-trouble signal.

33

Low Power Radio – Power Supplies Continued

NFPA 72 23.16.2.1 [‘19]

- This signal shall be distinctive from alarm, supervisory, tamper, and trouble signals; shall visibly identify the affected low-power radio transmitter; and, when silenced, shall automatically re-sound at least once every 4 hours.
- Catastrophic (open or short) battery failure shall cause a trouble signal identifying the affected low-power radio transmitter at its receiver/control unit. When silenced, the trouble signal shall automatically re-sound at least once every 4 hours.
- Failure of the battery in a transmitter/repeater shall not affect any other transmitter/receiver.

34

Low Power Radio – Power Supplies

NFPA 72 23.16.2.2 [‘19]

- Allowances for multiple battery use, must follow single battery use with the following:
  - Each battery monitored and low battery sent when either has reached its threshold.
  - When one fails the other is capable of operating itself and associated device for 7 days.
  - Each transmitter/receiver shall be permitted to serve more than one device and shall be individually identified in the control unit.

35

Low Power Radio Alarm Signals

NFPA 72 23.16.3 [‘19]

- When actuated, each low-power radio transmitter shall automatically transmit an alarm signal and be identified at the fire alarm system.
- Each low-power radio transmitter shall automatically repeat alarm transmission at intervals not exceeding 60 seconds until the initiating device is returned to its non-alarm condition
- Fire alarm signals shall have priority over all other signals

36

Low Power Radio – Alarm Signals

Actuating of all alarm functions must happen within 10 seconds of initiating device attached to transmitter as required in NFPA 72 10.11.1 [‘19]

An alarm signal from a low-power radio transmitter shall latch at its receiver/control unit until manually reset and shall identify the particular initiating device in alarm

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37

Low Power Radio – Monitoring for Integrity

The low-power radio transmitter shall be specifically listed as using a transmission method that is highly resistant to misinterpretation of simultaneous transmissions and to interference (e.g., impulse noise and adjacent channel interference)

NFPA 72 23.18.4.1 [‘19]

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38

Low Power Radio - Monitoring for Integrity

- The occurrence of any single fault that disables transmission between any low-power radio transmitter and the receiver/control unit shall cause a latching trouble signal within 200 seconds at the system control unit that individually identifies the affected device.
- Single fault on the signaling channel shall not cause an alarm signal.
- Periodic communication required to assure trouble signal within 200 seconds if it fails.

NFPA 72 23.18.4 [‘19]

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39

Monitoring for Integrity

- Reception of any unwanted (interfering) transmission by a retransmission device (repeater) or by the main receiver/control unit, for a continuous period of 20 seconds or more, shall cause an audible and visible trouble indication at the main receiver/control unit
- This indication shall identify the specific trouble condition as an interfering signal

NFPA 72 23.18.4.6 [‘19]

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40

1

Fire Alarm Control Unit (Panel)

- A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s)

NFPA 72 3.3.108 ['19]

2

NFPA 72 3.3.108.1 ['19]

Master Control Unit (Panel)

- Serves the protected premises or portion of the protected premises as a local control unit and accepts inputs from other fire alarm control units

3

NFPA 72 3.3.108.2 ['19]

Protected Premises (Local) Control Unit (Panel)

- A fire alarm control unit that serves the protected premises or a portion of the protected premises

4

NFPA 72 3.3.108.2.1 ['19]

Dedicated Function Control Unit (Panel)

- A fire alarm control unit that is intended to operate specifically identified emergency control functions.

5

Combination Systems

- A fire alarm system in which components are used, in whole or in part, in common with a non-fire signaling system

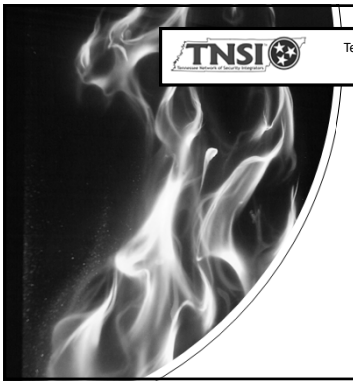
NFPA 72 3.3.111.1 ['19]

6

- NFPA 72 – Chapter 10 and 23
- UL 864- Control Units and Accessories for Fire Alarm System

Applicable Standards

7



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Location Requirements

8

Location

Audible trouble notification located where likely to be heard.

NFPA 72 10.15.5 [‘19]

Mounted so vibration or jarring does not cause activation or failure

NFPA 2 10.4.2 [‘19]

9

Location

Must not exceed environmental and power requirements of manufacture instruction or 10.3.5.

NFPA 72 10.4.3 [‘19]

Equipment designed to operate under following conditions:

- 85 to 110% of input voltage
- 32 to 120 degrees Fahrenheit
- Relative humidity of 85% at 86 degrees Fahrenheit.

NFPA 72 10.3.5 [‘19]

10

Location

Must provide adequate working space:

36 inches from equipment in front of equipment.

The with for the person standing in front must be 30 inches or the width of the panel, whichever is greater. Door must open 90 degrees.

Height in front of panel must be 6 1\2 feet from floor or height of panel, whichever is taller.

NFPA 70 110.26 [‘20]

11

Fire Alarm Control Unit Protection

NFPA 72 10.4.5 [‘19]

- Unless otherwise permitted by 10.4.6, in areas that are not continuously occupied, early warning fire detection shall be at the location of each control unit(s), notification appliance circuit power extender(s), and supervising station transmitting equipment to provide notification of fire at that location by one of the following:
  1. An automatic smoke detector
  2. Automatic heat detector if conditions prohibit smoke detectors

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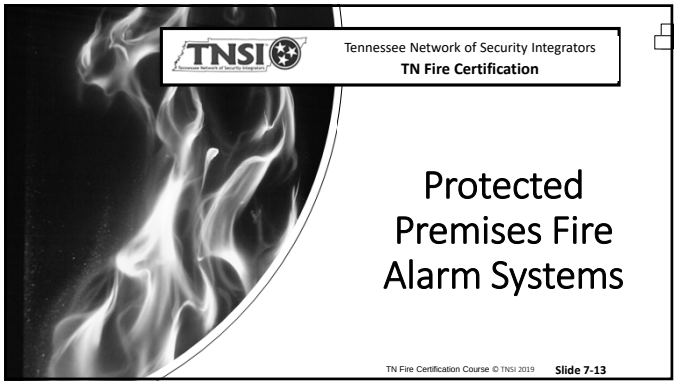

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Alarm Control Units

- In facilities without a building fire alarm system, a dedicated function fire alarm system shall be permitted and shall not be required to include other functions of a building fire alarm system
- Where a dedicated function system exists and a building fire system is subsequentially installed it must be interconnected to comply with 23.8.2

NFPA 72 23.3.3.2 [‘19]

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14

Alarm Control Units

- Alarm and signaling systems may be single system or combination of component subsystems
- System components permitted to share control equipment or operate stand alone but arraigned to function as single system
- All components must be capable of operating under full load without degrading overall system performance

NFPA 72 23.8.2 [‘19]

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15

Alarm Control Units

- Each interconnected unit shall separately monitored for alarm, supervisory, and trouble with supervised pathways
- Alarm conditions shall annunciate as an alarm signal and initiate evacuation signal
- Supervisory and trouble signals shall annunciate as each type

NFPA 72 23.8.2 [‘19]

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16

Alarm Control Units

- Protected Premise fire alarm control unit shall only be capable of reset or silence at unit unless remote reset or silencing approved by AHJ

NFPA 72 23.8.2 [‘19]

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17

Alarm Control Units

- If multiple components of the same manufacture are interconnected in a networked arrangement and are in one protected premise, the control units shall be arraigned to reset or silence from one location
- If multiple components of different manufactures are interconnected according to 23.8.2.5 through 23.8.2.8 and serve one protected premise, the control units shall be permitted to reset or silence at individual control unit

NFPA 72 23.8.2 [‘19]

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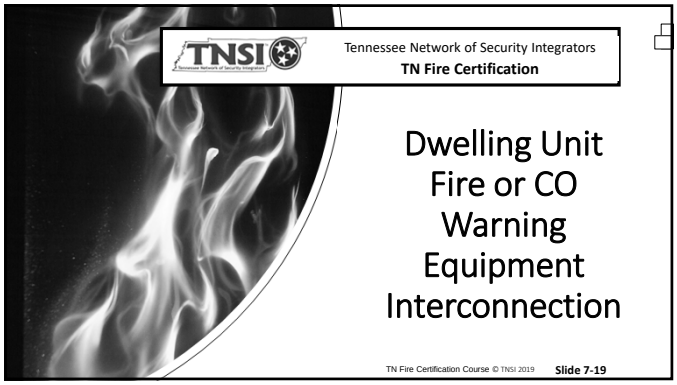

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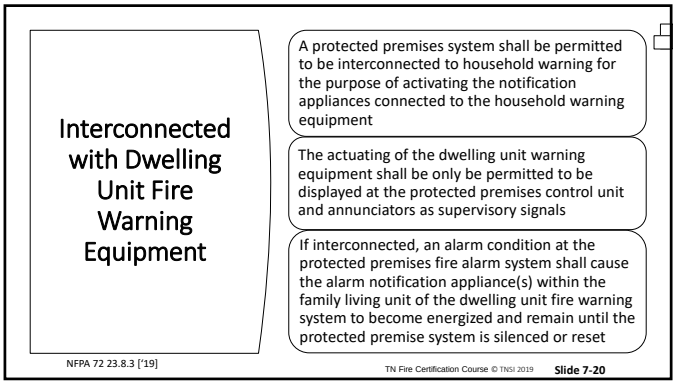

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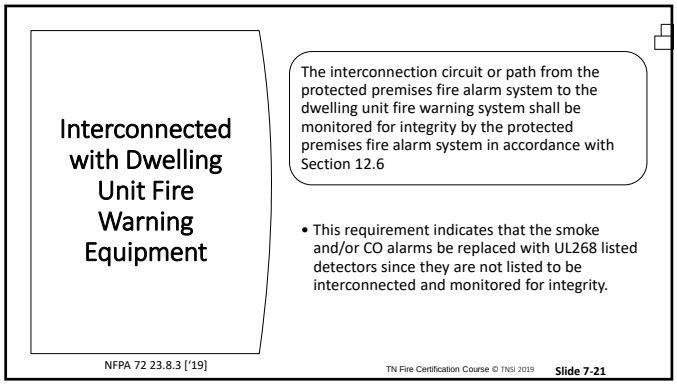

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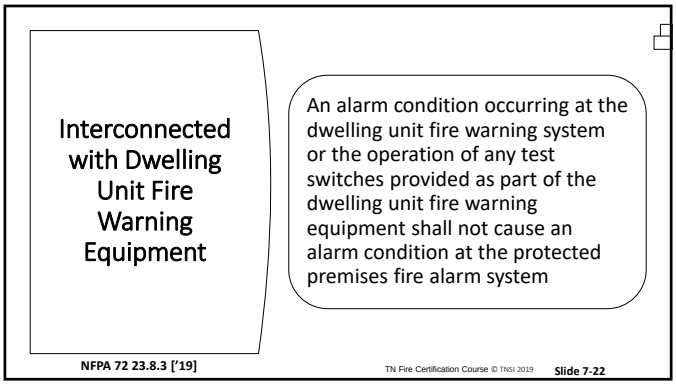

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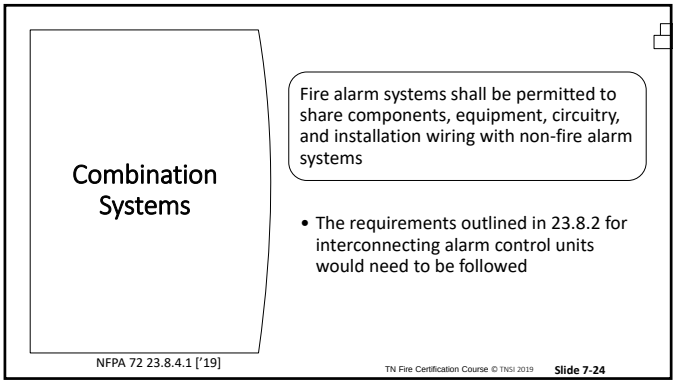

24

Combination Systems

Fire Alarm signals shall be distinctive, clearly recognizable, and shall be indicated as follows in descending order, except where otherwise required by another part of the code:

- Signals associated with life safety
- Signals associated with property protection
- Trouble signals associated with life or property protection
- All other protection

25

Combination Systems

Dedicated annunciator not required however if the AHJ determines that the information being displayed or annunciated on a combination system is excessive and is causing confusion and delayed response to a fire emergency, the AHJ shall be permitted to require that the display or annunciation of information for the fire alarm system be separate from and have priority in accordance with 23.8.4.7 over information for the non-fire alarm systems

NFPA 72 23.8.4.8 ['19]

26

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Signals

27

Alarm Signals

Indication of the existence of a condition that requires an immediate response.
NFPA 72 3.3.11 ['19]

Panel must annunciate within 10 seconds of activation of initiating device.
NFPA 72 10.11.1 ['19]

If panel is silenced it must reactivate every 24 hours or less until restored to normal
NFPA 72 10.11.8.1 ['19]

Shall trigger NAC until manually silenced or reset.
NFPA 72 10.11.8.2 ['19]

28

Alarm Signals

Subsequent activation of the alarm initiating devices shall cause the NAC to reactivate

NFPA 72 10.12.5 ['19]

29

Supervisory Signals

Visible and audible indication of both self restoring and latching supervisory signals and restoration to normal must de visibly annunciated at the following within 90 seconds:

- Local fire alarm control
- Building fire command center
- Supervising station

Audible and visual annunciation shall automatically reactivate every 24 hours or less

NFPA 72 10.14 ['19]

30

Trouble Signals

Trouble signals and their restoration shall be indicated within 200 seconds at the locations indicated in 10.15.7 and 10.15.8.
NFPA 72 10.15.1 [‘19]

- Local fire alarm control
- Building fire command center
- Central, remote stations, or proprietary stations

Supervising station systems shall allow a delay of primary power failure signals of 60 to 180 minutes unless not permitted by AHJ
NFPA 72 10.6.9.3 [‘19]

31

Trouble Signals

Trouble that has been deactivated shall automatically reactivate audible and visual annunciation every 24 hours.
NFPA 72 10.15.9.1 [‘19]

Audible and visual annunciation signaling the depletion or failure of the primary battery of wireless equipment shall automatically resound every 4 hours.
NFPA 72 10.15.9.2 [‘19]

32

Means for Deactivating Signals

The means shall be key-operated, located within a locked cabinet, or arraigned to provide equivalent protection against unauthorized use
NFPA 72 10.12.3 & 10.14.7.2 & 10.15.10.2 [‘19]

33

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Panel False Alarm Prevention Features

34

Pre-signal

Pre-signal feature allowed if approved by AHJ

Shall meet the following conditions:

- Initial fire signal sounds in department offices, control room, fire brigade station, or other constantly attended location.
- Signal to supervising station happens on initial signal.
- Subsequent system operation by:
  - a. Human action activates fire alarm.
  - b. A feature that allows the control equipment to delay the alarm by more than a minute.

NFPA 72 23.8.1.1 [‘19]

35

Positive Alarm Sequence

Positive alarm sequence feature allowed if approved by AHJ
NFPA 72 23.8.1.2.1 [‘19]

System shall provide a means for bypassing the sequence
NFPA 72 23.8.1.2.1.2 [‘19]

36

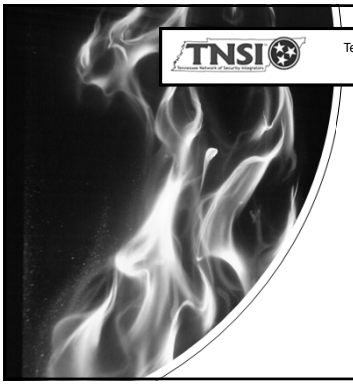
Positive Alarm Sequence

Shall comply with the following:

- To initiate PAS the signal from a automatic fire detection device shall be acknowledged within 15 seconds by trained personal
- If not acknowledged in 15 seconds notification automatically actuated
- If PAS is initiated the operator has 180 seconds to evaluate
- If alarm is not reset during investigative phase than notification shall automatically actuate
- If a second detector is activated during investigation phase notification shall automatically actuate
- If any other fire initiating device actuates notification shall automatically actuate

NFPA 72 23.8.2.1.1 ['19]

37



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Pre-signal and Positive Alarm Sequence

38

Alarm Verification

Alarm verification not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area of smoke detection. Enabling of the feature shall be protected by password or limited access

Smoke that remains in alarm condition does not delay more than 1 minute

Activation of an alarm-initiating device other than a smoke detector causes the system to function without delay

Current status of alarm verification feature is shown on record of completion

NFPA 72 23.8.5.4.1 ['19]

39

Sensitivity Compensation

If automatic drift compensation of sensitivity is provided, the fire alarm control unit shall identify the affected detector when the limit of compensation is reached

NFPA 72 23.8.5.4.2 ['19]

40

Cross Zoning

Systems that require the operation of two automatic detectors to initiate the alarm response shall be permitted, provided that the following conditions are satisfied.

- Not prohibited by the AHJ
- At least two detectors in each protected space
- Alarm verification is not used

NFPA 72 23.8.5.4.3 ['19]

41

Cross Zoning

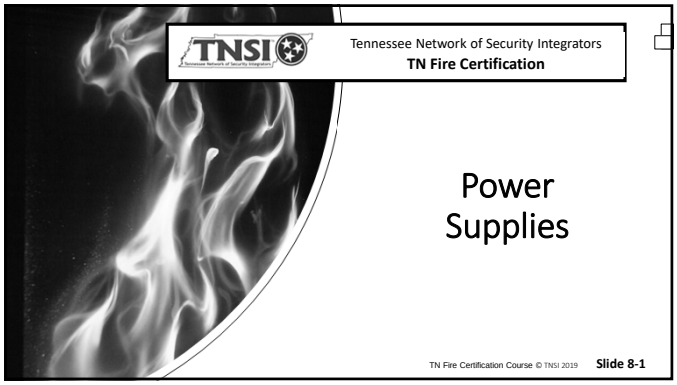
Systems to initiate emergency control functions or to actuate fire extinguishing or suppression systems, detectors shall be install by spacing requirements in Chapter 17

NFPA 23.8.5.4.4 ['19]

Systems to actuate public mode notification, detectors shall be installed at a linear spacing of not more than 0.7 times the linear spacing determined in accordance with Chapter 17

NFPA 72 23.8.5.4.5 ['19]

42



1

Power Supplies

- Shall be installed in accordance with applicable requirements of NFPA 70
  NFPA 72 10.6.2 [‘19]
- In addition to all wiring requirements must follow panel mounting requirements in Article 110.26 as discussed in Panels section.
- Unless configured in compliance with 10.6.4, at least two independent and reliable power supplies shall be provided, one primary and one secondary
  NFPA 72 10.6.3.2 [‘19]

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2

Primary Power

- Shall be provided by one of the following:
  NFPA 72 10.6.5.1.1 [‘19]
  - Electric Utility
  - Engine-driven generator or equivalent in accordance with 10.6.11.2, where a person trained in its operation is on duty at all times
  - Engine-driven generator or equivalent in arranged for cogeneration with an electric utility in accordance with 10.6.11.2, where a person trained in its operation is on duty at all times
- Shall supply no other loads
  NFPA 72 10.6.5.1.2 [‘19]
- Branch circuit must have overcurrent protection of no more than 20 amps
  NFPA 70 760.127 [‘20]

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3

Primary Power

- Location of disconnect shall be permanently identified at control unit
- System disconnect means marked to identify the equipment it serves
- Shall have red markings that shall not damage the overcurrent device
- Disconnect means shall be accessible to only authorized personnel

NFPA 72 10.6.5.2 [‘19]

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4

Secondary Power

- Secondary shall automatically provide power within 10 seconds whenever the primary power is insufficient
  NFPA 72 10.6.6.1 [‘19]
- Operation on secondary shall not affect performance of the system
  NFPA 72 10.6.7.1.1 [‘19]

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5

Secondary Power

- Secondary power supply shall provide sufficient capacity to operate the system in non-alarm condition for a minimum of 24 hours and at the end of that time shall operate all NAC used for evacuation or to direct aid to the location of the emergency for 5 minutes
  NFPA 72 10.6.7.2.1 [‘19]
- Battery calculations shall include a minimum 20 percent safety margin above the amp-hour requirement
  NFPA 72 10.6.7.2.1.1 [‘19]

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6

Secondary Power

EVAC system shall be 24 hours normal operation plus 15 minutes of maximum connected load.
NFPA 10.6.7.2.1.2 [‘19]

CO detection not monitored by a supervising station shall offer 24 hours under normal load plus 12 hours of operation under alarm condition.
NFPA 10.6.7.2.3 [‘19]

CO detection monitored by a supervising station shall offer 24 hours under normal load plus 5minutes of operation under alarm condition.
NFPA 10.6.7.2.3 [‘19]

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7

Current Draw Calculation

Per Manufacturers instructions you must do current draw calculations to make sure you do not exceed panels output capacity

Device	Quantity	Standby Each	Alarm Each	Total Standby	Total Alarm
Control	1	150mA	220mA	150mA	220mA
Annunciator	1	75mA	120mA	75mA	120mA
Relay Module	2	35mA	75mA	70mA	150mA
Smoke Detector	20	45mA	120mA	900mA	2400mA
Horn\Strobe	10	-	650mA	0	6500mA
Total				1195mA	9390mA

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8

Fire Alarm Calculation

Per Manufacturers instructions you must do current draw calculations to make sure you do not exceed panels output capacity

Total Non-Alarm Current	**1.195A**	**X**	**24**	**28.68 AH**
Total Alarm Current	**9.390A**	**X**	**.08333** **5 minutes**	**.783 AH**
Standby and Alarm				**29.463 AH**
Total Required Amp Hours	**29.463 Ah**	**X**	**1.2** **De-rating factor**	**35.355 AH**

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9

Secondary Power

Batteries shall be marked with month and year of manufacture
NFPA 10.6.10.1.1 [‘19]

If not marked then installer must obtain the date code and mark the battery with month and year of manufacture
NFPA 10.6.10.1.2 [‘19]

Batteries replaced when they fail load testing or the manufacture’s replacement date is exceeded
NFPA Table 14.4.3.2(9)(5) [‘19]

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10

Notification Appliances

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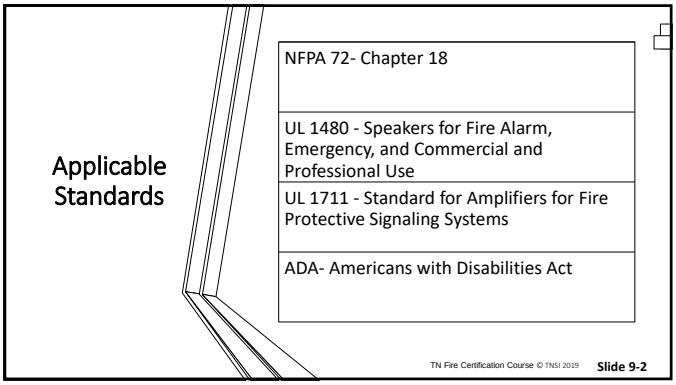

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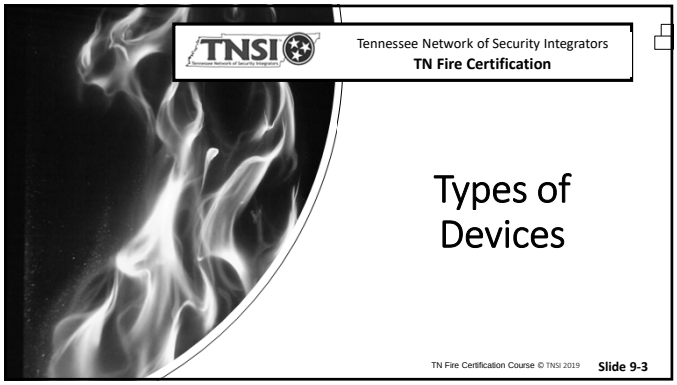

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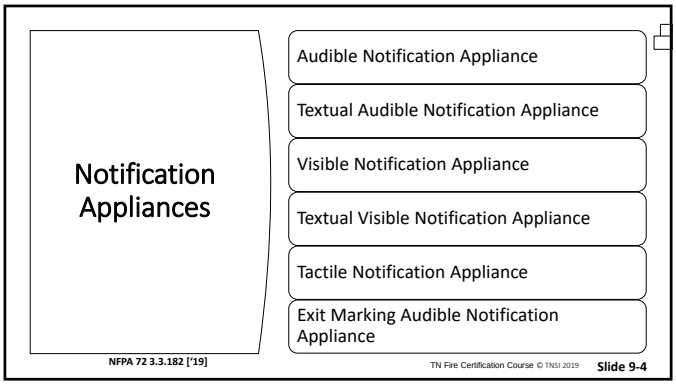

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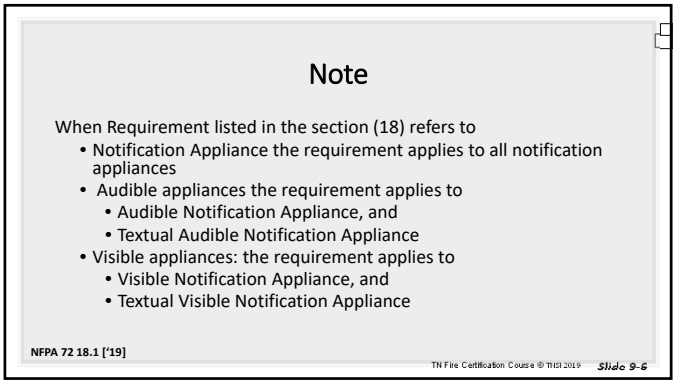

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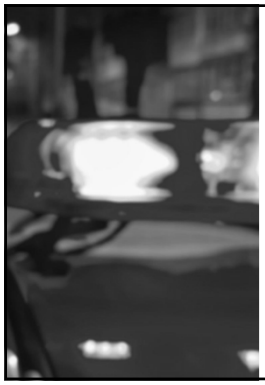
Notification Appliances



Purpose

Notification appliances for fire alarm systems shall contribute to fire protection by providing stimuli for initiating emergency action and by providing information to users, emergency response personnel, and occupants

NFPA 72 18.2 ['19]

7

General

Listing

- All notification appliances installed in conformity with Chapter 18 shall be listed for the purpose for which they are used
- NFPA 72 18.3.1 ['19]

Physical Construction

- Appliances intended for use in special environments, such as outdoors versus indoors, high or low temperatures, high humidity, dusty conditions, & hazardous locations, or where subject to tampering, shall be listed for the intended application
- NFPA 72 18.3.3.1 ['19]

8

Nameplates

Notification appliances shall include on their nameplates reference to electrical requirements and rated audible or visible performance, or both, as defined by the listing authority

Audible appliances shall include on their nameplates reference to their parameters or reference to installation documents (supplied with the appliance) that include the parameters in accordance with 18.4.3 or 18.4.4

Visible appliances shall include on their nameplates reference to their parameters or reference to installation documents (supplied with the appliance) that include the parameters in accordance with 18.5.2.1 or Section 18.6

NFPA 72 18.3.2 ['19]

9

Nameplates

Notification appliances used for signaling other than fire shall not have the word FIRE, or any fire symbol, in any form (i.e. stamped, imprinted, etc.) on the appliance visible to the public

NFPA 72 17.3.3.2 ['19]

Notification appliances with multiple visible elements used for signaling other than fire shall be permitted to have fire markings only on those visible elements used for fire signaling

NFPA 72 18.3.3.3 ['19]

10

Mechanical Protection

NFPA 72 18.3.4 ['19]

- Appliances subject to mechanical damage shall be suitably protected
- If guards or covers are employed, they shall be listed for use with the appliance
- The effect of guards or covers on the appliance's field performance shall be in accordance with the listing requirements

11

Mounting

Appliances shall be supported independently of their attachments to the circuit conductors

Appliances shall be mounted in accordance with the manufacturer's instructions

NFPA 72 18.3.5 ['19]

12

Audible Characteristics

- An average ambient sound level greater than 105 dBA shall require the use of a visible notification appliance(s)

NFPA 72 18.4.1.1 ['19]

- The total sound pressure level produced by combining the ambient sound pressure level with all audible notification appliances operating shall not exceed 110 dBA anywhere in the occupiable area

NFPA 72 18.4.1.2 ['19]

- Sound from a temporary or abnormal source having a duration of at least 60 seconds, shall be included in measuring maximum ambient sound level

NFPA 72 18.4.1.3 ['19]

13

Evacuation Signal Zoning

Undivided fire or smoke areas shall not be divided into multiple evacuation signaling zones

If multiple notification appliance circuits are provided within a single evacuation signaling zone, all of the notification appliances within the zone shall be arranged to activate or deactivate simultaneously, either automatically or by actuation of a common, manual control

- *Exception: Where the different notification appliance circuits within an evacuation signaling zone perform separate functions (for example, pre-signal and general alarm signals, and pre-discharge and discharge signals)*

NFPA 72- 24.4.1.9.1

14

Notification Zones

Notification zones shall be consistent with the emergency response or evacuation plan for the protected premises

The boundaries of notification zones shall be coincident with building outer walls, building fire or smoke compartment boundaries, floor separations, or other fire safety subdivisions

NFPA 72 23.8.6.3 ['19]

15

Distinctive Evacuation Signal

- Alarm audible signal pattern used to notify building occupants of the need to evacuate (leave the building) or relocate (from one area to another) shall be the standard alarm evacuation signal consisting of a three-pulse temporal pattern
- The pattern shall consist of the following in this order:
  1. "On" phase lasting 0.5 second ±10 percent
  2. "Off" phase lasting 0.5 second ±10 percent for three successive "on" periods
  3. "Off" phase lasting 1.5 seconds ±10 percent

NFPA 72 18.4.2.1 ['19]

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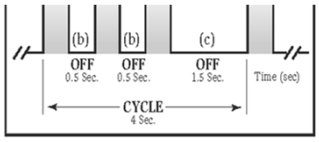

Key:
Phase (a) signal is "on" for 0.5 sec ± 10%
Phase (b) signal is "off" for 0.5 sec ± 10%
Phase (c) signal is "off" for 1.5 sec ± 10% [(c) = (a) + 2(b)]
Total cycle lasts for 4 sec ± 10%

ANSI S3.41

NFPA 72 Figure 18.4.2.1 ['19]

American National Standard Audible Emergency Evacuation Signal

Click Speaker to Play ANSI S3.41 Tone

17

Distinctive Evacuation Signal

A single-stroke bell or chime sounded at "on" intervals lasting 1 second ±10 percent, with a 2-second ±10 percent "off" interval after each third "on" stroke, shall be permitted

The minimum repetition time shall be permitted to be manually interrupted

The minimum time shall be permitted to be automatically interrupted for the transmission of mass notification messages in accordance with Chapter 24.

NFPA 72 18.4.2.2 ['19]

18

Distinctive Evacuation Signal

The standard evacuation signal shall be synchronized within a notification zone

NFPA 72 18.4.2.3 [‘19]

19

Operating Modes

NFPA 72 3.3.193 [‘19]

- ***Private Operating Mode***
  - Audible or visible signaling only to those persons directly concerned with the implementation and direction of emergency action initiation and procedure in the area protected by the fire alarm system
- ***Public Operating Mode***
  - Audible or visible signaling to occupants or inhabitants of the area protected by the fire alarm system

20

Public Mode Audible Requirements

NFPA 72 18.4.4.1 [‘19]

To ensure that audible public mode signals are clearly heard, unless otherwise permitted by 18.4.3.2 through 18.4.3.5, they shall have a sound level **at least 15 dB above the average ambient sound** level or **5 dB above the maximum sound** level having a duration of at least 60 seconds, whichever is greater, **measured 5 ft above the floor** in the occupiable area, using the A-weighted scale (dBA)

21

Ambient Noise

Average Ambient Sound Level According to Location

Locations	Average Ambient Sound Level
Business occupancies	55 dBA
Educational occupancies	45 dBA
Industrial occupancies	80 dBA
Institutional occupancies	50 dBA
Mercantile occupancies	40 dBA
Piers and water-surrounded structures	40 dBA
Places of assembly	55 dBA
Residential occupancies	35 dBA
Storage occupancies	30 dBA
Thoroughfares, high density urban	70 dBA
Thoroughfares, medium density urban	55 dBA
Thoroughfares, rural and suburban	40 dBA
Tower occupancies	35 dBA
Underground structures and windowless buildings	40 dBA
Vehicles and vessels	50 dBA

NFPA 72 Annex A Table 18.4.4 [‘19]

22

Public Mode Audible Requirements

- Where approved by the AHJ or other governing codes or standards, the requirements for audible signaling shall be permitted to be reduced or eliminated when visible signaling is provided in accordance with Section 18.5.

NFPA 72 18.4.4.2 [‘19]

- Audible alarm notification appliances installed in elevator cars shall be permitted to use the audibility criteria for private mode appliances detailed in 18.4.5.1.

NFPA 72.18.4.4.3 [‘19]

23

Public Mode Audible Requirements

- If approved by the AHJ, audible alarm notification appliances installed in restrooms shall be permitted to use the audibility criteria for private mode appliances detailed in 18.4.5.1

NFPA 72 18.4.4.4 [‘19]

24

Public Mode Audible Requirements

- A signaling system arranged to stop or reduce ambient noise shall comply with 18.4.4.5.1 through 18.4.4.5.3
- A fire alarm system arranged to stop or reduce ambient noise shall produce a sound level at **least 15 dB above the reduced average ambient sound level** or 5 **dB above the maximum sound level** having a duration of at least 60 seconds after reduction of the ambient noise level, whichever is greater, **measured 5 ft above the floor** in the occupiable area, using the A-weighted scale (dBA)

NFPA 72 18.4.4.5 ['19]

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25

Public Mode Audible Requirements

- Visible notification appliances shall be installed in the affected areas in accordance with Section 18.5 or Section 18.6
- Relays, circuits, or interfaces necessary to stop or reduce ambient noise shall meet the requirements of Chapter 10, 12, 22, and 23

NFPA 72 18.4.4.5 ['19]

TN Fire Certification Course © TNSI 2019 **Slide 9-26**

26

Private Mode Audible Requirements

- Shall have a sound level at **least 10 dB above the average ambient sound level or 5 dB above the maximum sound level** having a duration of at least 60 seconds, whichever is greater, **measured 5 ft above the floor** in the occupiable area, using the A-weighted scale (dBA)

NFPA 72 18.4.5.1 ['19]

- Where approved by the AHJ or other governing codes or standards, the requirements for audible signaling shall be permitted to be reduced or eliminated when visible signaling is provided in accordance with Section 18.5

NFPA 72 18.4.5.2 ['19]

TN Fire Certification Course © TNSI 2019 **Slide 9-27**

27

Private Mode Audible Requirements

NFPA 72 18.4.5.3 ['19]

A fire alarm system arranged to stop or reduce ambient noise, when approved by the AHJ, shall

- be permitted to produce a sound level at least 10 dB above the reduced average ambient sound level or 5 dB above the maximum sound level having a duration of at least 60 seconds after reduction of the ambient noise level, whichever is greater, measured 1.5 m (5 ft) above the floor, using the A-weighted scale (dBA)
- Visible notification appliances shall be installed in the affected areas in accordance with Section 18.5 or Section 18.6
- Relays, circuits, or interfaces necessary to stop or reduce ambient noise shall meet the requirements of Chapters 10, 12, 22 and 23

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28

Sleeping Areas

- Shall have a sound level measured at the pillow level in the occupiable area, using the A-weighted scale dBA of
  - at least 15 dB above the average ambient sound level
  - or 5 dB above the maximum sound level having a duration of at least 60 seconds
  - or a sound level of at least 75 dBA, whichever is greater

NFPA 72 18.4.6.1 ['19]

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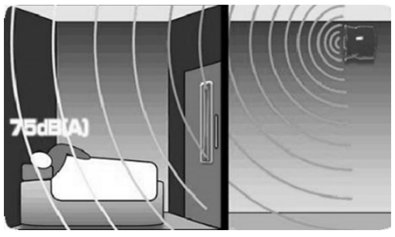

Sleeping Area Measurements

- Sound pressure level shall be measured with any barrier (door, curtain, or retractable partition) placed between the appliance and the pillow

NFPA 72 18.4.6.2 ['19]

TN Fire Certification Course © TNSI 2019 **Slide 9-30**

30

Sleeping Areas

- Audible appliances provided for the sleeping areas to awaken occupants shall produce a low frequency alarm signal that complies with the following:
  - (1) The waveform shall have a fundamental frequency of 520 Hz ± 10 percent.
  - (2) The notification equipment shall be listed for producing the low frequency waveform.

NFPA 72 18.4.6.3 ['19]

31

Narrow Band Tone Signaling for Exceeding Masked Thresholds

This subsection permits a more rigorous analysis and design for audible signaling

Acoustic design practice and psychoacoustic research have long recognized that for a signal to be audible it need only penetrate the background noise in a one-third or a one octave band

Noise at a lower frequency can mask a signal at an adjacent higher frequency.

Thus, it is necessary to calculate the effective masked level of the noise in accordance with established procedures

NFPA 72 18.4.7 ['19]

32

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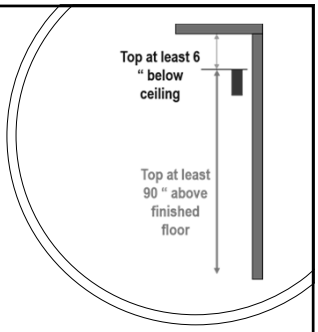
Audible Notification Appliance Requirements

33

Location of Audible Notification Appliances

- If ceiling heights allow, and unless otherwise permitted by 18.4.9.2 through 18.4.9.5, wall-mounted appliances shall have their tops above the finished floors at heights of not less than 90 in. and below the finished ceilings at distances of not less than 6 in



NFPA 72 18.4.9 ['19]

34

Location of Audible Notification Appliances

Ceiling-mounted or recessed appliances shall be permitted

NFPA 72 18.4.9.2 ['19]

If combination audible/visible appliances are installed, the location of the installed appliance shall be determined by the requirements of 18.5.5

NFPA 72 18.4.9.3 ['19]

35

Location of Audible Notification Appliances

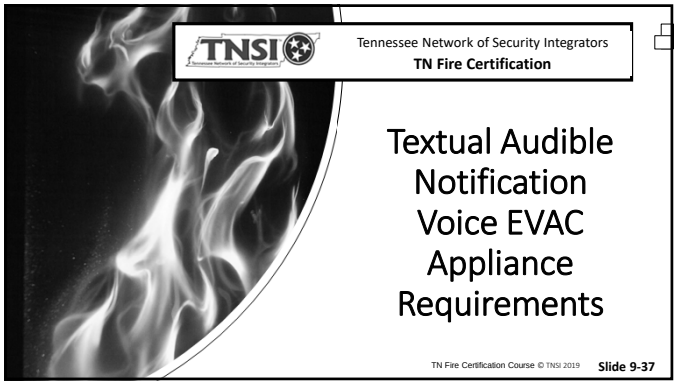
Appliances that are an integral part of a smoke detector, CO detector, smoke alarm, CO alarm or other initiating device shall be located in accordance with the requirements for that device

NFPA 72 18.4.9.4 ['19]

Mounting heights other than required by 18.4.9.1 and 18.4.9.2 shall be permitted provided the sound pressure level requirements of 18.4.4 for public mode or 18.4.5 for private mode or 18.4.6 for sleeping areas are met

NFPA 72 18.4.9.5 ['19]

36



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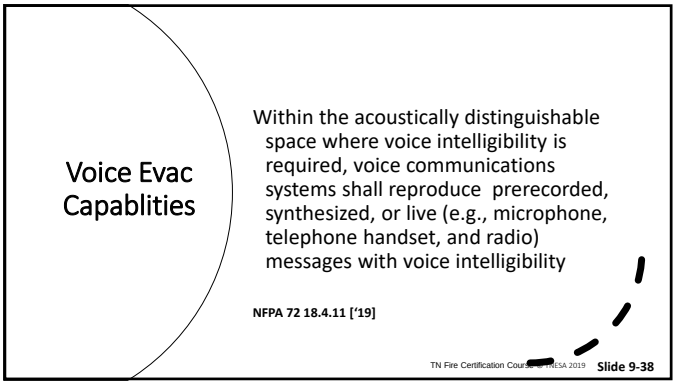

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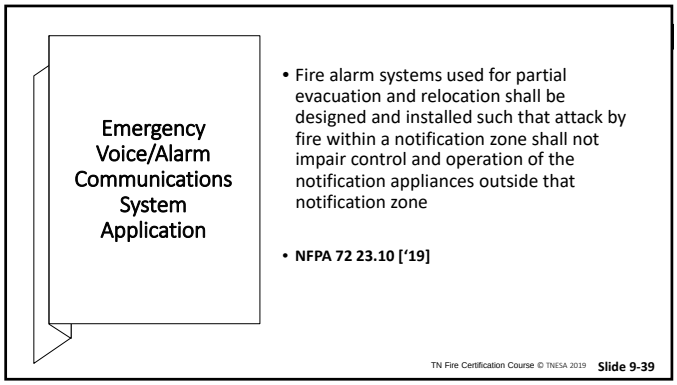

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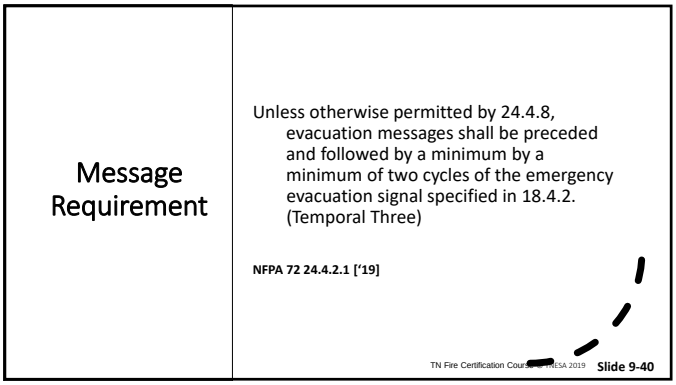

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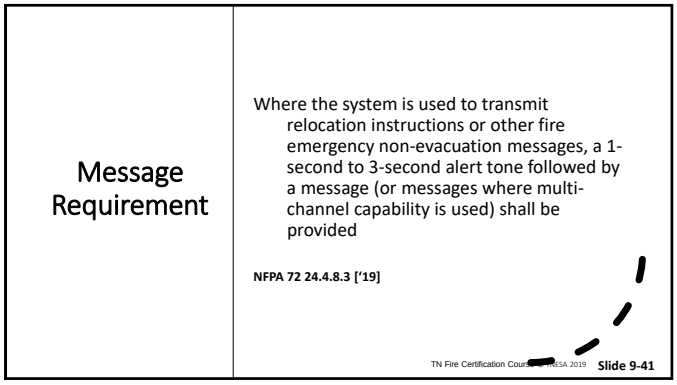

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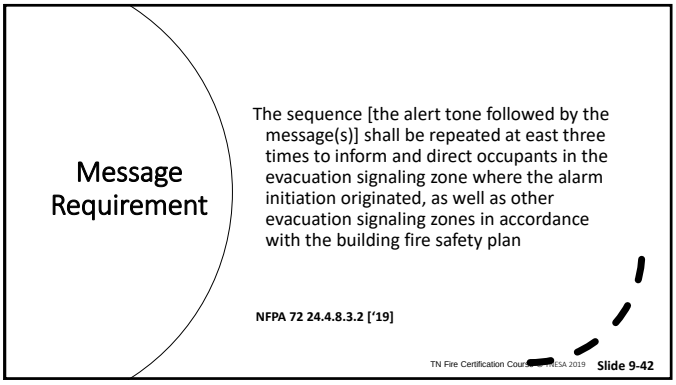

42

Alert Tone

Need an attention-getting signal to alert occupants of the pending transmission of a voice message

Play Standard Voice Message

Play Message with Tone

43

Ancillary Functions

NFPA 72 24.3.5 ['19]

Shall not impair the required operation

Fire alarm system speakers providing ancillary functions shall meet the conditions of either 24.3.4.2(1) or (2):

(1) The fire command center shall be constantly attended by trained personnel, and selective paging is permitted by the AHJ
(2) All of the following conditions shall be met:

(a) The speakers and associated audio equipment are installed or located with safeguards to resist tampering or mis-adjustment of those components essential for intended emergency notification.
(b) The monitoring integrity requirements of Section 10.17 continue to be met while the system is used for non-emergency purposes

44

Fire Alarm Speaker Appliances

Where required, each enclosed stairway shall be equipped with speakers connected to a separate notification zone for manual selective paging only

NFPA 72 24.4.8.5 ['19]

45

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Visible Notification Appliance Requirements

46

Two Sets of Requirements

Private ***Operating Mode – See 18.6***	Audible or visible signaling only to those persons directly concerned with the implementation and direction of emergency action initiation and procedure in the area protected by the fire alarm system
Public ***Operating Mode – See 18.5***	Audible or visible signaling to occupants or inhabitants of the area protected by the fire alarm system

47

Device Requirements

- The flash rate shall not exceed two flashes per second (2 Hz) nor be less than one flash every second (1 Hz) throughout the listed voltage range of the appliance
- A maximum pulse duration shall be 20 milliseconds
- Pulse greater than 2o milliseconds but not greater than 100 milliseconds shall be permitted if the alerting capability is equal or greater than a 20 millisecond device.
- The pulse duration shall be defined as the time interval between initial and final points of 10 percent of maximum signal

NFPA 72 18.5.3 ['19]

48

Device Requirements

Visual notifications appliances used for fire alarm signaling only or to signal the intent for complete evacuation shall be clear or nominal white and shall not exceed 1000 cd (effective intensity)

NFPA 72 18.5.3.5 [‘19]

Appliances used to signal occupants to seek information or instructions shall be clear, nominal white, or other color required by the building emergency plan.

NFPA 72 18.5.3.6 [‘19]

49

NFPA Appliance Location

- Wall-mounted appliances shall be mounted such that the entire lens is not less than 80 in. and not greater than 96 in. above the finished floor or at the height determined by performance based alternative of 18.5.5.7.

NFPA 72 18.5.5.1 [‘19]

- Appliances listed for mounting parallel to the floor shall be permitted to be located on the ceiling or suspended below the ceiling.

NFPA 72 18.5.5.4 [‘19]

50

NFPA Appliance Location

- Where low ceilings do not allow 80 inch mounting - they shall be mount 6 inches below the ceiling

NFPA 72 18.5.5.2 [‘19]

- Where low ceilings do not allow 80 inch mounting the room size covered by a visual appliance shall be reduced by twice the difference between the minimum mounting height of 80 inches and the actual mounting height

NFPA 72 18.5.5.3 [‘19]

51

Spacing in Rooms

NFPA 72 18.5.5.5.1 [‘19]

Spacing shall be in accordance with either Table 18.5.5.5.1(a) and Figure 18.5.5.5.1 or Table 18.5.5.5.1(b).

Visible notification appliances shall be installed in accordance with Table 18.5.5.5.1(a) or Table 18.5.5.5.1(b) using one of the following:

- A single visible notification appliance
- Two groups of visible notification appliances, where visual appliances of each group are synchronized, in the same room or adjacent space within the field of view. This shall include synchronization of strobes operated by separate systems
- More than two visible notification appliances or groups of synchronized appliances in the same room or adjacent space within the field of view that flash in synchronization

52

Spacing in Rooms

NFPA 72 18.5.5.5 [‘19]

- Room spacing in accordance with Table 18.5.5.5.1(a) and Figure 18.5.5..1 for wall-mounted appliances shall be based on locating the visible notification appliance at the halfway distance of the wall
- In square rooms with appliances not centered or in non-square rooms, the effective intensity (cd) from one visible wall-mounted notification appliance shall be determined by maximum room size dimensions obtained either by measuring the distance to the farthest wall or by doubling the distance to the farthest adjacent wall, whichever is greater, as required by Table 18.5.5.5.1(a) and Figure 18.5.5.5.1

53

Spacing in Rooms

NFPA 72 18.5.5.5 [‘19]

- If room configuration is not square, the square room size that allows the entire room to be encompassed or allows the room to be subdivided into multiple squares shall be used

54

Spacing in Rooms

Table 18.5.5.5.1(a) Room Spacing for Wall-Mounted Visual Notification Appliances

Maximum Room Size		Minimum Required Light Output [Effective Intensity (cd)]	
ft	m	One Visual Notification Appliance per Room	Four Visual Notification Appliances per Room (One per Wall)
20 × 20	6.10 × 6.10	15	NA
28 × 28	8.53 × 8.53	30	NA
30 × 30	9.14 × 9.14	34	NA
40 × 40	12.2 × 12.2	60	15
45 × 45	13.7 × 13.7	75	19
50 × 50	15.2 × 15.2	94	30
54 × 54	16.5 × 16.5	110	30
55 × 55	16.8 × 16.8	115	30
60 × 60	18.3 × 18.3	135	30
63 × 63	19.2 × 19.2	150	37
68 × 68	20.7 × 20.7	177	43
70 × 70	21.3 × 21.3	184	60
80 × 80	24.4 × 24.4	240	60
90 × 90	27.4 × 27.4	304	95
100 × 100	30.5 × 30.5	375	95
110 × 110	33.5 × 33.5	455	135
120 × 120	36.6 × 36.6	540	135
130 × 130	39.6 × 39.6	635	185

NA: Not allowable.

NFPA 72 Table 18.5.5.5.1(a) ['19]

55

Ceiling Mounted Spacing

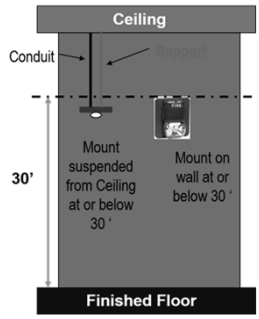
Table 18.5.5.5.1(b) Room Spacing for Ceiling-Mounted Visible Notification Appliances

Maximum Room Size		Maximum Lens Height*		Minimum Required Light Output (Effective Intensity); One Visual Notification Appliance (cd)
ft	m	ft	m	
20 × 20	6.1 × 6.1	10	3.0	15
30 × 30	9.1 × 9.1	10	3.0	30
40 × 40	12.2 × 12.2	10	3.0	60
44 × 44	13.4 × 13.4	10	3.0	75
20 × 20	6.1 × 6.1	20	6.1	30
30 × 30	9.1 × 9.1	20	6.1	45
44 × 44	13.4 × 13.4	20	6.1	75
46 × 46	14.0 × 14.0	20	6.1	80
20 × 20	6.1 × 6.1	30	9.1	55
30 × 30	9.1 × 9.1	30	9.1	75
50 × 50	15.2 × 15.2	30	9.1	95
53 × 53	16.2 × 16.2	30	9.1	110
55 × 55	16.8 × 16.8	30	9.1	115
59 × 59	18.0 × 18.0	30	9.1	135
63 × 63	19.2 × 19.2	30	9.1	150
68 × 68	20.7 × 20.7	30	9.1	177
70 × 70	21.3 × 21.3	30	9.1	185

*This does not preclude mounting lens at lower heights.

NFPA 72 Table 18.5.5.5.1(b) ['19]

56



Adjust for Ceiling Heights

- If ceiling heights exceed 30 ft , ceiling-mounted visible notification appliances shall be suspended at or below 30 ft or at the mounting height determined using the performance-based alternative of 18.5.5.7, or wall-mounted visual notification appliances shall be installed in accordance with Table 18.5.5.5.1(b)

NFPA 72 18.5.5.5.6 ['19]

57

Corridor Options

20 feet or less in width shall follow either 18.5.5.5 or 18.5.5.6.

NFPA 72 18.5.5.6.1 ['19]

Greater than 20 feet in width shall not follow 18.5.5.6

NFPA 72 18.5.5.6.2 ['19]

58

Corridor Requirement

In a corridor application, visible appliances shall be rated not less than 15 cd

NFPA 72 18.5.5.6.3 ['19]

Visual notification appliances in corridors shall be located not more than 15 feet from the end of the corridor with a separation not greater than 100 feet between appliances

NFPA 72 18.5.5.6.6 ['19]

59

Spacing in Corridors

If there is an interruption of the concentrated viewing path, such as a fire door, an elevation change, or any other obstruction, the area shall be treated as a separate corridor

NFPA 72 18.5.5.6.6 ['19]

Wall-mounted visible notification appliances in corridors shall be permitted to be mounted on either the end wall or the side wall of the corridor in accordance with spacing requirements of 18.5.5.6.5

NFPA 72 18.5.5.6.8 ['19]

60

Corridor Requirement

In corridors where more than two visible notification appliances are in any field of view, they shall flash in synchronization

NFPA 72 18.5.5.6.7 ['19]

61

Performance-Based Alternative

Any design that provides a minimum of 0.4036 lumens/ m2 (0.0375 lumens/ft2) of illumination at any point within the covered area at all angles specified by the polar dispersion planes for wall- or ceiling-mounted public mode visual notification appliances in ANSI/UL 1971, ANSI/UL 1638, or equvalent, as calculated for the maximum distance from the nearest appliance, shall be permitted in lieu of 18.5.5, excluding 18.5.5.8.

NFPA 72 18.5.5.7 ['19]

62

Performance-Based Alternative

Documentation provided to the AHJ shall include the following:

- Inverse Square Law calculations using each of the vertical and horizontal polar distribution angles in ANSI/UL 1971, Standard for Safety Signaling Devices for Hearing Impaired, or equivalent
- The calculations shall account for the effects of polar distribution using one of the following:
  (a) The percentages from the applicable table(s) in ANSI/UL 1971, Standard for Safety Signaling Devices for Hearing Impaired, or equivalent
  (b) The actual results of laboratory tests of the specific appliance to be used as recorded by the listing organization

NFPA 72 18.5.5.7 ['19]

63

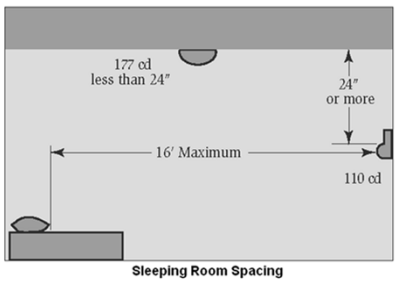
Sleeping Areas

- Combination smoke detectors or CO detectors and visible notification appliances or combination smoke alarms or CO alarms and visible notification appliances shall be installed in accordance with the applicable requirements of Chapters 17, 18, 23, and 29
- Table 18.5.5.8.3 shall apply to sleeping areas
- For rooms with a linear dimension greater than 16 ft, the visible notification appliance shall be located within 16 ft of the pillow

NFPA 72 18.5.5.8 ['19]

64

Sleeping Room Spacing



Sleeping Room Spacing

Figure from System Sensor System Audible Visible Appliance Application Guide Pg 5

65

Visible Characteristics – Private Mode

Visible notification appliances used in the private mode shall be of a sufficient quantity and intensity, and located so as to meet the intent of the user and the AHJ

NFPA 72 18.6 ['19]

66

Supplementary Visible Signaling Method

A supplementary visible notification appliance shall be intended to augment an audible or visible signal

A supplementary visible notification appliance shall comply with its marked rated performance

Supplementary visible notification appliances shall be permitted to be located less than 80 in. above the floor

NFPA 72 18.7 ['19]

67

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Textual Visible Notification Appliance Requirements

68

Textual Visible Appliances

- **Application.**
  - Textual and graphic visual appliances shall be permitted to be to signal information about fire or other emergency conditions or to direct intended responses to those conditions

NFPA 72 18.9.1 ['19]

- **Performance**.
  - The information produced by textual visible appliances shall be clear and legible at the intended viewing distance

NFPA 72 18.9.3 ['19]

69

Textual Visible Appliances

Public Mode

Textual and graphical visible notification appliances used in the public mode shall be located to ensure visibility to the occupants of the protected area or to the intended recipients

NFPA 2 18.9.2.2 ['19]

70

Textual Visible Appliances

NFPA 72 18.9.2.1 ['19]

Private Mode

Unless otherwise permitted or required by other governing laws, codes, or standards, or by other parts of this Code or by the AHJ, all textual and graphical visible notification appliances in the private mode shall be located in rooms that are accessible only to those persons directly concerned with the implementation and direction of emergency response in the areas protected by the system

71

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Tactile Notification Appliance Requirements

72

Notification Appliances

Tactile Appliances

- Tactile appliances shall be permitted if used in addition to audible or visible, or both, notification appliances
- Tactile appliances shall meet the performance requirements of ANSI/UL 1971, Standard for Safety Signaling Devices for Hearing Impaired, or equivalent

NFPA 72 18.10 [‘19]

73

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Exit Marking audible Appliances

74

Exit Marking Audible Appliances

Must meet or exceed the manufacture’s specifications

To ensure that they produce the desired directional effects for 50 feet within unobstructed path, they shall meet the audibility requirements of 18.4.7 in at least 1/3 octave band or one octave band within the effective ranges of the interaural time difference, interneural level, or intensity difference, and anatomical transfer function or head-related transfer function localization clues

NFPA 72 18.4.8 [‘19]

75

Exit Marking Audible Appliances

The exit marking audible notification appliance signal shall penetrate both the ambient noise and the fire alarm signal

Must be installed in accordance with all manufacture’s requirements

Shall be located at the entrance to all building exits and areas of refuge

Devices marking areas of refuge shall provide a sound distinct from that used for other exits

NFPA 72 18.4.8 [‘19]

76

Directional Sound

77

1

Alarm Signal Disposition

Except as permitted by 26.2.2, all fire alarm signals received by a supervising station shall be immediately retransmitted to the communications center.

- 26.2.2 allows an AHJ to allow verification call to be made for specific reasons if 8 specific requirements are met.

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2

Alarm Signal Disposition

Signals shall be retransmitted to the communications center by one of the following:

- Signals identified by zone retransmitted by zone.
- Signals identified by point retransmitted by point.
- Signals received by event retransmitted by event.

NFPA 72 26.2.1.3 ['19]

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3

Alarm Signal Content

- Where required by the enforcing authority, governing laws, codes, or standards, alarm signals transmitted to a supervising station shall be by addressable device or zone identification

NFPA 72 26.2.3 ['19]

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4

CO Signals

CO signals must take precedence over supervisory and trouble signals, and be distinct as a CO alarm.

Upon receipt supervising station shall do the following in this order:

- Immediately retransmit the signal
- Contact the responsible party
- Inform the subscriber to either follow pre-set plan or get to fresh air (by window or outdoors), verify all occupants accounted for and not to re-enter the building.

NFPA 72 26.2.4.1 ['19]

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5

Restoral Signals

All supervising station fire alarm systems shall be programmed to report restoral signals to the supervising station of all alarm, supervisory, and trouble signals upon restoration of the activation

NFPA 72 26.2.5.1 ['19]

Any signal received by the supervising station that has not restored to normal condition within 24 hours of initial receipt shall be redisplayed to an operator as a nonrestored signal and shall be reported to the subscriber.

NFPA 72 26.2.5.2 ['19]

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6

Change of Service

Supervising station customers or clients and the AHJ shall be notified in writing by the new supervising station within 30 days of any change of service provider that results in signals from their property being handled by a new supervising station facility

NFPA 72 26.2.7.1 [‘19]

Where the new provider supervising station service covered by 26.2.7.1 also provides the required testing, the new provider shall test all zones, points, and signals from each affected property in accordance with the requirements of Chapter 14 at or prior to the next scheduled periodic test

NFPA 72 26.2.7.2 [‘19]

7

Change of Service

Where the new provider of supervising station services covered by 26.2.7.1 does not provide the required testing, the new provider shall notify the alarm system owner of the need to test all zones, points, and signals from each affected property in accordance with the requirements of Chapter 14 prior to or at the next scheduled periodic test

NFPA 72 26.2.7.3 [‘19]

The supervising station shall notify the AHJ prior to terminating service

NFPA 72 26.2.7.4 [‘19]

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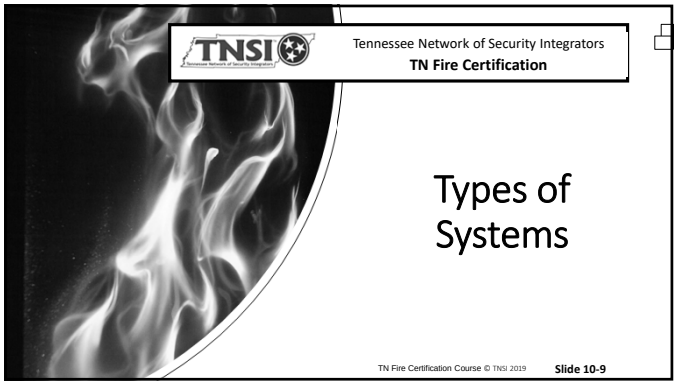

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Types of Systems

9

System Types

Central Station Service Alarm System 26.3

- The use of a system or a group of systems in which the operations of circuits and devices at a protected property are transmitted to, recorded in, maintained by, and supervised from a listed central station that has competent and experienced operators who, upon receipt of a signal, take such action as required by this Code.

NFPA 72 3.3.219.1 [‘19]

10

System Types

Proprietary Supervising Station Alarm System 26.4

- An installation of an alarm system that serves contiguous and noncontiguous properties under one ownership, from a proprietary supervising station located at the protected premise, or at one of multiple noncontiguous protected premises, at which trained, competent personnel are in constant attendance.

Not covered in this course. Study this section if you have this type of system to install.

NFPA 72 3.3.219.2 [‘19]

11

System Types

Remote Supervising Station Alarm System 26.5

- A protected premise fire alarm system (exclusive of any connected to a public emergency reporting system) in which alarm, supervisory, or trouble signals are transmitted automatically to, recorded in, and supervised from a remote supervising station that has competent and experienced servers and operators who, upon receipt of a signal, take such action as required by code.

NFPA 72 3.3.219.3 [‘19]

12

13

Central Station Service Scope

- Installation of fire alarm transmitters
- Alarm, guard, supervisory, and trouble signal monitoring
- Retransmission
- Associated record keeping and reporting
- Testing and maintenance
- Runner service

NFPA 72 26.3.2 [‘19]

14

Contract Requirements

The central station service elements shall be provided under contract to a subscriber by a prime contractor that has a listing for central station fire alarm services.

The prime contractor shall be responsible for code compliant service delivery, regardless of any subcontracting arrangements involved in the delivery of service.

Signal monitoring, retransmission, and associated record keeping shall be provided by a company that has a listing for central station alarm services covering these elements.

NFPA 72 26.3.3 [‘19]

15

Indication of Central Station Service

The prime contractor shall conspicuously indicate that the alarm system providing service at a protected premise complies with all the requirements of this code through the use of a systematic follow-up program under the control of the organization that has listed the prime contractor

The documentation shall include at a minimum:

- 1. Name of prime contractor
- 2. Full description of alarm system
- 3. Issue and expiration date of the documentation
- 4. Name, address, and contact information of listing agency
- 5. Identity of AHJ for the installation

The documentation shall be posted within 3 feet of the control unit and copies made available to the AHJ upon request

16

Central Supervising Station Requirements

The requirements for the Facilities, equipment, personal, and record keeping at the listed Central Supervising Station are found at NFPA 72 26.3.5, 26.3.6, 26.3.7, and 26.3.9 [‘19]

These go beyond scope of this course

17

Disposition of Alarm Signals

The central station shall perform the following actions:

- Retransmit the alarm to the communications center in accordance with 26.2.1 unless it is a test
- Dispatch a runner or maintenance person to the arrive within 2 hours after receipt of a signal to investigate unless the supervisory signal is cleared in accordance with a scheduled procedure determined by 26.3.8.3.3(1)
- Immediately notify the subscriber unless it is a test
- Provide notice to the subscriber or AHJ jurisdiction, or both, if required

NFPA 72 26.3.8.3.1 [‘19]

18

Guard's Tour Supervisory Signal

- Upon failure to receive a guard's tour supervisory signal within a 15-minute maximum grace period, the central station shall perform the following actions:
  1. Communicate without unreasonable delay with personnel at the protected premises
  2. Dispatch a runner to the protected premises to arrive within 30 minutes of the delinquency if communications cannot be established
  3. Report all delinquencies to the subscriber or AHJ, or both, if required
- Failure of the guard to follow a prescribed route in transmitting signals shall be handled as a delinquency

NFPA 72 26.3.8.3.2 ['19]

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19

Disposition of Supervisory Signals

NFPA 72 26.3.8.3.3 ['19]

The central station shall perform the following actions:

- Communicate immediately with the person(s) designated by the subscriber & notify the fire department, law enforcement agency, or both when required by the AHJ
- Dispatch a runner or technician to the protected premises to arrive within 2 hours after receipt of a signal if equipment needs to be manually reset by the prime contractor
- Except where prohibited by AHJ the runner or technician can be recalled if the system can be reset back to normal

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20

Disposition of Supervisory Signals

NFPA 72 26.3.8.3.3 ['19]

The central station shall perform the following actions:

- Notify the AHJ & subscriber when sprinkler systems or other fire suppression systems or equipment have been wholly or partially out of service for 8 hours
- When service has been restored, provide notice to the AHJ and the subscriber as to the nature of the signal, the time of occurrence, and the restoration of service when equipment has been out of service for 8 hours or more

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21

Trouble Signals

Upon receipt of trouble signals or other signals pertaining solely to matters of equipment maintenance of the fire alarm systems, the central station shall perform the following actions:

1. If a received trouble signal does not restore within 15 minutes, communicate immediately with persons designated by the subscriber
2. Dispatch personnel to arrive within 4 hours to initiate maintenance, if necessary
3. When the interruption is more than 8 hours provide notice to the subscriber or the fire department if required by the AHJ as to the nature of the interruption, the time of occurrence, and the restoration of service

NFPA 72 26.3.8.3.4 ['19].

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22

Test Signals

All test signals received shall be recorded to indicate date, time, and type

Test signals initiated by the subscriber, including those for the benefit of an AHJ, shall be acknowledged by central station personnel whenever the subscriber or authority inquires

Any test signal not received by the central station shall be investigated immediately and action shall be taken to reestablish system integrity

NFPA 72 26.3.8.3.5 ['19]

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23

Test Signals

The central station shall dispatch personnel to arrive within 2 hours if protected premises equipment needs to be manually reset after testing

The prime contractor shall provide each of its representatives and each alarm system user with a unique personal identification code

In order to authorize the placing of an alarm system into test status, a representative of the prime contractor or an alarm system user shall first provide the central station with his or her personal identification code

NFPA 72 26.3.8.3.5 ['19] TN Fire Certification Course © TNSI 2019 **Slide 10-24**

24

25

Remote Station

Section 26.5 shall apply where central station service is neither required nor elected

NFPA 72 26.5 ['19]

26

Indication of Remote Station Service

Owners of system shall provide annual documentation to the AHJ identifying the party responsible for inspection, testing, and maintenance required in Chapter 14

The documentation shall take one of the following forms:

- 1. Affidavit attesting to the responsibilities and qualifications of the parties performing the inspection, testing, and maintenance and accepting responsibility of compliance and signed by a representative of the service provider
- 2. Documentation indicating code compliance of the remote station alarm system issued by the organization that listed the service provider
- 3. Other documentation acceptable to the AHJ

27

Remote Supervising Station Requirements

The requirements for the Facilities, equipment, personal, and record keeping at the listed Central Supervising Station are found at NFPA 72 26.5.3, 26.5.4, 26.5.5, and 26.5.8 ['19]

These go beyond scope of this course

28

Disposition of Alarm and Supervisory Signals

The remote station shall perform the following actions:

- Retransmit the alarm to the communications center in accordance with 26.2.1.
- Immediately notify the owner or the owner's representative.
- NFPA 72 26.5.6.3.1 ['19]

Upon receipt of a supervisory signal that is not prearranged:

- Immediately notify the owner or the owner's representative.
- Where required, notify the AHJ
- NFPA 72 26.5.6.3.2 ['19]

29

Disposition of Trouble Signals

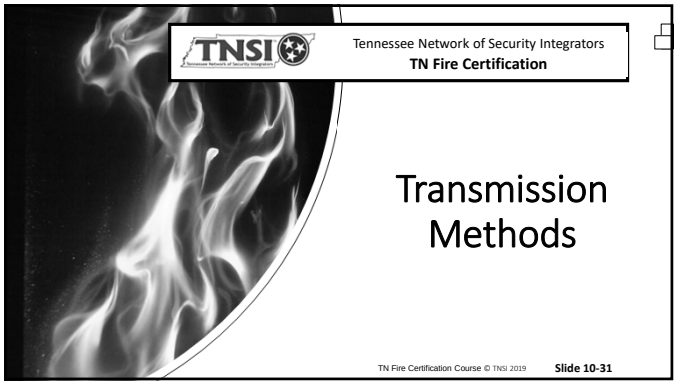
Upon receipt of a trouble signal that is not prearranged:

- Immediately notify the owner or the owner's representative.
- Where required, notify the AHJ

Remote station operators may delay transmission for 15 minutes and if trouble restoral is received in that 15 minute period no notification is needed.

NFPA 72 26.5.6.3 ['19]

30



31

Performance Based Technologies

- Communication methods operating on principles different from specific methods covered in this chapter shall be allowed if they conform to the performance requirements of this section
- Provision shall be made to monitor the integrity of the transmission technology & its communication path
- Where a single path is used the following requirements shall be met:
  - The path shall be supervised at an interval of not more than 60 minutes
  - A failure of the path shall be annunciated at the supervising station within 60 minutes
  - Failure to complete a signal shall be annunciated at the premises in accordance with 10.15

NFPA 72 26.3 ['19]

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32

Performance Based Technologies

- Where a multiple transmission path is used the following requirements shall be met:
  - 1. The path shall be supervised at an interval of not more than 6 hours.
  - 2. A failure of any path shall be annunciated at the supervising station within 6 hours..
  - 3. Shall be arranged so that a single point of failure shall not cause more than a single path to fail.
  - 4. Failure to complete a signal shall be
- A single technology shall be permitted to be used to create multiple paths provided that 26.6.3.4(1) through 26.6.3.4(4) are met.

NFPA 72 26.3 ['19]

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33

34

Digital Alarm Communicator Transmitter

- Shall be connected to Managed-Facilities-Based Voice Network upstream of any private telephone system at the protected premise
- MFBVN shall be under the control of the subscriber of the alarm service

NFPA 72 26.6.4 ['19]

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35

Digital Alarm Communicator Transmitter

- A system employing a DACT shall employ a single phone line and one of the following:
  - One-way private radio system
  - Two-way RF multiplex system
  - Transmission means complying with 26.6.3.
  - A second phone line where all the following are met:
    - Access to other technology in 1, 2, or 3 is not available
    - The AHJ approves
    - The DACT is programmed to call a second DACR when the signal transmission sequence to the first is unsuccessful
    - DACT is capable of selecting the operable means if the other fails
    - Each line is tested in accordance with 26.6.4.1.4(B) or alternating 6 hours

NFPA 72 26.6.4.1.4 (A) ['19]

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36

Digital Alarm Communicator Transmitter

The following requirements shall apply to all combinations listed in 26.6.4.1.4(A):

- Means for supervising each channel approved for its method of communication.
- If no signal sent within 6 hours a test signal is sent.
- Failure of one channel will cause a trouble sent on the other within 4 minutes.
- When one fails all status changes shall be sent over the other.
- Primary channel capable of indicating to the DACT that message received at supervising station.
- Unless the primary has failed, the first attempt shall be on the primary channel.
- Simultaneous transmission on both channels permitted.
- Failure of telephone lines annunciated locally.

NFPA 72 26.6.4.1.4(B) ['19] TN Fire Certification Course © TNSI 2019 **Slide 10-37**

37

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Radio System

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38

Radio Systems

- Code breaks them into two sections.
- Two-Way RF Multiplex systems 26.6.5
- One-Way Private Radio Alarm Systems 26.6.5.2
- If installing one of these read through the proper section in NFPA 72

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39

Annunciators

1

Alarm Annunciation

- Where required by other governing laws, codes, or standards, the location of an operated initiating device shall be annunciated by visible means

NFPA 72 18.1.1 ['19]

2

Alarm Annunciation

- Visible annunciation of the location of an operated initiating device shall
  - be by an indicator lamp, alphanumeric display, printout, or other approved means
  - not be canceled by the means used to deactivate alarm notification appliances

NFPA 72 10.18.1 ['19]

3

Supervisory and Trouble Annunciation

- Where required by other governing laws, codes, or standards, supervisory and/or trouble conditions shall be annunciated by visible means
- Visible annunciation shall be by an indicator lamp, an alphanumeric display, a printout, or other means

NFPA 72 10.18.2 ['19]

4

Supervisory and Trouble Annunciation

- The visible annunciation of supervisory and/or trouble conditions shall not be canceled by the means used to deactivate supervisory or trouble notification appliances
- **<u>You can Silence but must display until issue is fixed</u>**

NFPA 72 10.18.2 ['19]

5

Annunciator Access and Location

- All required annunciation means shall be readily accessible to responding personnel
- All required annunciation means shall be located as required by the AHJ to facilitate an efficient response to the situation

NFPA 72 10.18.3 ['19]

6

Annunciators

Alarm Annunciation Display

- Visible annunciators shall be capable of displaying all zones in alarm
- If all zones in alarm are not displayed simultaneously, the zone of origin shall be displayed
- If all zones in alarm are not displayed simultaneously, there shall be an indication that other zones are in alarm

NFPA 72 10.18.4 ['19]

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7

Annunciation Zoning

- Each floor of the building shall be considered as a separate zone
- If a floor of the building is subdivided into multiple zones by fire or smoke barriers and the fire plan for the protected premises allows relocation of occupants from the zone of origin to another zone on the same floor, each zone on the floor shall be annunciated separately
- Each building shall be annunciated separately

NFPA 72 10.18.5 ['19]

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8


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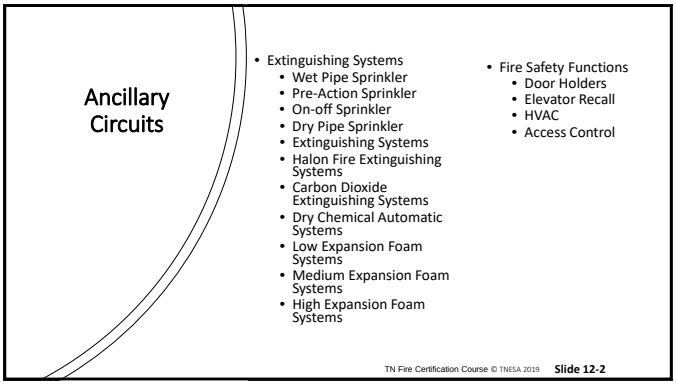
TN Fire Certification
Ancillary Circuits- Interconnecting Special Systems
TN Fire Certification Course © TNSI 2019
Slide 12-1

1


Ancillary Circuits
Extinguishing Systems
Wet Pipe Sprinkler
Pre-Action Sprinkler
On-off Sprinkler
Dry Pipe Sprinkler
Extinguishing Systems
Halon Fire Extinguishing Systems
Carbon Dioxide Extinguishing Systems
Dry Chemical Automatic Systems
Low Expansion Foam Systems
Medium Expansion Foam Systems
High Expansion Foam Systems
Fire Safety Functions
Door Holders
Elevator Recall
HVAC
Access Control
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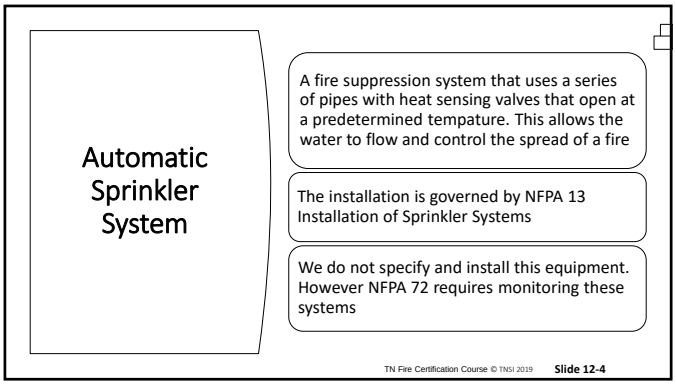
Slide 12-2

2


Tennessee Network of Security Integrators
TN Fire Certification
Automatic Sprinkler Systems
TN Fire Certification Course © TNSI 2019
Slide 12-3

3


Automatic Sprinkler System
A fire suppression system that uses a series of pipes with heat sensing valves that open at a predetermined tempature. This allows the water to flow and control the spread of a fire
The installation is governed by NFPA 13 Installation of Sprinkler Systems
We do not specify and install this equipment. However NFPA 72 requires monitoring these systems
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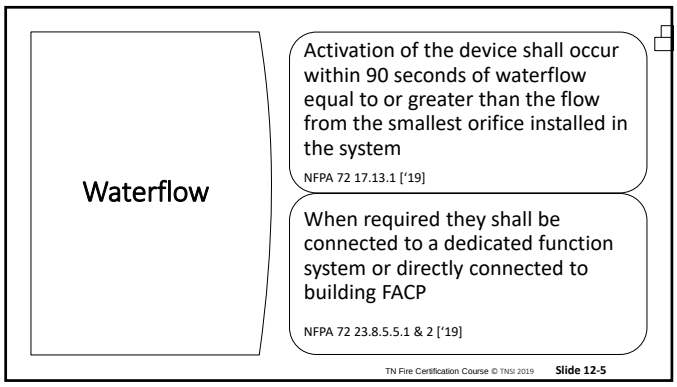
Slide 12-4

4


Waterflow
Activation of the device shall occur within 90 seconds of waterflow equal to or greater than the flow from the smallest orifice installed in the system
NFPA 72 17.13.1 [‘19]
When required they shall be connected to a dedicated function system or directly connected to building FACP
NFPA 72 23.8.5.5.1 & 2 [‘19]
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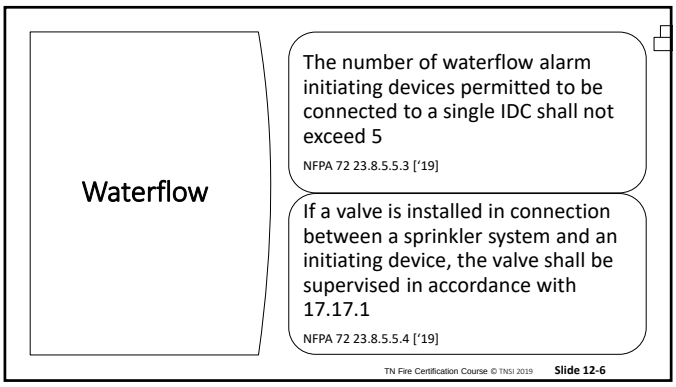
Slide 12-5

5


Waterflow
The number of waterflow alarm initiating devices permitted to be connected to a single IDC shall not exceed 5
NFPA 72 23.8.5.5.3 [‘19]
If a valve is installed in connection between a sprinkler system and an initiating device, the valve shall be supervised in accordance with 17.17.1
NFPA 72 23.8.5.5.4 [‘19]
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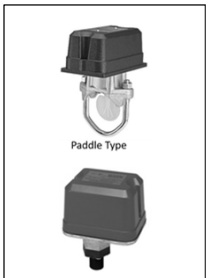
Slide 12-6

6



Waterflow Switch

- Vane type waterflow detectors mount to water-filled pipes in sprinkler systems Waterflow in the pipe deflects a vane
- Deflection of the vane produces a switched output, usually after a specified delay
- The switch has a pneumatically controlled mechanical delay mechanism
- Delays are noncumulative; they reset if the flow of water stops before the entire delay has elapsed
- All detectors will activate on a sustained flow of water greater than the maximum specified

7

Supervisory Devices

When required they shall be connected to a dedicated function system or directly connected to building FACP
NFPA 72 23.8.5.6.1 & 2 ['19]

The number of supervisory initiating devices permitted to be connected to a single IDC shall not exceed 20
NFPA 72 23.8.5.6.3 ['19]

8

Control Valve Supervisory Signal-Initiating Device

Two separate and distinct signals shall be initiated: one indicating movement of the valve from its normal position (off-normal) and the other indicating restoration of the valve to its normal position

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

Off-normal shall not be restored at any valve position except normal

NFPA 72 17.17.1 ['19]

9

Supervisory

10

OS & Y Valve

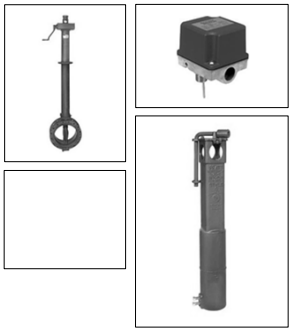
Outside Screw & Yoke

- A valve design in which the stem threads are above the packing gland or outside the valve body and there is a yoke to support the top or outer end of the stem
- Used to cut off water to the sprinkler system

11

P.I.V.
Post Indicator Valves

- The unseen gate valve used to control water supply to sprinkler, deluge, water spray, foam and standpipe systems
- The PIV controls water flow into the sprinkler system from the public water system



12

Butterfly Valves

- A gate valve used to control water supply to sprinkler, deluge, water spray, foam and standpipe systems
- The Butterfly Valve controls water flow into the private system from the public water system

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13

Pressure Supervisory Signal-Initiating Device

Two separate and distinct signals shall be initiated: one indicating the pressure has increased or decreased (off-normal) and the other indicating restoration of the pressure to its normal position

Shall indicate both high and low pressure

Off-normal shall indicate when the required pressure increases or decreases by 10psi

NFPA 72 17.17.2 ['19]

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14

Pressure Switch

- As pressure changes, a diaphragm actuates 1 or 2 snap action switches
- The pressure switch actuation is determined by adjustment settings

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15

Water Level Supervisory Signal-Initiating Device

Two separate and distinct signals shall be initiated: one indicating the required water level been lowered or raised (off-normal) and the other indicating restoration

Pressure tank initiating device shall indicate raise of 3 inches or lower by 3 inches

Other than pressure tank shall initiate a signal when lowered by 12 inches

NFPA 72 17.17.3 ['19]

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16

Water & Room Temperature Supervisory Signal-Initiating Device

Temperature supervisory device for water tanks exposed to freezing conditions shall send two signals. One when temperature falls below 40 degrees Fahrenheit and when it restores above 40 degrees Fahrenheit.

Room temperature supervisory device for shall indicate a decrease in room temperature to 40 degrees Fahrenheit and when it restores above 40 degrees Fahrenheit.

NFPA 72 17.17.4 & 5 ['19] TN Fire Certification Course © TNSI 2019 **Slide 12-17**

17

Water Temperature Supervisory Signal

- A temperature supervisory device for a water storage container exposed to freezing conditions shall initiate two separate and distinctive signals
- One signal shall indicate a decrease in water temperature to 40°F, and the other shall indicate its restoration to above 40°F

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18

Alarm Signal Initiating Fire Suppression Other Than Sprinklers

When a building fire alarm is installed then actuation shall annunciate an alarm or supervisory at the FACP

NFPA 72 23.8.5.7 ['19]

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19

Supervisory Signal Initiating Fire Suppression Other Than Sprinklers

Where required to be monitored and a building fire alarm system is installed, an off-normal condition of a fire suppression system shall annunciate a supervisory condition at the building fire alarm control unit

NFPA 72 23.8.5.8 ['19]

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20

Fire Pump

Where fire pumps are required to be monitored and a building fire alarm system is installed, a pump running signal shall be permitted to be a supervisory or alarm

Where fire pumps are required to be monitored and a building fire alarm system is installed, signals other than pump running shall be supervisory signals

NFPA 72 23.8.5.9 ['19]

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21

Releasing Fire Alarm Sytems

Shall be connected to protected premise system

Fire alarm and supervisory signals shall be annunciated at the building systems

NFPA 72 23.8.5.10 ['19]

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22

Tennessee Network of Security Integrators
TN Fire Certification

Protected Premises Fire Safety Functions General Requirements

TN Fire Certification Course © TNSI 2019 Slide 12-23

23

Fire Safety Functions or Emergency Control Functions

Elevator Recall

Elevator Shutdown

Smoke Control/HVAC Systems

Door Release Service

Door Unlocking Devices

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24

General Requirements

- Emergency control functions shall be permitted to be performed automatically
- Performance of emergency control functions shall not interfere with power for lighting or for operating elevators
- Performance of emergency control functions shall not preclude the combination of fire alarm services with other services requiring monitoring of operations

NFPA 72 21.2 ['19]

25

Listing & Monitoring

- A listed relay or other listed appliance used to initiate control of emergency control functions shall
  - be located within 3 ft of the controlled circuit or appliance.
  - function within the voltage and current limitations of the fire alarm control unit
- Installation wiring between the fire alarm control unit and the relay or other appliance shall be Class A, B, D, N, or X.

NFPA 72 21.2 ['19]

26

Non-Interference & Protection

- Emergency control functions shall not interfere with other operations of the fire alarm system
- The method(s) of interconnection between the fire alarm system and controlled electrical and mechanical systems shall be monitored for integrity; shall comply with the applicable provisions of NFPA 70, National Electrical Code, Article 760; and shall be achieved by one of the following recognized means:

Electrical contacts listed for the connected load	Data communications over signaling line circuit(s) dedicated to the fire alarm or shared with other premises operating systems	Other listed methods

NFPA 72 21.2 ['19]

27

Tennessee Network of Security Integrators
TN Fire Certification

Elevator Recall

28

Connect to System

- All fire alarm initiating devices used to initiate elevator Phase 1 Emergency Recall Operation shall be connected to the required building fire alarm system

NFPA 72 21.3.1 ['19]

29

Dedicated Panel Allowed

- In facilities without a building fire alarm system, initiating devices used to initiate fire fighters' service recall shall be connected to a nonrequired system or a dedicated function fire alarm control unit that shall be designated as "elevator recall control and supervisory control unit," permanently identified on the dedicated function fire alarm control unit and on the record drawings

NFPA 72 21.3.1 ['19]

30

Specific Detectors Required

NFPA 72 21.3.3.1 ['19]

Unless otherwise permitted by 21.3.3.2 or required by the AHJ, only the elevator lobby, elevator hoistway, elevator machine, elevator machinery space, elevator control room, and elevator control space smoke detectors or other automatic fire detection as permitted by 21.3.10 shall be used to initiate Elevator Phase 1 Emergency Recall Operation.

31

Independent Action Required

NFPA 72 21.3.4 ['19]

Each fire alarm initiating device used to initiate Phase 1 Emergency Recall Operation shall be capable of initiating the elevator recall when all other devices on the same initiating device circuit have been manually or automatically placed in the alarm condition

32

Lobby Detector Location

NFPA 72 21.3.5.1 & 2 ['19]

- A lobby smoke detector shall be located on the ceiling within 21 ft of the centerline of each elevator door within the elevator bank under control of the detector
- For lobby ceiling configurations exceeding 15 ft in height or that are other than flat and smooth, detector locations shall be determined in accordance with Chapter 17

33

UnSprinklered Hoistways

NFPA 72 21.3.6 ['19]

Smoke detectors or other automatic fire detection as permitted in 21.3.10 shall not be installed in unsprinklered elevator hoist ways unless they are required by ANSI/ASME A17.1/CSA B44 for actuation of the elevator hoist way smoke relief equipment and/or to initiate Elevator Phase 1 Emergency Recall Operation for either of the following:

1. Hoist way machinery spaces containing a motor controller or driving machine
2. Control spaces located in the hoist way

34

Consider Ambient Conditions

NFPA 72 21.3.10 ['19]

If ambient conditions prohibit installation of automatic smoke detection, other automatic fire detection shall be permitted

35

Reporting

NFPA 72 21.3.12 ['19]

Actuation of the elevator hoist way, elevator machine room, elevator machinery space, elevator control space, elevator control room smoke detectors or other automatic fire detection as permitted by 21.3.10 shall cause separate and distinct visible annunciation at the building fire alarm control unit or at the fire control unit described in 21.3.2

36

Distinct Annunciation

The initiating devices shall cause separate and distict visibal annunciation at the building fire alarm control unit or at the fire alarm control unit described in 21.3.2

If approved by the AHJ, detectors shall be permitted to initiate a supervisory signal

NFPA 72 21.3.12 & 13 ['19]

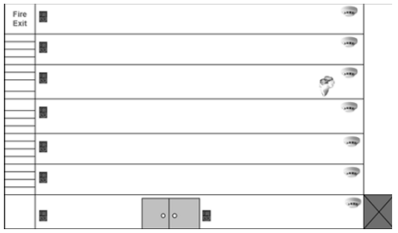
37

Elevator Control

NFPA 72 21.3.14 ['19]

- Three outputs shall be provided to the elevator equipment the to implement Elevator Phase 1 Emergency Recall Operation in accordance with Section 2.27 of ANSI/ASME A17.1, Safety Code for Elevators and Escalators
- 1. Designated level output
- 2. Alternate level output
- 3. Elevator machine room, elevator machinery, elevator control space, or elevator control room output

38

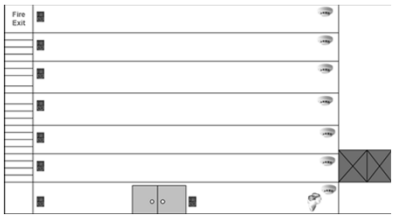


Elevator Recall – Phase I Designated Level

- If fire is detected on any floor except the floor designated as the level of discharge, system sends elevator car to the "designated floor"

NFPA 72 21.3.14.1 ['19]

39



Elevator Recall – Phase I Alternate Level

- If fire is detected on the floor designated as the level of discharge, system sends elevator car to "alternate floor"

NFPA 72 21.3.14.2 ['19]

40

Elevator Shutdown By Heat Detectors

Heat detector shall have both a lower temperature rating and a lower response time as compared to the sprinkler

Heat detectors shall be placed within 2ft of each sprinkler head and be installed in accordance with the requirements of Chapter 17. Alternatively, engineering methods, such as specified in Annex B, shall be permitted to be used to select and place heat detectors to ensure response prior to any sprinkler head operation under a variety of fire growth rate scenarios

NFPA 72 21.4 ['19]

41

Other Requirements

Control circuits to shut down elevator power shall be monitored for presence of operating voltage

Loss of voltage to the control circuit for the disconnecting means shall cause a supervisory signal to be indicated at the control unit and required remote annunciators

Initiating devices shall be monitored for integrity by the control unit

NFPA 72 21.4 ['19]

42

Elevator Shutdown By Pressure or Waterflow Switches

If pressure or waterflow switches are used the use of devices with time delay switches or time-delay capability shall not be permitted

NFPA 72 21.4 ['19]

43

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Smoke Management

44

Smoke Management

- Door Control
- Dampers
- Automatic Shutdown
- Air Conditioning and Ventilating Systems

45

HVAC Systems

If connected to the fire alarm system serving the protected premises, all detection devices used to cause the operation of HVAC systems smoke dampers, fire dampers, fan control, smoke doors, and fire doors shall be monitored for integrity in accordance with 12.6

NFPA 72 21.7.2 ['19]

46

Connections

Connections between fire alarm systems and the HVAC system for the purpose of monitoring and control shall operate and be monitored in accordance with applicable NFPA standards

Smoke detectors mounted in the air ducts of HVAC systems shall initiate a supervisory signal. An alarm signal shall be permitted

NFPA 72 21.7.4 ['19]

47

System Requirements

- If the fire alarm control unit actuates the HVAC system for the purpose of smoke control, the automatic alarm initiating zones shall be coordinated with the smoke-control zones they actuate
- Where interconnected as a combination system, a Firefighter's Smoke Control Station (FSCS) shall be provided to perform manual control over the automatic operation of the system's smoke control strategy
- Where interconnected as a combination system, the smoke control system programming shall be designed such that normal HVAC operation or changes do not prevent the intended performance of the smoke control strategy

48

Smoke Detector Requirements

- Shall follow requirements of 21.7.4 HVAC Systems
- If powered from premise system, operation of power circuit follow 23.4.2.2. Power loss causes trouble on circuit
- If separate power then follow 23.8.5.3
- If not resettable from premise system , a listed alarm/supervisory indicator with a reset switch shall be provided in an accusable location

NFPA 72 23.8.5.4.6 ['19]

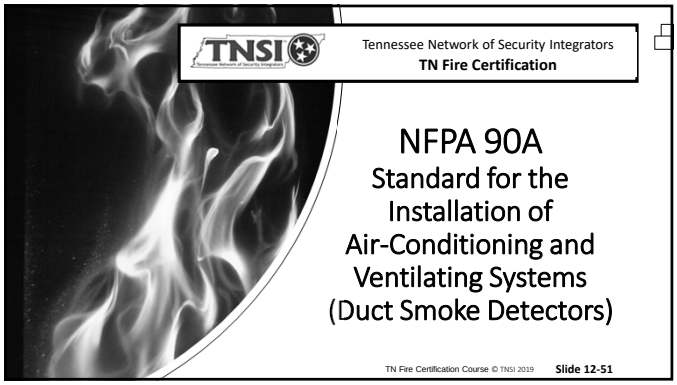
49

System Requirements

- If CO detection or a dedicated CO system initiates a ventilation response, a smoke control response of the fire alarm system shall take precedence over the response of the CO detection

NFPA 72 21.7.6 ['19]

50



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NFPA 90A
Standard for the Installation of Air-Conditioning and Ventilating Systems (Duct Smoke Detectors)

51

Smoke Detection for Air Duct Systems

- Where required by other NFPA codes, a smoke detector listed for the air velocity present shall be installed in the supply air duct downstream from fan and filters.
  NFPA 17.7.5.4..1(A) ['19]
- The International Mechanical Code and NFPA 90A are the codes requiring installation.

52

International Mechanical Code

NFPA 90A 6.4.2.1 [19]

Smoke Detectors listed for use in air distribution systems shall be located:

(a) Downstream of the air filters and ahead of any branch connections in air return systems having a capacity greater than 2,000 cfm

(b) At each story prior to the connection to a common supply and prior to any recirculation or fresh air inlet connection in air supply systems having a capacity greater than 15,000 cfm, and serving more than one story

- Exception No. 1: Supply system smoke detectors are not required when the entire space served by the air distribution system is protected by a system of area smoke detectors
- Exception No. 2: Fan units whose sole function is to remove air from inside the building to outside the building"

53

Duct Detectors

- ***The primary purpose of duct smoke detection is to prevent injury, panic, and property damage by reducing the spread (recirculation) of smoke***
- Duct smoke detection can also serve to protect the air conditioning system itself from fire and smoke damage, and can be used to assist in equipment protection applications, for example, in the ventilation/exhaust duct work of mainframe computers and tape drives
- Duct smoke detection is ***not***
  - *a substitute for an area smoke detector.*
  - *a substitute for early warning detection.*
  - *a replacement for a building's regular fire detection system*

54

Smoke Detector Requirements

- Must be listed for the purpose they are being used
- Installed in a way to obtain representative sample of air
- Must be installed according to manufacture's requirements and accusable for testing and cleaning
- All penetrations of the air duct shall be sealed to prevent entrance of outside air and possible dilution of smoke in the duct

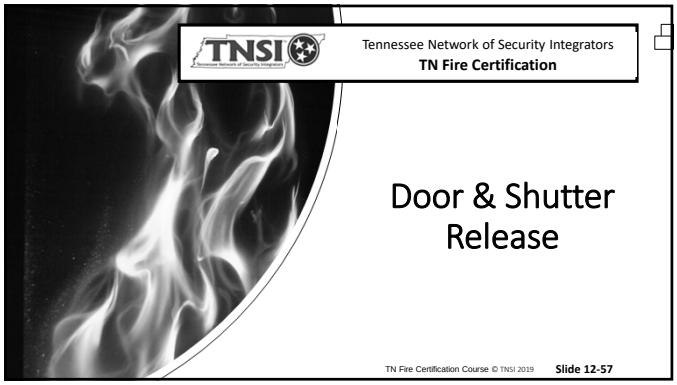
NFPA 72 17.5.5 ['19]

55

Check with your local AHJ

- ***The primary purpose of duct smoke detection is to <u>shut down the fan units</u> as to prevent injury, panic, and property damage by reducing the spread (recirculation) of smoke.***
- In many jurisdictions' you will need a Mechanical, electrical and/or other form of licensure to install, service, inspect or test the Duct Smoke Detector.
- In many new HVAC Units, the devices are built into the units by the manufacture and may be inaccessible to improperly licensed service technicians.


56



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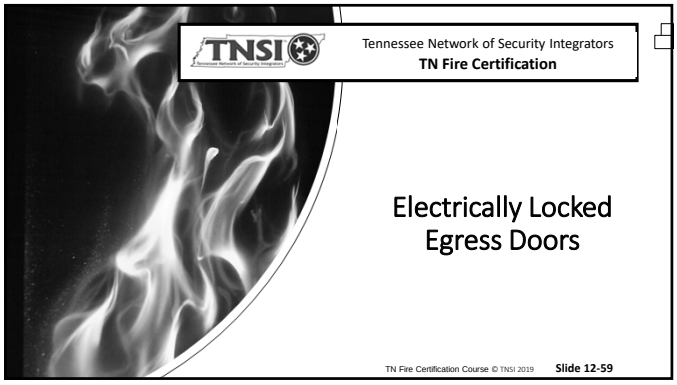
Door & Shutter Release

57

Door Release Service

- Other than smoke detectors used only for door and shutter release, all detection devices used for door hold-open release service shall be monitored for integrity in accordance with 12.6.
- Unless installed as Class D all door hold-open release and integral door release and closure devices used for release service shall be monitored for integrity in accordance with 12.6.
- Magnetic door and shutter holders that allow doors to close upon loss of operating power shall not be required to have a secondary power source

58



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Electrically Locked Egress Doors

59

Electrically Locked Egress Doors

- The code governing electrically locked egress doors is covered by the International Building Code
- Sensor release of electrically locked egress doors
  Requires activation of sprinkler and/or building fire alarm system to unlock doors and remain unlocked until reset
  IBC 1010.1.9.9 ['18]
- Door hardware release of electrically locked egress doors.
  Does not require sprinklers or building fire alarm system to unlock the doors
  IBC 1010.1.9.10 ['18]

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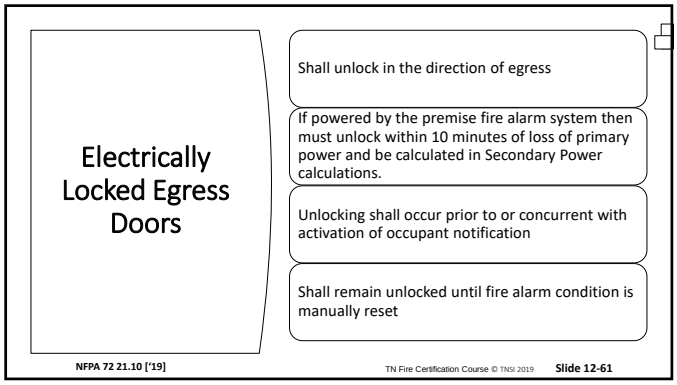
Electrically Locked Egress Doors
Shall unlock in the direction of egress
If powered by the premise fire alarm system then must unlock within 10 minutes of loss of primary power and be calculated in Secondary Power calculations.
Unlocking shall occur prior to or concurrent with activation of occupant notification
Shall remain unlocked until fire alarm condition is manually reset
NFPA 72 21.10 ['19]
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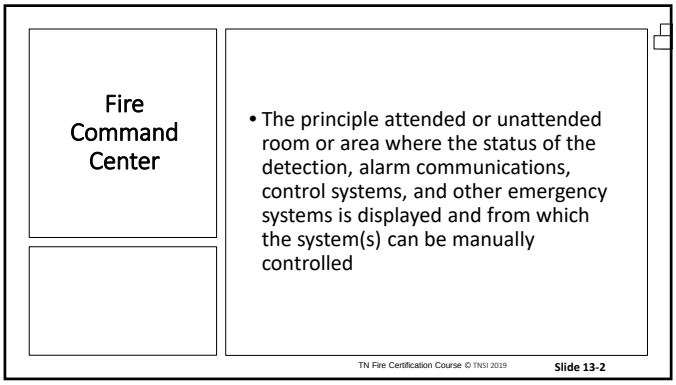
Slide 12-61

61

Fire Command Centers

1



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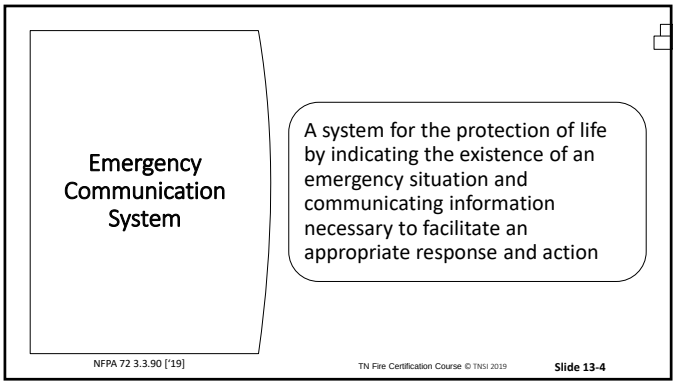

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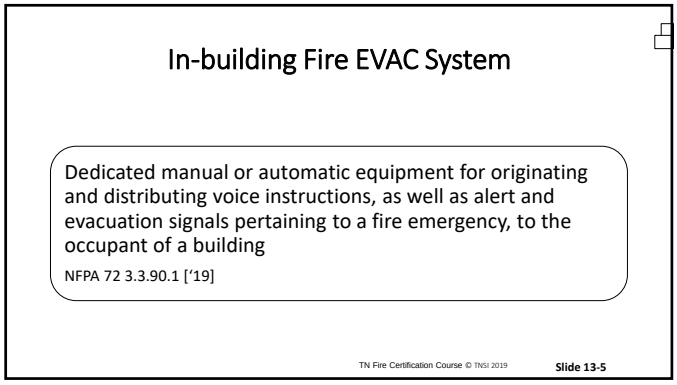

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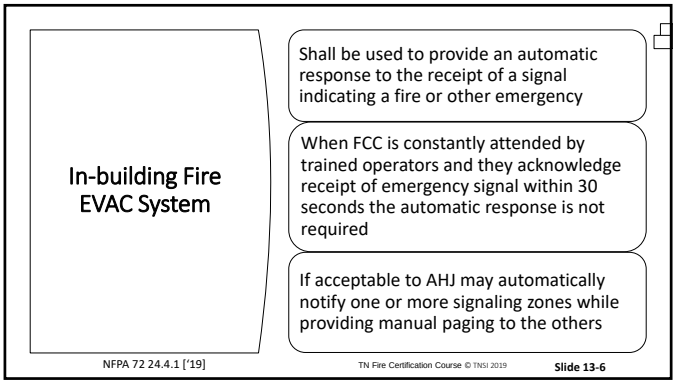


6

In-building Fire EVAC System

- Controls must be located where acceptable to the AHJ, only accessible to trained personnel, and clearly identified
- If multiple controls then only one can be used at a time, location having control identified by visual indicator
- If live voice instructions are provided they shall:
  - Override previous signals
  - Have priority over new automatic messages
  - Once mic is released shall not resume previous messages

NFPA 72 24.4.5 ['19]

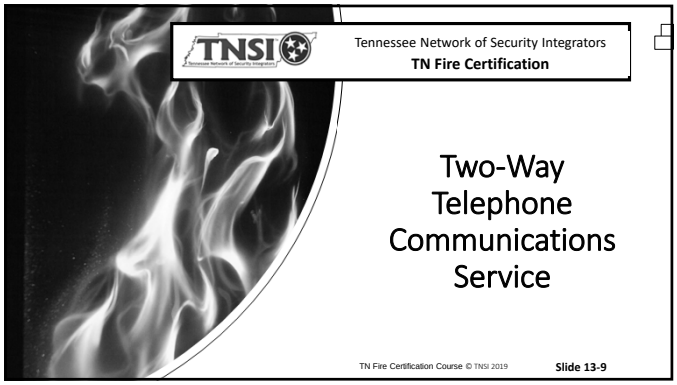
7

Mass Notification

- Other systems covered in Chapter 24 that go beyond class scope
- (1) In-building mass notification systems *(see Section 24.5)*
- (2) Wide-area mass notification systems *(see Section 24.6)*
- (3) Distributed recipient mass notification systems (DRMNS) *(see Section 24.7)*

NFPA 72 24 ['19]

8



9

Two-Way Telephone Communications Service

- Shall be for use by the fire service and be collocated with the EVAC system
  NFPA 72 24.8.2 ['19]
- Monitoring of the integrity of the two-way communication in accordance with 10.19.2
  NFPA 72 24.8.3 ['19]

10

Two-Way Telephone Communications Service

- Additional uses, if specifically permitted by the AHJ shall be permitted to include signaling and communications for a building fire warden organization, signaling and communications for reporting a fire and other emergencies (e.g., voice call box service, signaling, and communications for guard's tour service)
  NFPA 72 24.8.4 ['19]
- Variation of equipment and system operation provided to facilitate additional use of the two-way telephone communications service shall not adversely affect performance when used by the fire service
  NFPA 72 24.8.5 ['19]

11

Two-Way Telephone Communications Service

- Two-way telephone communication shall permit simultaneous operation of any five telephone stations in common talk mode
  NFPA 72 24.8.6 ['19]
- A notification signal at the control equipment, distinctive from any other shall indicate off-hook condition
  NFPA 72 24.8.7 ['19]
- Where selective talk service is supplied, a distinctive visual indication shall be furnished for each circuit so that each indicates off-hook status
  NFPA 72 24.8.8 ['19]

12

Two-Way Telephone Communications Service

A means for silencing the audible call-in signal sounding appliance shall be permitted, provided it is key-operated, in a locked cabinet, or provided with protection to prevent use by unauthorized persons

The means shall operate a visible indicator and sound a trouble signal whenever the means is in the silence position and no telephone circuits are in an offhook condition

NFPA 72 24.8.9 ['19]

13

Two-Way Telephone Communications Service

At least one telephone station or jack at the following locations:

- Each floor level
- Each notification zone
- Each elevator cab
- Elevator lobby
- Elevator machine room
- Emergency and standby room
- Fire pump room
- Area(s) of refuge
- Each floor level inside an enclosed exit stairs
- Other room(s) or area(s) as required by the AHJ

NFPA 72 24.8.12 ['19]

14

Two-Way Telephone Communications Service

If the two-way telephone system is intended to be used by fire wardens in addition to the fire service, the minimum requirement shall be a selective talk system (where phones are selected from the fire command center)

NFPA 72 27.8.13 ['19]

Telephone circuits shall be selectable from the fire command center either individually or, if approved by the AHJ, by floor or stairwell

NFPA 72 24.8.14 ['19]

If the control equipment provided does not indicate the location of the caller (common talk systems), each telephone station or telephone jack shall be clearly and permanently labeled to allow the caller to identify his or her location to the fire command center by voice

NFPA 72 24.8.15 ['19]

15

Two-Way Telephone Communications Service

If telephone jacks are provided, two or more portable handsets, as determined by the AHJ, shall be stored at the fire command center for use by emergency responders

NFPA 72 24.8.16 ['19]

Wall-mounted telephone appliances or related jacks shall be not less than 36 in. and not more than 66 in. above floor level with clear access to the appliance that is at least 30 in. wide

NFPA 72 24.8.17 ['19]

16

Two-Way Telephone Communications Service

If accessible to the general public, one telephone appliance per location shall be not more than 48 in. above floor level

NFPA 72 24.8.18 ['19]

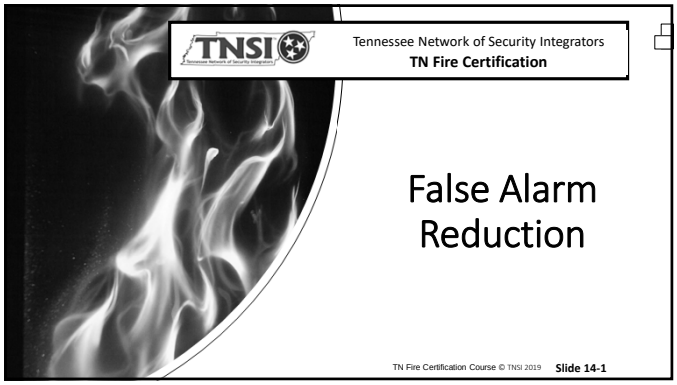
All circuits necessary for the operation of two-way telephone communications shall be installed in accordance with the pathway survivability requirements in 24.3.14.7

NFPA 72 24.8.19 ['19]

- Where building has less than 2-hour fire rated construction shall have pathway survivability of Level 1, 2, or 3.

17

False Alarm Reduction



1

Unwanted Alarms

- **Unwanted Alarms.** Any alarm that occurs that is not the result of a potentially hazardous condition
- **Malicious Alarm**. An unwanted activation of an alarm initiating device caused by a person acting with malice.
- **Nuisance Alarm.** An unwanted activation of a signaling system or an alarm initiating device in response to a stimulus or condition that is not the result of a potentially hazardous condition.

NFPA 72 3.3.314 ['19]

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2

Unwanted Alarms

NFPA 72 3.3.314 ['19]

- **Unintentional Alarm**. An unwanted activation of an alarm initiating device caused by a person acting without malice
- **Unknown Alarm**. An unwanted activation of an alarm initiating device or system output function where the cause has not been identified

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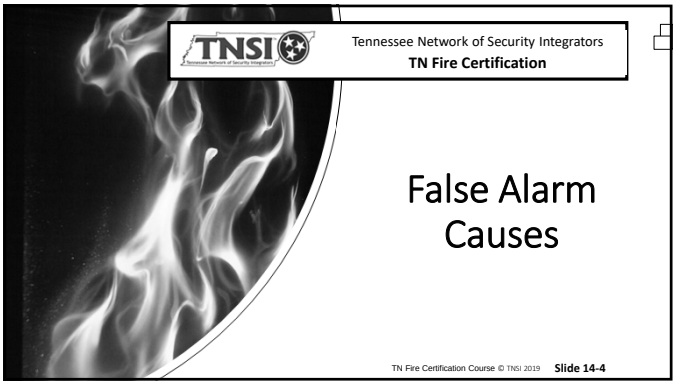
3



4

Equipment Selection

One of the major causes of unwanted alarms is improper placement of detectors

The best way to avoid unwanted alarms is not to install detectors in environments that can cause them to malfunction, or to install detectors specially designed for those environments

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5

Improper Installation

Improper installation can occur when detectors and their wiring are not protected from interference from induced currents and noise in adjacent wiring systems, radio-frequency transmissions, and other types of electromagnetic effects

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6

Equipment Location

Improper locations are environments where they will not operate properly because of temperature extremes; excessive dust, dirt, or humidity, excessive air flow rates, or the normal presence of combustion particles in the air streams surrounding the detectors

7

Equipment Location

- Placement of detectors near air conditioning or incoming air vents can cause excessive accumulation of dust and dirt on the detectors. This dirt can cause detectors to malfunction and cause unwanted alarms
- Detectors should not be located closer than **3 feet** from an air **supply** diffuser or an air **return** vent

NFPA 72 17.7.4.1 & A.17.4.1 ['19]

8

Equipment Location

Improper locations are environments where a detector will not operate properly because of:

a) Temperature extremes
b) Excessive dust or dirt
c) Humidity
d) Excessive air flow rates (i.e. ceiling fans)
e) Normal presence of combustion particles in the air streams surrounding the detectors. (above ash trays, kitchens, garages, etc.)

9

Maintenance

Inadequate maintenance can result in the accumulation of dust and dirt on the detector's sensing chambers over a period of time

Building maintenance issues, such as accidental triggering of a detector's magnetic test switch, or the introduction of plaster dust from drywall repairs into a detector's sensing chamber can cause unwanted alarms

10

Protection During Construction

When installed for signal initiating during construction, detectors shall be cleaned and verified to be within listed sensitivity or replaced

Were installed but not operational, they shall be protected from construction debris, dust, dirt, and damage in accordance with manufacture's instructions & verified to be in listed sensitivity or replaced

Where not required during construction detectors shall not be installed until all other trades have completed clean up

NFPA 72 17.7.1.12 ['19]

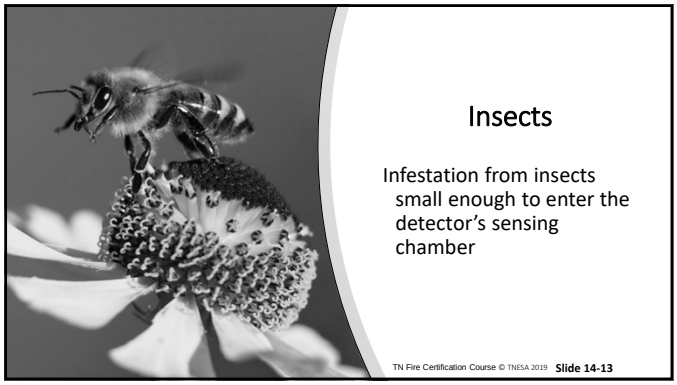
11

Seasonal Effects

Seasonal effects such as the reactivation of a building heating system after an extended summer shutdown can cause alarms

Induced current effects from lightning storms can cause alarms

12



Insects

Infestation from insects small enough to enter the detector's sensing chamber

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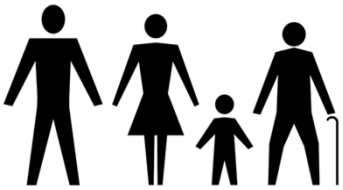

People

- Vandalism or mischievous acts — detectors set off as a prank
- Failure to notify when servicing a system

14

Effects of Other Systems

- Security systems
- Walkie-talkie; mobile telephones
- Heating, ventilating, and air conditioning controls
- Elevator call systems
- Remote control equipment (door closers, etc.)
- Microwave antennas

15

Alarm Logs

- All alarms should be entered into an Alarm Log
- Periodic review of the Alarm Log can show patterns in the reported alarms
- Most newer fire alarm control units have a history log

16

Eliminate Interference

The wiring layouts of the alarm system and any recent building or system modifications should be compared to make sure that the spacing and/or shielding required to protect the alarm system wiring from other potentially interfering electrical systems was maintained

17

Filters

- In excessively dusty or dirty areas consider using a detector that incorporates a microprocessor-controlled air intake fan and filter that allows the unit to be installed in areas where ordinary detectors cannot be used
- An intelligent smoke detector removes airborne particles before they reach the sensing chamber
- It is ideal for textile mills, dusty manufacturing facilities, paper mills, and recycling centers

18

False Alarm Reduction

Add Approved Guards

AHJ approved guards on pull stations can reduce false alarms

NFPA 72 17.3 ['19]

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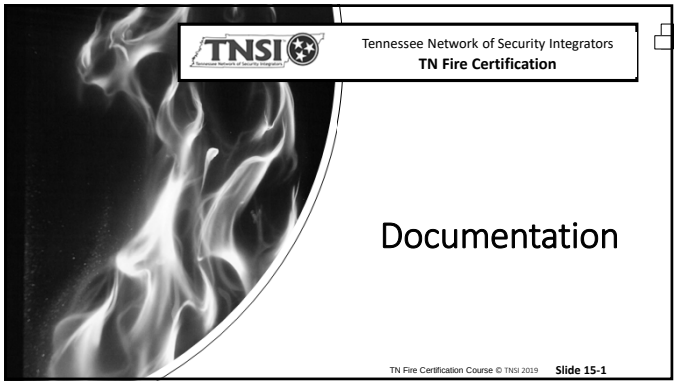
19

Documentation



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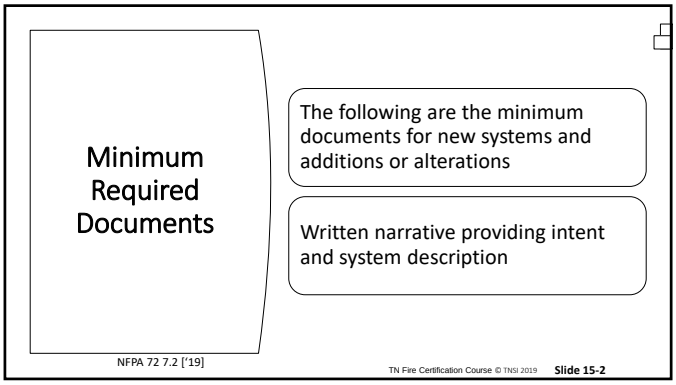

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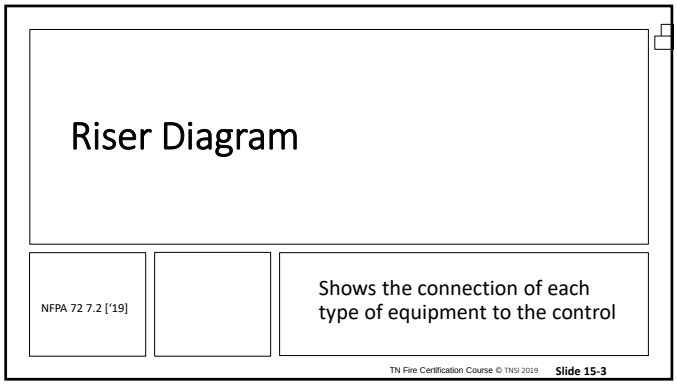

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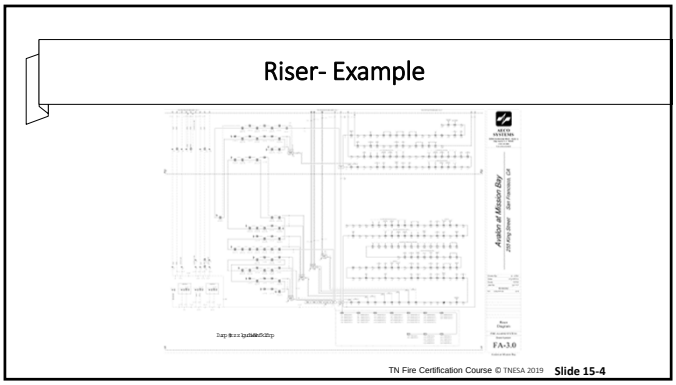

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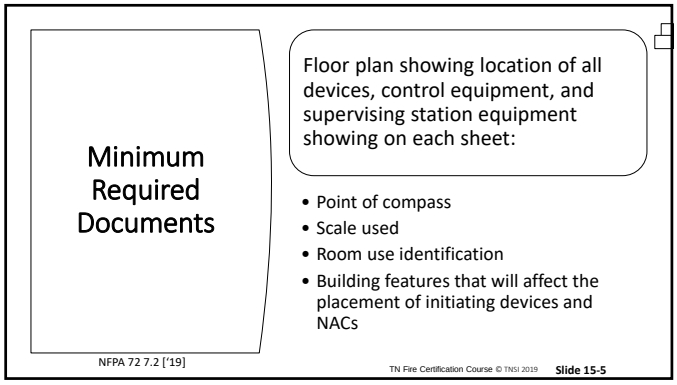

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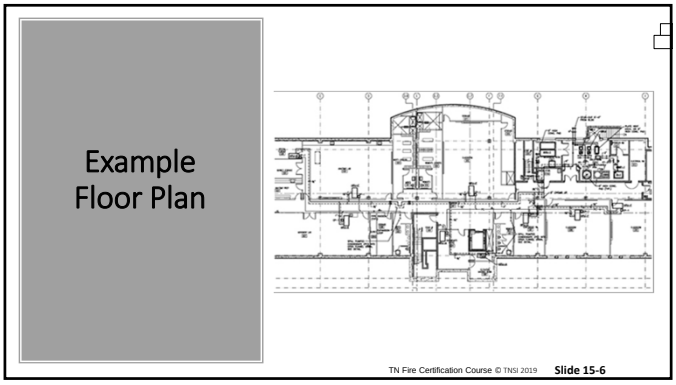

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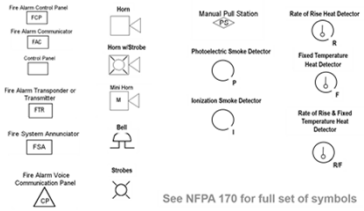
Documentation

Symbols



See NFPA 170 for full set of symbols

7

Minimum Required Documents

- Sequence of operations in either input/output matrix or narrative form
- Equipment technical data sheets
- Manufactures' published instructions, including operation and maintenance instructions
- Battery capacity and safety margins calculations

NFPA 72 7.2 ['19]

8

Minimum Required Documents

- Voltage drop calculations for NAC
- Mounting height for wall mounted devices and appliances
- Where occupant notification is required, minimum sound pressure levels produced by the NACs
- Location of notification appliances, including candela rating of visual notification appliances

NFPA 72 7.2 ['19]

9

Minimum Required Documents

- Pathway diagrams between control unit and shared communication equipment
- Completed record of completion in accordance with 7.5.6 and 7.8.2
- Copy of site specific software including instructions on how to obtain the means of system and software access

NFPA 72 7.2 ['19]

10

Minimum Required Documents

- Record (as-built) drawings
- Records, record retention, and record maintenance in accordance with section 7.7
- Completed record of inspection and testing in accordance with 7.6.6 and 7.8.2

NFPA 72 7.2 ['19]

11

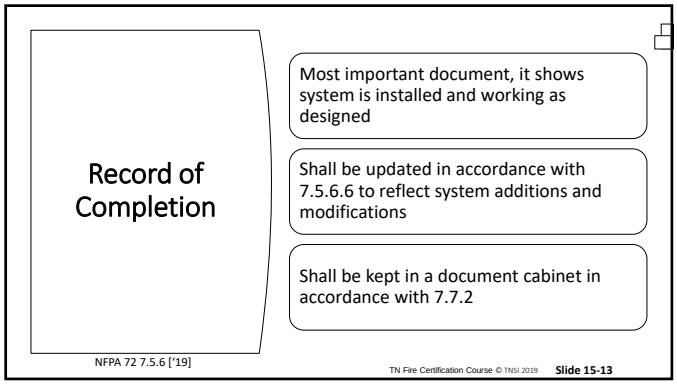
Record of Completion

- Most important document, it shows system is installed and working as designed.
- Can use the forms in NFPA 72 Figure 7.8.2(a) through Figure 7.8.2(f) or an alternative that contains only the needed elements.
- Shall be completed by the installing contractor. If more than one contractor each completes their portion.

NFPA 72 7.5.6 ['19]

12

Documentation



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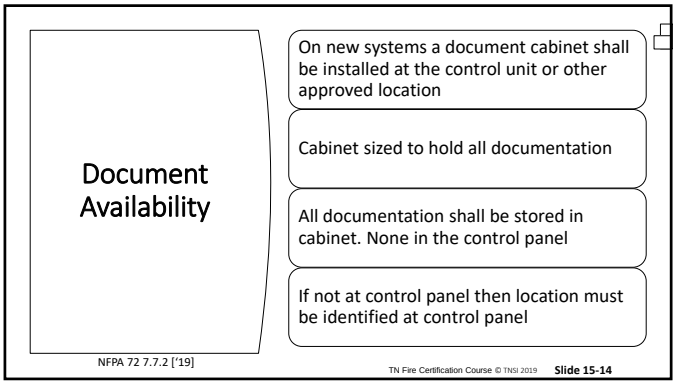

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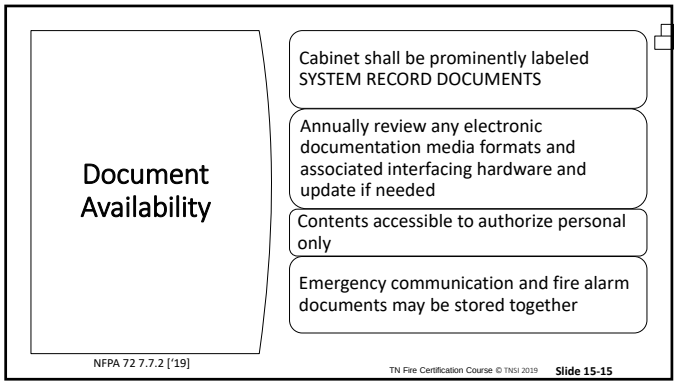

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Approvals & Acceptance

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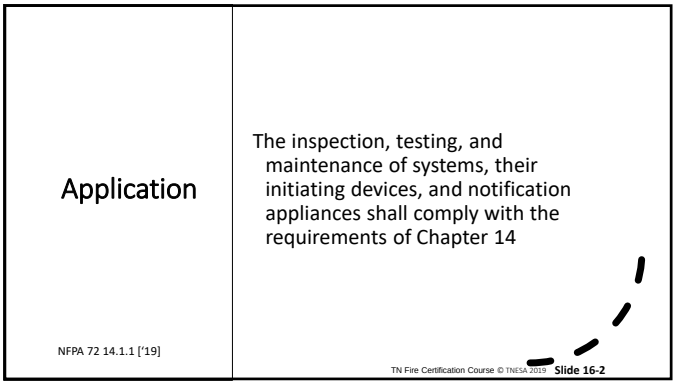

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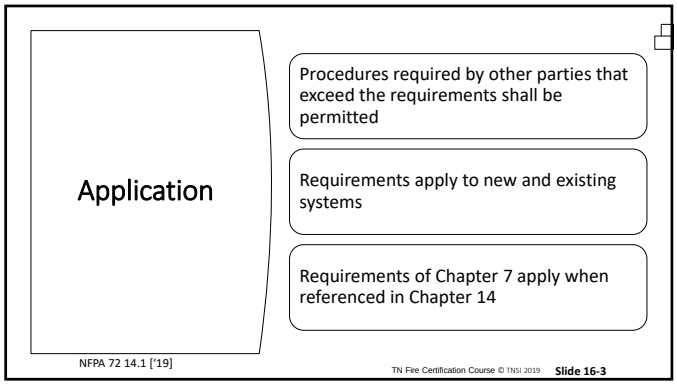

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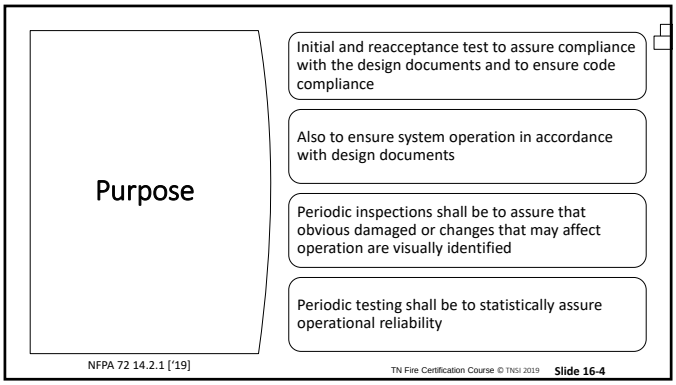

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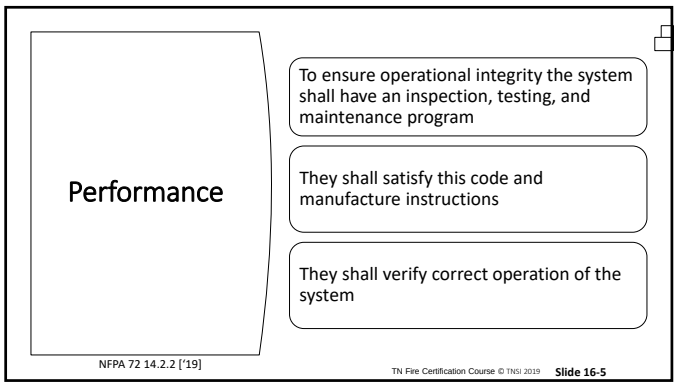

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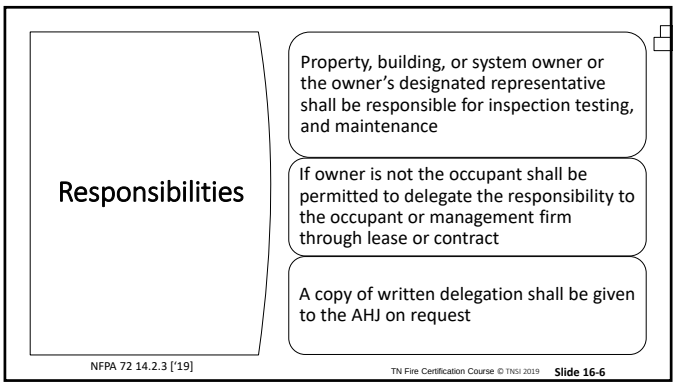


6

Service Personnel Qualification

- Must follow requirements of 10.5.3.
- Inspection, Testing, and Service personnel developed competence through training and experience acceptable by AHJ.
- Shall include Factory trained and certified, certified by nationally recognized organization, registered, licensed, or certified by a state or local agency, or employed and qualified by an organization listed by a NRTL

NFPA 72 14.2.3.6 ['19]

7

Notification

- Before proceeding all persons and facilities receiving signals and all building occupants shall be notified to prevent unnecessary response
- At the conclusion all previously notified shall be notified at the conclusion
- Building owner and service personnel shall coordinate system testing to prevent interruption of critical building systems

NFPA 72 14.2.4 ['19]

8

Releasing and other Emergency Control Functions

- Unless you are trained and qualified on ancillary systems these are not part of our scope

NFPA 72 14.2.6 & 14.2.7 ['19]

9

Test Plan

- A test plan shall be developed to clearly establish the scope of the testing for the fire alarm or signaling system
- The test plan and results shall be documented with the testing records

NFPA 72 14.2.10 ['19]

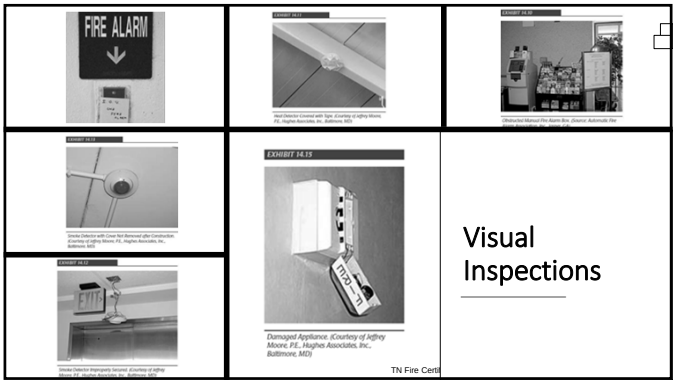
10

Inspection

- Visual inspection of the system shall be done in accordance with Table 14.3.1.
- If devices are not available due to safety issues the inspection may be done next shutdown as long as it does not exceed 18 months

NFPA 72 14.3 ['19]

11



Visual Inspections

12

Testing

- Testing is the act of triggering all devices to assure they are operating as listed
- There are two types
- Initial Acceptance is when a new system is inspected and tested in accordance with Chapter 14.
  AHJ shall be notified prior to this test

NFPA 72 14.4 ['19]

13

Testing

- Reacceptance test is done when a device is added or deleted
  Or if there are modifications or repairs to control hardware
- When changes to site specific software the following apply:
  - All functions affected by the change 100 percent tested
  - 10 percent of initiating devices not directly affected, up to 50 devices
  - Revise the Record of Completion

NFPA 72 14.4 ['19]

14

Functional Testing

15

Test Methods

- Unless the manufacture has specific instructions you will follow Section 14.4.3, 14.4.4 and Table 14.3.1
- This table will list all requirements on how often devices must be inspected and tested
- It will also describe exactly how to test each device

16

Maintenance, Inspection, and Testing Records

- Shall be retained until the next test and then for 1 year thereafter
- Restorable fixed-temp, spot type heat detectors tested over multiple years, records retained for 5 years and then 1 year thereafter
- Retained on a medium that will survive the retention period
  Electronic permitted

NFPA 72 10.21 ['19]

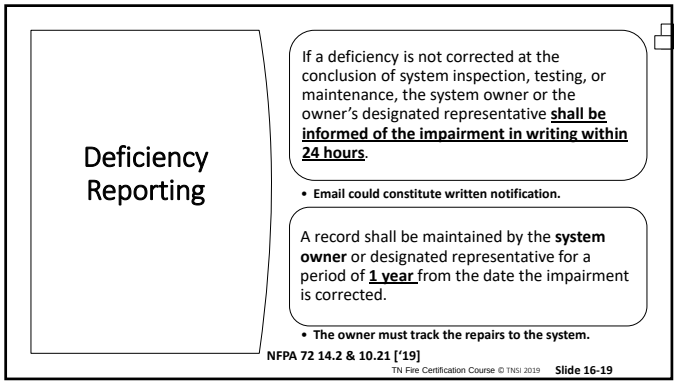
17

Impairments

- System defects and malfunctions shall be corrected
- If a defect or malfunction is not corrected at the conclusion of system inspection, testing, or maintenance, the system **owner** or the owner's designated representative **shall be informed of the impairment in writing within 24 hours**

NFPA 72 14.2.2.2 ['19]

18


Deficiency Reporting
If a deficiency is not corrected at the conclusion of system inspection, testing, or maintenance, the system owner or the owner's designated representative shall be informed of the impairment in writing within 24 hours.
• Email could constitute written notification.
A record shall be maintained by the system owner or designated representative for a period of 1 year from the date the impairment is corrected.
• The owner must track the repairs to the system.
NFPA 72 14.2 & 10.21 ['19]
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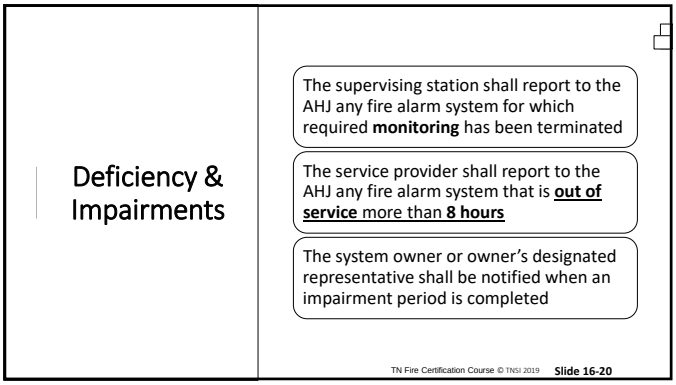
19


Deficiency & Impairments
The supervising station shall report to the AHJ any fire alarm system for which required monitoring has been terminated
The service provider shall report to the AHJ any fire alarm system that is out of service more than 8 hours
The system owner or owner's designated representative shall be notified when an impairment period is completed
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