

# Fire Alarm Plan Review

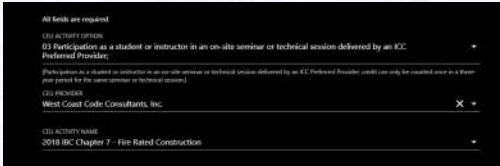
## The Basics

By: Rob Neale, CFPS  
801.547.8133  
robn@wc-3.com  
www.wc-3.com



### Certificate

- ❑ West Coast Code Consultants, Inc. is an ICC Preferred Provider (Provider #1129)
- ❑ This course has been approved by ICC to count for Preferred Provider Credit (Course #38471)



### Course Objectives

*The intent of this course is...*

1. To help ensure that an adequate fire alarm submittal has been provided.
2. Know what to verify on the fire alarm shop drawings.
3. Know what to check on the material specifications.



### Seminar Format

- 1) Introduction
- 2) Code Requirements
- 3) Submittal Requirements
- 4) **Document Review**
- 5) Example Projects
- 6) Final Thoughts


**This is the main structure, but we need to build the foundation first.**



## Limitations

*We only have one day!*

- ❑ Not all code requirements can be discussed.
- ❑ Not all items that may be associated with the fire alarm system can be addressed.
  - Firefighter's smoke control panel
  - ERCC
  - Emergency alarms (H-occupancies)
  - Gas detection
  - And more!
- ❑ *We are covering the basics only.*



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## PART 1

### Introduction





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## Introduction

*IBC §202 and §3.3.111 of NFPA 72 both define as:*

- ❑ **Fire Alarm System:** A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

*The Wikipedia definition is a bit clearer:*

- ❑ A fire alarm system is a building system designed to **detect and alert occupants and emergency forces** of the presence of smoke, fire, carbon monoxide, or other fire-related emergencies.




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## Introduction

*Why are they important?*

- ❑ It plays an important role in protecting and saving lives and properties. Here are a few items to highlight:
  - **Saves Lives:** Whether sleeping or working, early fire detection will warn building occupants and help them to respond quickly and get out of danger.
  - **Reduces Property Loss:** Notifies first-responders so they can be dispatched more quickly and reduce property loss.
  - **Shortens Recovery Time:** The less damage that occurs to the property, the more quickly the facility can reopen for business.
  - **Provides Insurance Discounts:** Many policies provide reduced premiums for properties with code compliant fire alarm systems.



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# Basic Components

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# Basic Components

## FACU

- ❑ The fire alarm control unit (FACU), or panel (FACP), serves as the brain for the fire alarm system.
- ❑ This is where all inputs are received, and outputs take place. Three separate conditions are shown at the panel, (1) alarm, (2) trouble, and (3) supervisory.

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# Basic Components

## Initiation

- ❑ Initiation devices can be either automatic or manual.
  - **Automatic** – Heat, smoke, duct, and beam detectors; tamper switches; fire sprinkler water flow switches
  - **Manual** – Pull station
- ❑ To initiate a response from equipment and occupants.
- ❑ They can be addressable or nonaddressable.
  - **Addressable** – Each device has separate address allowing FACU to monitor status and location.
  - **Non-addressable** – Set up in zones, each zone being connected to FACU

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# Basic Components

## Notification

- ❑ Notification devices are either audible, visible, or a combination.
- ❑ The purpose is to notify occupants of an emergency.
- ❑ The initiation devices send a signal to the FACU which in turn sends a signal to the notification devices by means of the Notification Appliance Circuit (NAC).

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# Basic Components

## Supervision

❑ This has two parts...

- 1) Other components/systems that are supervised by the fire alarm system.
- 2) Relaying alarm to first responders.

National Fire Protection Agency, "A Guide to Fire Alarm Basics", September 24, 2021



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# Basic Components

## Supervision (cont.)

I. Fire alarm systems have three capabilities: alarms, trouble, and supervisory. The supervisory signal indicates there is a problem with one of the systems monitored by the system. Components supervised by the FACU may include:

- Valves
- Fire pump condition
- Temperatures
- Gas detection systems
- Other suppression (e.g., hoods)
- Air pressure
- Water level in tank
- ERCCs monitoring
- And more

National Fire Protection Agency, "Guide to Fire Alarm Basics", January 2022





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# Basic Components

## Supervision (cont.)

2. This is how alarms are relayed to first responders.

- **Remote supervising station** – Constantly attended remote location
- **Proprietary supervising station** – Supervising station under same ownership as the protected building that it supervises
- **Central station fire alarm systems** – Remote supervising station listed for central station service per UL 827
- **Auxiliary fire alarm system** – System is connected to municipal fire alarm system



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# Basic Components



## Power Supplies

❑ Reliable power must be provided.

❑ IBC 907.2.11.6: Both primary and secondary power required.

- **Primary Power** – electric utility, generator, SEPSS, cogeneration system
- **Secondary Power** – batteries, emergency generator

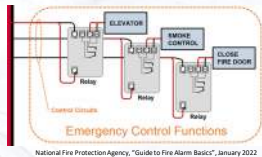
Oliver Fire Protection & Security, "Functions of a Fire Alarm System Power Supply", <https://oliverps.com/fire-alarm-system-power-supply/>



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# Basic Components



## Emergency Control Functions

- ❑ Typically, by means of a control circuit and relay, the FACU can control the function of other systems such as...
  - Elevator Recall
  - Door closers
  - Smoke control systems



# Plan Review Considerations

## Ponder the following:

- ❑ Is there a way to perform a smarter plan review?
- ❑ What really matters?
- ❑ Why have we been doing it this way for so long?
- ❑ What defines a quality plan review?
- ❑ Does your review ignore the experience level of your inspector(s)?
- ❑ Do your plan review comments add value to the project? If so, how?



# Plan Review Considerations

## Ponder the following (cont.):

- ❑ Are you enforcing this in the field?
- ❑ More comments **does not = higher quality**
- ❑ What are contractors consistently missing?
- ❑ What's new in the code that contractors aren't used to?
- ❑ Obscure notes in random places help no one.
- ❑ Adjust accordingly!
- ❑ The plans aren't our backstop → **The Code Is!**



# Plan Review Considerations

## Conditional Approval:

- ❑ Does everything have to be addressed on the plans prior to permit?
- ❑ Adding red-lines can expedite the process.
- ❑ A "Conditional Approval" list can be included as part of the approved plans and is legally binding.
- ❑ Remember they will need to provide "as-built" documents.

**Issued with Conditions**



## Plan Review Considerations

**Discussion:**

☐ Our authority to enforce the code is never weakened due to plan review approval.

☐ Pick up the “crumbs” in the field, the code allows us to do that.

[A] 105.4 Revocation. The fire code official is authorized to revoke a permit issued under the provisions of this code where it is found by inspection or otherwise that there has been a false statement or misrepresentation as to the material facts in the application or construction documents on which the permit or approval was based including, but not limited to, any one of the following:

[A] 105.3.6 Compliance with code. The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the fire code official from requiring the correction of errors in the construction documents and other data. Any addition to or alteration of approved construction documents shall be approved in advance by the fire code official, as evidenced by the issuance of a new or amended permit.

## Plan Review Considerations

**Comment Formatting**

☐ Number your comments

☐ Reference a plan sheet

☐ Include a code reference

☐ Write clearly, use spell check, be specific

☐ Provide direction

**Bad Example**



Provide smoke detectors.

**Good Example**

1. Sheet A1.1: Please provide smoke detectors in each sleeping room, outside of each sleeping area, and on each story as required by IFC 907.2.11.2.

## PART 2

### Code Requirements






## Code Requirements

**General:**

☐ The IFC/IBC tell us when a FAS is required.

☐ NFPA 72 tells us how to design the FAS.


☐ NFPA 70 (NEC) tells us how to wire the system.



# 2021 IBC

**IBC 101.4.5:**

- ❑ The IFC is a referenced code in the IBC.
- ❑ They are intended to work together to meet minimum life safety requirements.
- ❑ IFC 907 fire alarm provisions are duplicated within the IBC, except for Sections 907.8 – 907.10.




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# 2021 IFC

**IFC 907.1: General**

- ❑ Applies to application, installation, performance, and maintenance of fire alarm systems and their components.
  - **Construction documents** → “...sufficient clarity to indicate the location, nature and extent of the proposed work and show in detail that it will conform to the provisions of this code...”
  - **Shop drawings** → Per **NFPA 72**, submitted for review & approval
  - **Equipment** → Shall be **listed** and **approved**




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# 2021 IFC

**IFC 907.2: When Required**

- ❑ Fire alarm systems shall be installed per NFPA 72.
- ❑ Not fewer than one manual pull station shall be provided in an approved location for systems employing automatic fire detectors or waterflow detection devices.
- ❑ **Exceptions:**
  - Manual pull station not required for system dedicated to elevator recall.
  - Manual pull station not required in Group R-2 unless required by the FCO.




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# 2021 IFC

**IFC 907.2: When Required**

- ❑ IFC 907.2 has multiple alarm requirements...
  - Manual fire alarm systems
  - Visible and audible notification
  - Emergency voice/alarm communication systems
  - Automatic smoke detection systems
  - Smoke alarms
- ❑ The following slides summarize what is required based on occupancy or special cases



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2021 IFC			
Use Group	Occupant Load	Occupants Above/Below LED	Other
A	300	100	• Manual pull stations not required if sprinklered • Emergency voice/alarm communication system if > 1,000 occupants
B	500	100	• Manual pull stations not required if sprinklered • Contains ambulator care facility
E	50	---	• Emergency voice/alarm communication system if > 100 occupants
F	---	500, and...	• ... ≥ 2 stories • Manual pull stations not required if sprinklered
H-5, and...	All	All	• ...Occupancies used for manufacture of organic coatings • Smoke detection required for highly toxic gases, organic peroxides, and oxidizers

2021 IFC			
Use Group	Occupant Load	Occupants Above/Below LED	Other
I	All	All	• An automatic smoke detection system is also required • Special individual provisions for Groups I-1, I-2 & I-3 • Smoke alarms in and outside of Group I-1 sleeping rooms
M	500	100	• Manual pull stations not required if sprinklered • Manual fire alarm system not required in mall buildings complying with IBC 402
R-1	All	All	• Not required if... • ≤ 2 stories in height with separated units & attics • Sprinklered & at least one manual pull station • Smoke alarms in and outside of sleeping rooms • Smoke detection required in corridors serving sleeping rooms

2021 IFC			
Use Group	Occupant Load	Occupants Above/Below LED	Other
R-2	---	---	• Both manual fire alarms and smoke alarms required if... • Any dwelling/sleeping unit is ≥ 3 stories above LED • Any dwelling/sleeping unit > 1 story below LED • > 16 dwelling/sleeping units • Manual pull stations not required if sprinklered • Smoke alarms in and outside of sleeping rooms • Dormitories - Automatic smoke detection required in common spaces, laundry rooms, mechanical equipment rooms, storage rooms, and corridors serving sleeping units
R-3 & R-4	---	---	• Smoke alarms in and outside of sleeping rooms
S	All, if...	All, if...	• Public & self-storage ≥ 3 stories • Manual pull stations not required if sprinklered

2021 IFC			
<b>IFC 907.2: When Required (cont.)</b>			
❑ <b>Special Amusement Buildings (IFC 907.2.12):</b>			
▪ Automatic smoke detection → both audible and visible notification			
▪ Emergency voice/alarm communication system			
❑ <b>High-rise Buildings (IFC 907.2.13):</b>			
▪ Automatic smoke detection			
▪ Fire department communication system			
▪ Emergency voice/alarm communication system			



# 2021 IFC

## IFC 907.2: When Required (cont.)

- ☐ **Atriums** (IFC 907.2.14):
  - Fire alarm system
  - Automatic smoke detection
  - Groups A, E or M → Emergency voice/alarm communication system
- ☐ **High-piled Combustible Storage** (IFC 907.2.15):
  - Automatic smoke detection
- ☐ **Aerosol Storage** (IFC 907.2.16):
  - Manual fire alarm system → if required by IFC



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# 2021 IFC

## IFC 907.2: When Required (cont.)

- ☐ **Lumber, Wood Structural Panel Veneer Mills** (IFC 907.2.17):
  - Manual fire alarm system
- ☐ **Underground Buildings w/ Smoke Control** (IFC 907.2.18):
  - Smoke detectors required – monitored by constantly attended location
- ☐ **Deep Underground Buildings** [>60 feet] (IFC 907.2.19):
  - Manual fire alarm system
  - Emergency voice/alarm communication system



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# 2021 IFC

## IFC 907.2: When Required (cont.)

- ☐ **Mall Buildings** [>50,000 ft²] (IFC 907.2.20):
  - Emergency voice/alarm communication system
- ☐ **Residential Aircraft Hangars** (IFC 907.2.21):
  - One smoke alarm which causes audible alarm in sleeping areas
- ☐ **Airport Traffic Control Towers** (IFC 907.2.22):
  - Automatic smoke detection



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# 2021 IFC

## IFC 907.2: When Required (cont.)

- ☐ **Energy Storage Systems** (IFC 907.2.23):
  - Automatic smoke detection



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2021 IFC

IFC 907.2.1 I: Smoke Alarms

The timeline shows the evolution of smoke alarm standards and a significant reduction in deaths. In 1976, the smoke alarm safety standard was published. In 1977, there were 5,865 deaths due to home structure fires in the US. In 1995, long-life smoke alarms were introduced. In 1999, the 10 ft (3m) UL "smoke test" was implemented. In 2016, there were 2,735 deaths. In 2020, an enhanced standard was required. The timeline is credited to Underwriters Laboratories (UL) Presentation to Midwest Residential Engineering Conference, 2020 June.

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2021 IFC

IFC 907.2.1 I: Smoke Alarms (cont.)

- ☐ Listed per UL 217
- ☐ Single- or Multi-station
- ☐ Must be **interconnected** if > 1 in individual dwelling or sleeping unit
- ☐ Primary power from building wiring & battery backup

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2021 IFC

IFC 907.2.1 I: Smoke Alarms (cont.)

The floor plan diagram shows a house with bedrooms, a living area, and a kitchen. Yellow dots indicate required smoke alarm locations: in sleeping rooms, in every room in the means of egress path from the sleeping area, in each story of the sleeping unit, outside of each separate sleeping room/area, and in each story of the dwelling unit.

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2021 IFC

IFC 907.2.1 I: Smoke Alarms (cont.)

The diagrams show a smoke alarm placed 10+ feet from a cooking appliance (stove) and a smoke alarm placed at least 3 feet from the door or opening of a bathroom with a bathtub or shower. A red 'X' is placed over a smoke alarm placed too close to a cooking appliance.

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# 2021 IFC

## IFC 907.2.11.7: Smoke Detection System

- ❑ Alternative to single- and multiple-station smoke alarms
- ❑ Listed per UL 268 and part of FAS



**UL 217 – SMOKE ALARMS –**  
Independent, self-contained device with a smoke sensor, alarm-sounding appliance, commonly used in residential settings



**UL 268 – SMOKE DETECTORS –**  
typically intended for use with a control panel as part of fire detection within the system



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# 2021 IFC

## IFC 907.4.1: Protection of FACU

- ❑ If not continuously occupied, a single smoke detector shall be provided at FACU, NAC power extenders, and supervising station transmitting equipment.
- ❑ Heat detectors are permitted.



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# 2021 IFC

## IBC 907.3: Fire Safety Functions

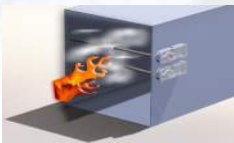
- ❑ The following 4 systems are noted:
  - Duct smoke detectors
  - Special locking systems
  - Elevator emergency operation
  - Wiring to auxiliary devices



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# 2021 IFC

## IBC 907.3.1: Duct Detectors



- ❑ Listed for air velocity, temperature & humidity
- ❑ Shall...
  - Be connected to building fire alarm system (if required)
  - Initiate audible and visible supervisory signal
  - Shutdown system upon activation (IMC 606.4)
  - Put in smoke control mode if part of smoke control system (IMC 606.4)
- ❑ Air-handling systems > 2,000cfm (IMC 606.2.2)
  - This is > 15,000cfm for existing high-rise buildings (IEBC 902.1.1)

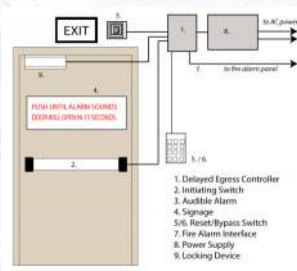


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# 2021 IFC

## IBC 907.3.2: Special Locking Systems

- ❑ Delayed Egress (IBC 1010.2.13)
- ❑ Controlled Egress Doors in Group I-1 & I-2 (IBC 1010.2.14)
- ❑ Automatic detection required

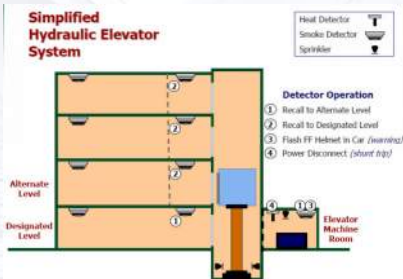


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# 2021 IFC

## IBC 907.3.3: Elevator Emergency Operation

- ❑ Requires automatic fire detectors per ASME A17.1/CSA B44 and NFPA 72
- ❑ Purpose is to provide elevator emergency operation.



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# 2021 IFC

## IBC 907.3.4: Wiring

- ❑ Wiring that is provided to auxiliary devices and equipment that should be monitored for integrity in accordance with NFPA 72.
  - Power supplies (Section 10.6.9)
  - Battery Charging Equipment (Section 10.6.10.6)
  - Control circuits for NAC extender panels (Section 10.17.3)
  - Emergency Voice/Alarm Communications Systems (Section 10.19)
  - Elevator power shutdown (Section 21.4)
  - HVAC detection equipment (Section 21.7.2)
  - Door hold-open release service (Section 21.9)

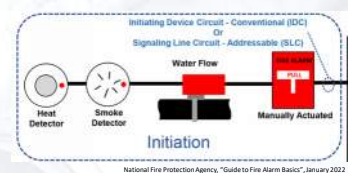


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# 2021 IFC

## IBC 907.4: Initiating Devices

- ❑ Manual fire alarm boxes
- ❑ Automatic smoke/heat detection
- ❑ Automatic waterflow devices
- ❑ Automatic fire-extinguishing systems



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## 2021 IFC

### IBC 907.4.2: Manual Fire Alarm Boxes

- ❑ Not more than 5-feet from entrance to each exit
- ❑ Not further than 200-foot travel distance
- ❑ Ready access, unobstructed, and unobscured
- ❑ Between 42- to 48-inches from floor
- ❑ Red in color
- ❑ If not monitored by supervising station, a sign must state:  
"WHEN ALARM SOUNDS CALL FIRE DEPARTMENT"





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## 2021 IFC

### IBC 907.4.3: Automatic Smoke Detection

- ❑ When an automatic smoke detection system is required...
- ❑ Must utilize smoke detectors, unless...
- ❑ Ambient conditions require heat detectors
- ❑ **Exception:**
  - For conditions other than fire safety functions of 907.3 (duct detectors, special locking systems, elevator emergency operation & wiring)...
  - Automatic sprinkler systems can be approved as automatic heat detection.



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## 2021 IFC

### IBC 907.5: Occupant Notification

- ❑ Audible alarms
- ❑ Emergency voice/alarm, communication
- ❑ Visible alarms





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## 2021 IFC

### IBC 907.5.2.1: Audible Alarms

- ❑ Must emit a distinctive sound
  - 15dBA above average ambient sound, or...
  - 5dBA above maximum sound level
  - Maximum total sound = **110dBA**
  - If ambient sound > 105 dBA → visible notification
- ❑ Located in every occupiable space within building
- ❑ Group R-1 & R-2 sleeping rooms
  - **520-Hz** low frequency signal (either fire alarm or smoke alarm)



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2021 IFC

IBC 907.5.2.2: Emergency Voice/Alarm Communication

- ❑ Triggered by fire detector, waterflow device, or pull station
- ❑ Sounds alert tone followed by instructions for evacuation
- ❑ Requires standby power
- ❑ Speakers throughout building
- ❑ Paging zones shall be:
  - Elevator groups
  - Interior exit stairways
  - Each floor
  - Areas of refuge



Firealarm.com, <https://firealarm.com/the-difference-between-a-voice-evacuation-system-a-music-notifcation-system/>



2021 IFC

IBC 907.5.2.2: Emergency Voice/Alarm Communication

- ❑ Paging zones shall be:
  - Elevator groups
  - Interior exit stairways
  - Each floor
  - Areas of refuge
- ❑ Other IBC references:
  - Required for occupant evacuation elevators (IBC 3008.9)
  - Stairway width can be reduced from 0.3 to 0.2 (IBC 1005.3.1 – Exc. #1)
  - Other egress can be reduced from 0.2 to 0.15 (IBC 1005.3.2 – Exc. #1)



2021 IFC

IBC 907.5.2.3: Visible Alarms

- ❑ Required in...
  - Public use areas & common areas
  - Habitable spaces of Groups I-I, R-I per IFC Table 907.5.2.3.2
  - Group R-2, where required to have a fire alarm system, each story with dwelling or sleeping units shall be capable to support future visible alarm notification

[F] TABLE 907.5.2.3.2 VISIBLE ALARMS	
NUMBER OF SLEEPING UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE ALARMS
6 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

International Code Council, 2021 IBC®



2021 IFC

IBC 907.6: Installation & Monitoring

- ❑ Wiring per NFPA 70 & NFPA 72
- ❑ Primary & secondary power per NFPA 72
- ❑ Initiating devices shall be identified by address, location, device type, floor level & status (*normal, alarm, trouble, supervisory*)
- ❑ Zones → per floor; ≤ 22,500ft²; Length ≤ 300-feet
- ❑ Shall be monitored by **approved** supervising station



# 2021 IFC

## IBC 907.7: Acceptance Tests & Completion

- ☐ Tested per NFPA 72
- ☐ Record of completion documentation
- ☐ Operating, testing & maintenance instructions &...
- ☐ Record drawings at **approved** location.



# 2021 IFC

## IBC 907.8: Inspection, Testing & Maintenance

- ☐ Records shall be maintained
- ☐ Devices, equipment and systems shall be maintained per NFPA
- ☐ Testing per NFPA 72 schedules or more frequently per FCO
- ☐ Smoke detector sensitivity shall be checked after one year and every alternate year thereafter
- ☐ Building owner is responsible to always maintain in operable condition



# 2021 IFC

## IBC 907.9: Existing Buildings

- ☐ Fire alarm system shall be provided in existing buildings if required by Chapter 11
- ☐ IFC 1103.7 – Fire Alarm Systems:
  - Group E
  - Group I-1
  - Group I-2
  - Group I-3
  - Group R-1
  - Group R-2



# 2021 IFC

## IBC 907.10: Smoke Alarm Maintenance

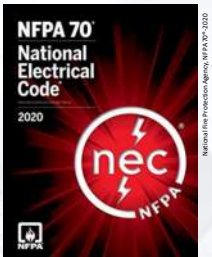
- ☐ Tested and maintained per MFR recommendations
- ☐ Must be replaced if inoperable or > 10 years from manufacture



# 2020 NFPA 70 (NEC)

## Article 760 – Fire Alarm Systems

- ❑ Power-Limited Circuit (PLFA):
  - A fire alarm circuit powered by a source that complies with 760.121.
- ❑ Non-Power-Limited (NPLFA):
  - A fire alarm circuit powered by a source that complies with 760.41 and 760.43.
- ❑ NEC Tables 12A & 12B



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# 2020 NFPA 70 (NEC)

## General Items:

- ❑ Look out for corrosive, damp, or wet locations → NEC 760.3(D)
- ❑ Bushings as cables emerge from raceways → NEC 760.3(K)
- ❑ Identify equipment grounding conductors → NEC 760.3(O)
- ❑ Circuits installed in a neat workmanlike manner → NEC 760.24(A)
- ❑ Circuit integrity (CI) cable shall be supported ≤ 24” o.c.
- ❑ If in hoistways, must be placed within conduit
- ❑ Circuit disconnecting means – **“FIRE ALARM CIRCUIT”**



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# 2020 NFPA 70 (NEC)

## Non-Power-Limited (NPLFA):

- ❑ Listed as NPLFA cables
- ❑ Output voltage ≤ 600 volts
- ❑ Copper 18AWG or larger
- ❑ Insulation for system voltage but ≥ 600 volts
- ❑ Must comply with survivability requirements of NFPA 72
  - Circuit integrity (CI)
  - 2-hour fire-resistance-rating per ANSI/UL 2196-2017



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# 2020 NFPA 70 (NEC)

## Non-Power-Limited (NPLFA):

- ❑ Cable Markings

Table 760.176(G) NPLFA Cable Markings

Cable Marking	Type	Reference
NPLFP	Non-power-limited fire alarm circuit cable for use in "other space used for environmental air"	760.176(C) and (G)
NPLFR	Non-power-limited fire alarm circuit riser cable	760.176(D) and (G)
NPLF	Non-power-limited fire alarm circuit cable	760.176(E) and (G)

Note: Cables identified in 760.176(C), (D), and (E) and meeting the requirements for circuit integrity shall have the additional classification using the suffix "-CI" (for example, NPLFP-CI, NPLFR-CI, and NPLF-CI).

National Fire Protection Agency, NFPA 70-2020



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## 2020 NFPA 70 (NEC)

### Power-Limited (PLFA):

- ❑ Listed as PLFA cables
- ❑ Copper 26AWG or larger (single conductor  $\geq$  18AWG,)
- ❑ Conductor voltage rating  $\geq$  300 volts
- ❑ Cable temperature rating  $\geq 60^{\circ}\text{C}$  (140°F)
- ❑ Must comply with survivability requirements of NFPA 72
  - Circuit integrity (CI)
  - 2-hour fire-resistance-rating per ANSI/UL 2196-2017
- ❑ Overcurrent device  $\leq$  20 amps



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## 2020 NFPA 70 (NEC)

### Power-Limited (PLFA):

- ❑ Cable Marking

Table 760.179(I) Cable Markings

Cable Marking	Type
FPLP	Power-limited fire alarm plenum cable
FPLR	Power-limited fire alarm riser cable
FPL	Power-limited fire alarm cable

Note: Cables identified in 760.179(D), (E), and (F) as meeting the requirements for circuit integrity shall have the additional classification using the suffix “-CI” (for example, FPLP-CI, FPLR-CI, and FPL-CI).

National Fire Protection Agency, NFPA 70®-2020



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## 2020 NFPA 70 (NEC)

### Power-Limited (PLFA):

National Fire Protection Agency, NFPA 70®-2020

Table 12(A) PLFA Alternating-Current Power Source Limitations

Power Source	Inherently Limited Power Source (Overcurrent Protection Not Required)			Not Inherently Limited Power Source (Overcurrent Protection Required)		
	0 through 20	Over 20 and through 30	Over 30 and through 100	0 through 20	Over 20 and through 100	Over 100 and through 150
Circuit voltage $V_{max}$ (volts) (see Note 1)	—	—	—	250 (see Note 2)	250	N.A.
Power limitations $VA_{max}$ (volt-amperes) (see Note 1)	—	—	—	1000/ $V_{max}$	1000/ $V_{max}$	1.0
Current limitations $I_{max}$ (amperes) (see Note 1)	8.0	8.0	150/ $V_{max}$	5.0	100/ $V_{max}$	1.0
Maximum overcurrent protection (amperes)	—	—	—	5.0	100/ $V_{max}$	1.0
Power source maximum nameplate ratings	VA (volt-amperes)	$5.0 \times V_{max}$	100	100	$5.0 \times V_{max}$	100
	Current (amperes)	5.0	100/ $V_{max}$	100/ $V_{max}$	5.0	100/ $V_{max}$



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## 2020 NFPA 70 (NEC)

### Power-Limited (PLFA):

Table 12(B) PLFA Direct-Current Power Source Limitations

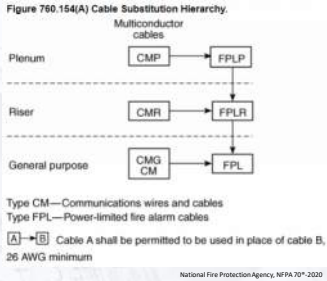
Power Source	Inherently Limited Power Source (Overcurrent Protection Not Required)			Not Inherently Limited Power Source (Overcurrent Protection Required)		
	0 through 20	Over 20 and through 30	Over 30 and through 100	0 through 20	Over 20 and through 100	Over 100 and through 150
Circuit voltage $V_{max}$ (volts) (see Note 1)	—	—	—	250 (see Note 2)	250	N.A.
Power limitations $VA_{max}$ (volt-amperes) (see Note 1)	—	—	—	1000/ $V_{max}$	1000/ $V_{max}$	1.0
Current limitations $I_{max}$ (amperes) (see Note 1)	8.0	8.0	150/ $V_{max}$	5.0	100/ $V_{max}$	1.0
Maximum overcurrent protection (amperes)	—	—	—	5.0	100/ $V_{max}$	1.0
Power source maximum nameplate ratings	VA (volt-amperes)	$5.0 \times V_{max}$	100	100	$5.0 \times V_{max}$	100
	Current (amperes)	5.0	100/ $V_{max}$	100/ $V_{max}$	5.0	100/ $V_{max}$

National Fire Protection Agency, NFPA 70®-2020



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Table 760.154 Applications of Listed PLFA Cables in Buildings		Cable Type		
Applications		FPLP & FPLP-CI	FPLR & FPLR-CI	FPL & FPL-CI
In fabricated ducts as described in 300.22(B)	In fabricated ducts	Y*	N	N
	In metal raceways that comply with 300.22(B)	Y*	Y*	Y*
	In other spaces used for environmental air as described in 300.22(C)	Y*	N	N
	In metal raceways that comply with 300.22(C)	Y*	Y*	Y*
	In plenum communications raceways	Y*	N	N
In risers	In plenum cable routing assemblies	Y*	N	N
	Supported by open metal cable trays	Y*	N	N
	Supported by solid bottom metal cable trays with solid metal covers	Y*	Y*	Y*
	In vertical runs	Y*	Y*	N
	In metal raceways	Y*	Y*	Y*
Within buildings in other than air handling spaces and fans	In rooftop shafts	Y*	Y*	Y*
	In plenum communications raceways	Y*	N	N
	In plenum cable routing assemblies	Y*	N	N
	In clear communications raceways	Y*	Y*	N
	In clear communications raceways	Y*	Y*	N
	In clear cable routing assemblies	Y*	Y*	N
	In one- and two-family dwellings	Y*	Y*	Y*
	General	Y*	Y*	Y*
	Supported by cable trays	Y*	Y*	Y*
	In any raceway recognized in Chapter 3	Y*	Y*	Y*
	In plenum communications raceways	Y*	N	N
	In plenum cable routing assemblies	Y*	N	N
	In clear communications raceways	Y*	Y*	N
	In clear cable routing assemblies	Y*	Y*	N
	In general-purpose communications raceways	Y*	Y*	Y*
	In general-purpose cable routing assemblies	Y*	Y*	Y*



2020 NFPA 70 (NEC)

IFC 907.1: General

- Power-Limited (PLFA):
  - Output voltage ≤ 600 volts
  - Circuit disconnecting means – “FIRE ALARM CIRCUIT”
  - Overcurrent device ≤ 20 amps
  - Only copper conductors
  - If in hoistways, must be placed within conduit
  - Shall be PLFA listed

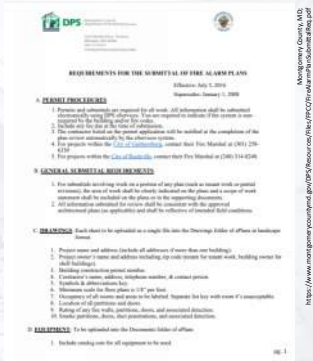
PART 3  
Submittal Requirements



Permit Submittals

General Items:

- Some jurisdictions have minimum FAS submittal criteria
- Typically, we need to ensure that the following are provided:
  - FAS Plans
  - Equipment cut sheets



# Permit Submittals

## IFC 907.1: General

- ❑ **Construction documents** → “...sufficient clarity to indicate the location, nature and extent of the proposed work and show in detail that it will conform to the provisions of this code...”
- ❑ **Shop drawings** → Per **NFPA 72**, submitted for review & approval



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# Permit Submittals

## Separate Permits

- ❑ **Construction documents** → Building permit plans
  - This is when a general Fire & Life Safety review is performed
  - Fire Alarms typically listed as “deferred submittal”
- ❑ **Shop drawings** → Fire alarm permit application
  - Not truly a deferred submittal
  - Separate fire department construction permit (IFC 105.6.6)
  - Be careful to consider other systems required by the building permit!
    - Water flow, Elevator recall, ERCCS, Fire pumps, etc.

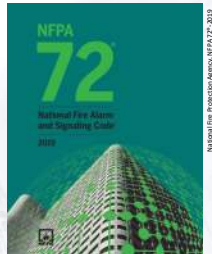


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# Permit Submittals

## Shop Drawing Submittal

- ❑ We will assume that the building permit has been issued and the FAS submittal consists of the shop drawing review.
- ❑ This review will rely on the requirements of NFPA 72 with occasional reference to the IBC, IFC, or NEC.

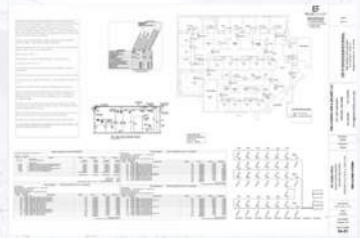


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# Documentation

## Minimum Required (Section 7.2):

- ❑ Applies to all alarm submittals, new, additions & alterations
- ❑ All documents should have name and contact for designer
- ❑ **17 specific items** are to be provided



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# Documentation

**Minimum Required (Section 7.2):**

I. Written narrative

**Simple:**

SCOPE OF WORK: THIS PROJECT SHALL INCLUDE THE INSTALLATION OF AN ADDRESSABLE FIRE ALARM SYSTEM WITH SPRINKLER MONITORING AND NOTIFICATION APPLIANCES FOR THE CORE AND SHELL.

**Often missing from FAS plans!**

**Detailed:**

THE SCOPE OF WORK FOR THIS PROJECT INVOLVES PROVIDING, INSTALLING, PROGRAMMING, CONNECTING AND TESTING NEW FIRE ALARM SYSTEM WIRING AND NOTIFICATION DEVICES FOR THE TENANT IMPROVEMENT. DEVICES TO BE INSTALLED SHALL BE LOW VOLTAGE, POWER LIMITED, SHVDC AND UL LISTED FOR FIRE ALARM USE. DEVICES TO BE INSTALLED IN ACCORDANCE WITH IFC 2018 AND OTHER ADOPTED NFPA STANDARDS.

THIS IS A FULLY SPRINKLED, 2-STORY BUILDING WITH BASEMENT PARKING AREA. FIRE ALARM SYSTEM IS EXISTING.

CEILING HEIGHT AND TYPE: 8 FT. CEILING, HANG UG IN BEDROOM AREAS. DROP TILE IN ALL OTHER AREAS.

OCCUPANCY TYPE: S

SQUARE FEET OF TENANT IMPROVEMENT: 6,543 SQUARE FT.

CONSTRUCTION TYPE: II-B

ALL NOTIFICATION AND INDICATION DEVICE WIRING SHALL BE SUPERVISED.

INSTALLATION SHALL COMPLY WITH NFPA 72 (2016) & THE IFC (2018).

ALL SPACES SHALL MEET THE ADDUCTORY CHARACTERISTICS OF NFPA 72 & IFC.

WIRE RUNS ARE NOT EXACT ROUTE OF FIREWIRE OR CONDUIT.

THIS IS A BATTERY BACKED SYSTEM WITH 24 HOURS OF BACKUP & 5 MINUTE ALARM SILENCE OF NORMAL 120VAC OPERATING POWER OCCUR. THE FACP WILL AUTOMATICALLY TRANSFER TO STANDBY BATTERY.

PROVIDE A FIRE ALARM PANEL SIGN FOR ANY ROOM OR CLOSET CONTAINING A FIRE ALARM CONTROL PANEL OR POWER SOURCE PANEL. REFERENCE IFC (2018).

AREAS HAVING MORE THAN ONE VISUAL NOTIFICATION APPLIANCE WITH THE SAME FIELD OF VIEW SHALL BE SYNCHRONIZED.

SYSTEM SHALL BE GROUNDING PER MANUFACTURE SPECIFICATION.

ALL RINGS ARE CONNECTED TO THE EXISTING FIRE ALARM SYSTEM. NO NEW RINGS ARE ADDED TO THE SYSTEM.

# Documentation

**Minimum Required (Section 7.2):**

2. Riser diagram

12. Pathway Diagrams

Figure A.10.3 NFPA Class N Pathway Block Diagram - Example 2

**Shop Drawings (\$7.4):**

- General arrangement of system
- Number of risers
- Type and number of circuits
- Type and number of system devices on each circuit, on each floor
- Number of conductors for each circuit

# Documentation

**Minimum Required (Section 7.2):**

3. Floor plans showing...

- All devices
- North arrow
- Scale used
- Room & area descriptions
- Features that may affect device placement

10. Location of notification devices & candela ratings for visual appliances

**Shop Drawings (\$7.4):**

- All walls and doors
- All partitions to w/in 15% of ceiling
- Locations of FAS primary power disconnecting means
- Locations of monitor/control interfaces to other systems
- System riser location(s)
- Type and number of devices on each circuit, on each floor or level
- Type and quantity of conductors and conduit (if used) for each circuit
- List any ceiling over 10-feet where automatic fire detection is proposed
- Details of ceiling geometries, including beams and solid joists, where automatic fire detection is proposed
- Acoustic properties (if known)





# Documentation

**Minimum Required (Section 7.2):**

10. Min. sound pressure for audible devices

**Often missing from FAS plans!**

Location	Average Ambient Sound Level (dBA)
Business occupancies	54
Educational occupancies	45
Industrial occupancies	80
Institutional occupancies	50
Manufacturing occupancies	40
Mechanical rooms	91
Piers and water-saturated structures	40
Places of assembly	60
Residential occupancies	36
Storage occupancies	30
Throughways, high density urban	70
Throughways, medium density urban	55
Throughways, rural and suburban	40
Traffic occupancies	35
Underground structures and windowless buildings	40
Vehicles and vessels	50

# Documentation

**Minimum Required (Section 7.2):**

- 13. Record of completion
- 14. Copy of software
- 15. As-built drawings
- 16. Records, record retention & record maintenance
- 17. Completed record of inspection & testing

**This is all close-out paperwork verified during inspection**

# Documentation

**Minimum Required (Section 7.2):**

- Section 7.2.3 requires all symbols to comply with NFPA 170, or AHJ.
- Chapter 8 provides typical symbols for fire alarm plans.

Symbol	Description
	Audible appliance — basic shape
CD	Combination horn/strobes CD = strobe rating/wattage
CD 1W	Combination speaker/strobes W = wattage CD = strobe rating/wattage

# Documentation

**Design Documentation (Section 7.3):**

- Where required (?)...
  - Documents shall be prepared prior to installing
  - Design professional shall be qualified
  - Documents shall include performance criteria
  - Documents shall clearly communicate the intended performance & functionality expected by all installing contractors
  - Shall specify rooms and spaces where visual notifications is provided

# Documentation

## Shop Drawings (Section 7.4):

- Shall include...
  - Name of protected premises, owner, and occupant (where applicable)
  - Name of installer or contractor
  - Location of protected premises
  - Device legend and symbols in accordance with NFPA 170, or other symbols acceptable to the authority having jurisdiction
  - Date of issue and any revision dates

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# Documentation

## Shop Drawings (cont.):

Rarely provided!

- Control Unit Diagrams, including...
  - Name & identification of control equipment
  - Location(s) of control equipment
  - All field wiring terminals and terminal identifications
  - All circuits connected to field wiring terminals and circuit identifications
  - All indicators and manual controls
  - Field connections to supervising station signaling equipment, releasing equipment, or emergency safety control interfaces (where provided)

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# Submittal Checklist

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# Sample Comments

Please provide the following information on the fire alarm plans so it can be verified that the proposed system will comply with the appropriate requirements of the IFC and IBC [IFC 907.1]:

- A. Occupancy classification(s) and use(s) [IBC Chapter 3]
- B. Type(s) of construction [IBC Chapter 6]
- C. General building heights and areas [IBC Chapter 5]
- D. Special occupancy provisions [IBC Chapter 4]

A written narrative describing the scope of the work for the project has not been provided as required by Section 7.2, Item #1, of NFPA 72. Please address.

The fire alarm plans provided do not include a riser diagram as required by Section 7.2, Item #2, of NFPA 72. This should include the type and number of circuits, type and number of devices on each circuit, and the number of conductors as required by Section 7.4 of NFPA 72.


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### Sample Comments

The fire alarm plans provided do not include a sequence of operations as required by Section 7.2, Item #4, of NFPA 72. Please address.

While fire alarm plans were provided, manufacturer's data sheets have not been provided as required by Section 7.2, Item #5, and Section 10.3 of NFPA 72. Please provide.


The fire alarm plans do not identify the use of each room or space. In addition, the plans should clearly note any building features that may affect the placement of initiation devices or notification appliances as required by Section 7.2, Item #3, of NFPA 72. Please address.




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## PART 4

### Document Review



© WC-3



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### Plan Review Breakdown

1. General Items

2. Initiating Devices

3. Notification Appliances

4. Communications & Monitoring

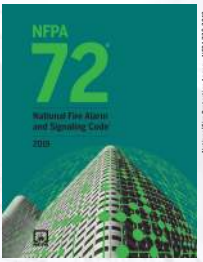
5. Battery Calculations

6. Voltage Drop Calculations


7. Material Specifications

8. Sequence of Operations

9. Testing & Inspections



NFPA 72  
National Fire Alarm and Signaling Code  
2019



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### I. General Items


☐ Are all **“Documentation”** items provided?

- Riser diagram, sequence of operations, etc.
- Device legend?
- Is a scale provided?
- Owner & contractor information?

☐ Is the correct building/fire code referenced?

☐ Is the correct edition of NFPA 72 referenced?

☐ Stamped/sealed/signed by an appropriate design professional?



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## 2. Initiating Devices

**General:**

- ❑ Devices subject to mechanical damage shall be protected (§17.4.2)
- ❑ Must be accessible for periodic maintenance (§17.4.3)
- ❑ Must be installed in locations required by other “laws, codes, or standards” (§17.4.4)
- ❑ Where partitions extended to within 15% of the ceiling height → shall be considered separate rooms (§17.5.2)



ArchEXPO, <https://www.archexpo.com/product/highlight/product/51115-1080647.html>



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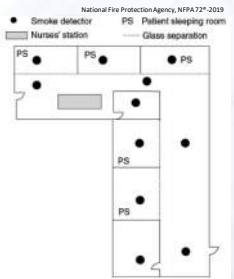
## 2. Initiating Devices

**Total (i.e., Complete) Coverage:**

- ❑ When required by laws, codes, or standards...
- ❑ Includes all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, other accessible spaces. (§17.5.3.1)
- ❑ Inaccessible areas that contain combustible materials shall be made accessible have detector coverage. (§17.5.3.1.1)

**NFPA 101:**

- Patient sleeping areas > 7,500ft<sup>2</sup>
- Patient nonsleeping > 12,500ft<sup>2</sup>



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## 2. Initiating Devices

**Partial (i.e., Selective) Coverage:**

- ❑ This is the most common as the IBC typically requires detection within specific areas of a building.
- ❑ **Example:** IBC 907.2.1.5 → Requires automatic smoke detection throughout high-piled combustible storage areas.



The Fire Protection International Consortium, Inc. (FPI), <https://www.fpi.com/single-post/high-piled-storage-permits>



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## 2. Initiating Devices

**Types:**

- Heat Detectors
- Smoke Detectors
- Carbon Monoxide Detection
- Sprinkler Waterflow
- Manual Fire Alarm Box
- Supervisory Signal Devices
- **And more...**



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## 2. Initiating Devices

### Heat Detectors (§17.6)

General:

- Shall be listed per ANSI/UL 521
- Shall be classified and color-coded per Table 17.6.2.1
- Temp. rating > 20°F above expected temperature at ceiling

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

Temperature Classification	Temperature Rating Range		Maximum Ceiling Temperature		Color Code
	°F	°C	°F	°C	
Low	100-134	38-56	80	26	Uncolored
Ordinary	135-174	57-79	115	47	Uncolored
Intermediate	175-249	80-121	155	68	White
High	250-324	122-162	220	111	Blue
Extra-high	325-399	163-204	300	152	Red
Very extra-high	400-499	205-259	350	184	Green
Ultra-high	500-575	260-302	430	249	Orange

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## 2. Initiating Devices

### Heat Detectors (§17.6)

Spacing & Locations:

- Spacing per listing (UL 521) → 50 feet common
- All points on ceiling shall have detector within **0.7 \* listed spacing**
- Adjust spacing for...
  - Non-smooth ceilings, and...
  - High ceilings
- Sloped ceilings:
  - < 30-degrees → detectors spaced per height at peak
  - > 30-degrees → detectors spaced per average slope height
  - First row of detectors at/within 3-feet of peak

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## 2. Initiating Devices

NFPA 72 Section	Special Case	Spacing & Location Adjustments
17.6.3.1.2	Irregular areas	• 0.7 * listed spacing
17.6.3.2	Solid joists	• Where measured at right angles • ≤ 50% of listed spacing • Detectors mounted to bottom of joists
17.6.3.3	Beams	• Where measured at right angles • ≤ 67% of listed spacing • If < 12-inches & < 8-feet on-center, placed on bottoms of beams • If > 18" deep & > 8-feet on-center each area treated separately
17.6.3.4	Sloped ceiling	• < 30-degrees; spaced considering height at peak • ≥ 30-degrees; spaced using average slope height or height at peak • Shall be first located within 36-inches of peak
17.6.3.5	High ceilings	• If > 10-feet must comply with Table 17.6.3.5.1

Table 17.6.3.5.1 Heat Detector Spacing Reduction Based on Ceiling Height

Ceiling Height Greater than (x)		Up to and including		Multiply Listed Spacing by
R	m	R	m	
0	0	10	3.0	1.00
10	3.0	12	3.7	0.91
12	3.7	14	4.3	0.86
14	4.3	16	4.9	0.77
16	4.9	18	5.5	0.71
18	5.5	20	6.1	0.64
20	6.1	22	6.7	0.58
22	6.7	24	7.3	0.52
24	7.3	26	7.9	0.46
26	7.9	28	8.5	0.40
28	8.5	30	9.1	0.34

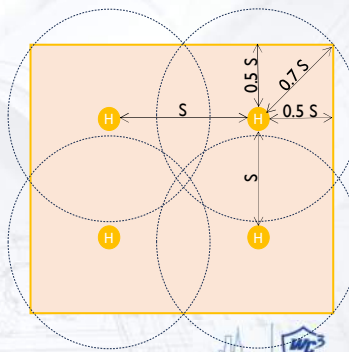
103

## 2. Initiating Devices

### Heat Detectors (§17.6)

Spacing & Locations:

- 3 Steps:
  - Assume smooth – first detectors placed at **half** allowable – all points within **0.7 \*** allowable spacing
  - Correct for non-smooth ceilings
    - Beams: > 4-inches deep & > 3-feet on-center
    - Joists: > 4-inches deep & < 3-feet on-center
  - Correct for ceiling height > 10-feet



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## 2. Initiating Devices

How many heat detectors will be required?

- 10-foot high ceiling
- 8-inch deep joists @ 2-foot on-center (running in short direction)
- Listed for 50-foot spacing

Joists:  $50 \times 0.5 = 25'-0''$

Ends:  $25 \times 0.5 = 12'-6''$

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## 2. Initiating Devices

Now assume 20-foot ceiling.

Ceiling Height Greater than (>)		Up to and Including		Multiply Listed Spacing by
ft	m	ft	m	
0	0	10	3.0	1.00
10	3.0	12	3.7	0.91
12	3.7	14	4.3	0.84
14	4.3	16	4.9	0.77
16	4.9	18	5.5	0.71
18	5.5	20	6.1	0.64
20	6.1	22	6.7	0.58

$50 \times 0.58 = 29'-0''$

$29 \times 0.5 = 14'-6''$

$14'-6'' \times 0.5 = 7'-3''$

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## 2. Initiating Devices

- 20-degree sloped ceiling
- Average ceiling height = 14-feet
- 30-feet wide & 40-feet long
- Listed for 30-foot spacing

How many heat detectors will be required?

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## 2. Initiating Devices

Ceiling Height Greater than (>)		Up to and Including		Multiply Listed Spacing by
ft	m	ft	m	
0	0	10	3.0	1.00
10	3.0	12	3.7	0.91
12	3.7	14	4.3	0.84
14	4.3	16	4.9	0.77
16	4.9	18	5.5	0.71

$30 \times 0.71 = 21'-3''$

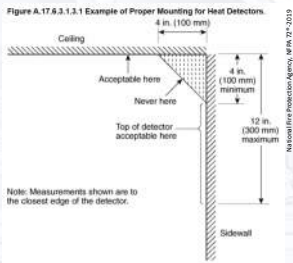
$21'-3'' \times 0.5 = 10'-6''$

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## 2. Initiating Devices

### Heat Detectors (§17.6)

**Mounting:**

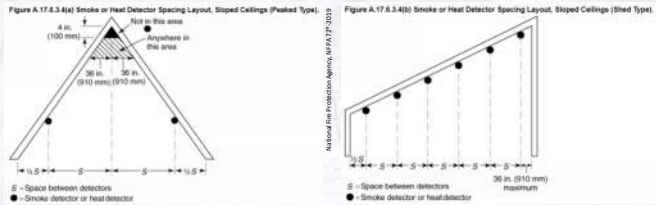


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## 2. Initiating Devices

### Heat Detectors (§17.6)

**Sloped Ceilings:**



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## 2. Initiating Devices

### Smoke Detectors (§17.7)

**General:**

- When specified by law, code, or standard.
- Shall not be installed when...
  - Temp. < 32°F
  - Temp. > 100°F
  - Relative humidity > 93%
  - Air velocity > 300cfm
- Located to minimize nuisance alarms (smoke, moisture, dust or fumes)

**IBC 907:**

- Ambulatory care facilities
- Group E
- Group H
- Group I
- Group R-1
- Group R-2
- Special Amusement Buildings
- Highrise Buildings
- Atriums
- High-piled Combustible Storage
- Underground Buildings
- Energy Storage Systems

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## 2. Initiating Devices

### Smoke Detectors (§17.7)

**Spacing & Locations:**

- Must consider...
  - Ceiling shape and surface
  - Ceiling height
  - Configuration of contents in the protected area
  - Combustion characteristics and fuel loads within the protected area
  - Compartment ventilation
  - Ambient temperature, pressure, altitude, humidity, and atmosphere

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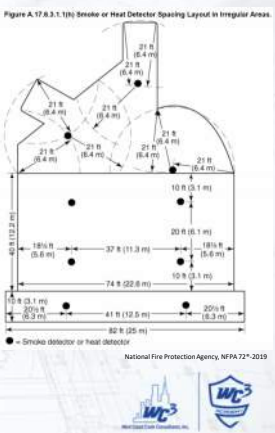


## 2. Initiating Devices

### Smoke Detectors (§17.7)

**Spacing & Locations:**

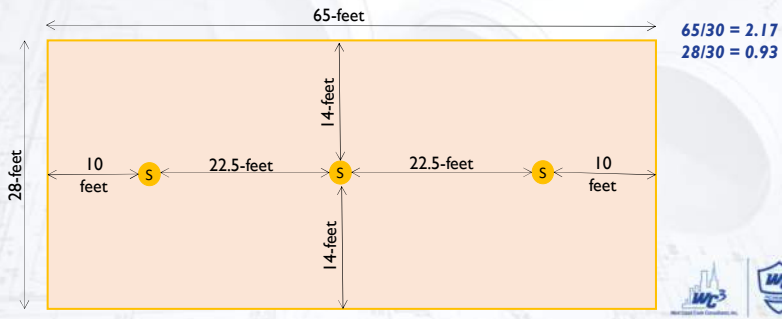
- If no specific performance-based criteria...
- No listed spacing – 30-foot nominal (§17.7.3.2.3.1)
- Half spacing near walls or partitions
- All points on ceiling shall have detector within **0.7 \* spacing** (21-feet)
- Adjust for...
  - Non-smooth ceilings, and...
  - High air-movement areas



## 2. Initiating Devices

How many smoke detectors will be required?

- 12-foot-high smooth ceiling
- Use nominal spacing



## 2. Initiating Devices

### Smoke Detectors (§17.7)

**Non-smooth Ceilings:**

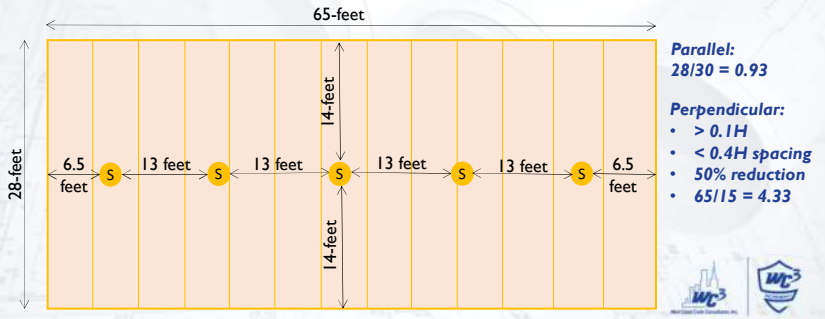
- When beam/joist depth > 0.1\*H of ceiling
- If spacing is ≥ 0.4\*H of ceiling → each beam pocket
- If spacing is < 0.4\*H → 50% nominal spacing
- **Exceptions:**
  - Corridors ≤ 15-feet wide → smooth ceiling spacing allowed
  - Room ≤ 900ft² → a single spot-type detector is allowed



## 2. Initiating Devices

How many smoke detectors will be required?

- 10-foot-high ceiling
- 16" deep joists (>0.1H)



## 2. Initiating Devices

### Smoke Detectors (§17.7)

☐ **High Air Movement Areas:**

- If airflow > 8 minutes per air change  
→ reduce detector spacing
- **Example:**
  - 100' by 300' data hall with 14' ceiling
  - 40 air supply diffusers @ 2,500cfm each
  - What is the detector spacing?

**Answer:**

- Volume = 100'x300'x14' = 420,000ft<sup>3</sup>
- Flow = 40x2,500 = 100,000cfm
- Minutes per air change = 420/100 = 4.2 min
- Per table → one per 500ft<sup>2</sup>
- **Square root = 22.4 feet**

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

Minutes per Air Change	Air Changes per Hour	Spacing per Detector	
		ft <sup>2</sup>	m <sup>2</sup>
1	60	125	12
2	30	250	23
3	20	375	35
4	15	500	46
5	12	625	58
6	10	750	70
7	8.6	875	81
8	7.5	1000	94
9	6.7	1125	104
10	6	1250	116

National Fire Protection Agency, NFPA 72™-2019



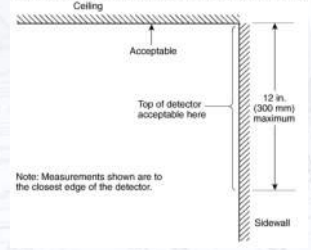
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## 2. Initiating Devices

### Smoke Detectors (§17.7)

☐ **Mounting:**

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

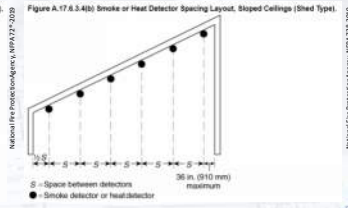
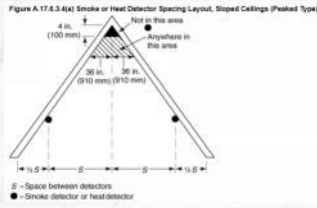


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## 2. Initiating Devices

### Smoke Detectors (§17.7)

☐ **Sloped Ceilings:**



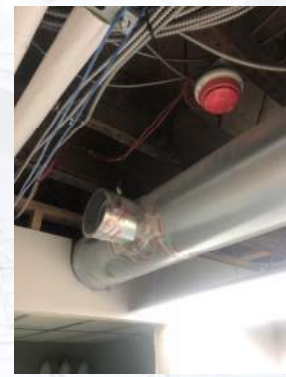
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## 2. Initiating Devices

### Smoke Detectors (§17.7)

☐ **Raised Floors & Suspended Ceilings:**

- These spaces shall be considered separate rooms for smoke detection
- Smoke detection not required if space is used to provide environmental air



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## 2. Initiating Devices

### Smoke Detectors (§17.7)

**In-Duct Smoke Detectors:**

- NFPA 72 does not specify when required.
  - IMC 606.2.1: Return air systems > 2,000cfm
  - IMC 606.2.2: Common supply and return systems > 2,000cfm
  - IMC 606.2.3: Return air risers > 15,000cfm
  - IMC 607.3.3.2: Required for smoke damper actuation
  - IMC 607.6.2.1: Required for ceiling radiation damper actuation

IC 606 also clarifies:

- Shall be listed per UL 268A
- Access required
- Shall shut down air distribution system
- Actuation must activate a visible & audible supervisory signal at constantly attended location.

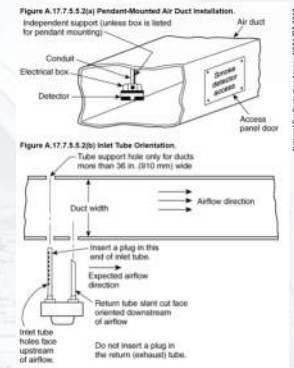


## 2. Initiating Devices

### Smoke Detectors (§17.7)

**In-Duct Smoke Detectors:**

- Shall be listed for air velocity, humidity & intended purpose (§17.7.5.4.2.1 & 17.7.5.5.1)
- Mounted per published instructions
- Accessible for cleaning (NFPA 90A)
- Locations shall be permanently and clearly identified and recorded (§17.7.5.5.5)

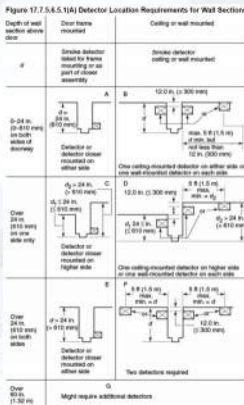


## 2. Initiating Devices

### Smoke Detectors (§17.7)

**For Door Release Service:**

- Detector shall be listed for releasing service (§17.7.5.6.3)
- Shall be photoelectric, ionization, or other approved type (§17.7.5.6.4)
- Separate provided for door closure in response to smoke from either direction, for one direction only, and for multiple doorways.



## 2. Initiating Devices

### Carbon Monoxide Detectors (§17.12)

**When required by laws, codes, or standards:**

- On ceiling of rooms with permanent fuel-burning appliances.
- Centrally located on every habitable level.
- Outside, and within 21-feet, of each separate dwelling unit, guest room, and guest suite sleeping area.
- Other required locations.



## 2. Initiating Devices

### Carbon Monoxide Detectors (§17.12)

**General:**

- Unless specifically design and listed for expected conditions, shall not be installed where any of the following exist:
  - Temperature < 32°F
  - Temperature > 100°F
  - Relative outside humidity
- Signals transmitted to FACU shall indicate carbon monoxide alarm signal. (§23.8.4.9)
- Operation of CO detectors shall not cause fire alarms to actuate either protected premises or supervising station fire alarm signals.



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## 2. Initiating Devices

### Miscellaneous Detectors

**Types:**

- Radiant Energy-Sensing Fire Detector (§17.8)
- Combination, Multi-Criteria, and Multi-Sensor Detectors (§17.9)
- Gas Detection (§17.10)
- Other Fire Detectors (§17.11)



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## 2. Initiating Devices

### Waterflow Alarm (§17.13)

**General:**

- When are these required?
- Shall activate within 90-seconds
- Movement due to waste, surges, or variable pressure shall not initiate
- NFPA 13 requirements:
  - Shall result in an audible alarm on the premises within 5 minutes (§7.7 & 28.2.3.1)
  - Wet pipe systems shall an inspector's test connection to test waterflow alarms (§16.14.1.1 & 28.2.3.1)
  - When fire alarm system is monitoring waterflow, an alarm signal shall activate in accordance with NFPA 72 (§28.2.3.1.1)



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## 2. Initiating Devices

### Manual Fire Alarm Box (§17.15)

**General:**

- Listed per ANSI/UL 38
- 42"-48" above floor
- Listed protective covers are allowed
- Must be conspicuous, unobstructed, and accessible
- Within 5-feet of each exit doorway on each floor
- Maximum 200-foot travel distance
- On both sides of grouped openings > 40-feet in width
- At FACU (§23.8.5.1.2)





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## 2. Initiating Devices

**Supervisory Signal (§17.17)**

- General
  - Two separate and distinct signals, one indicating movement from normal, and another indicating restoration to normal
- 5 types described...
  - Control Valve Supervisory
  - Pressure Supervisory
  - Water Level Supervisory
  - Water Temperature Supervisory
  - Room Temperature Supervisory




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## 2. Initiating Devices

**Supervisory Signal (§17.17)**

- IBC 903.4:
  - “Valves for water supply, pumps, tanks, water levels and temperatures, air pressures and water flow switches shall be supervised by a listed fire alarm control unit.”
  - Automatically transmitted to supervising station, or constantly attended location.
  - Exterior alarm
  - Highrise → Supervised valve at each floor



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## 3. Notification Appliances

**General**

- Consist of bells, horns, speakers, lights, and text displays.




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## 3. Notification Appliances

**General (Chapter 18)**

- §18.2: Provide stimuli for initiating emergency action and provide information to occupants and emergency response personnel.
- §18.3.1: Shall be listed.
- §18.3.2: Nameplates required with electrical requirements and rated audible/visual performance.
- §18.3.3: Shall be appropriate for environment (i.e., high humidity, dusty conditions, etc.)



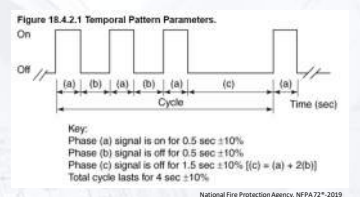
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### 3. Notification Appliances

#### Audible Appliances (§18.4)

General:

- §18.4.1.1: If ambient sound > 105dBA → visible notification required
- §18.4.1.2: Ambient + notification sound ≤ 110dBA
- §18.4.1.5.3: Notification is only required in occupiable areas
- §18.4.2: Distinct Evacuation Signal → Three-pulse temporal pattern



### 3. Notification Appliances

#### Audible Appliances (§18.4)

Public vs. Private Mode

- Public → Goal is to alert all occupants that there is an emergency
- Private → Goal is to alert only occupants responsible for responding when there is an emergency
- NFPA 101 states that “private mode” is only allowed where occupants are incapable of evacuating themselves.



### 3. Notification Appliances

#### Audible Appliances (§18.4)

Public Mode (§18.4.4):

- Sound level ≥ 15dBA average ambient, or...
- 5dBA above maximum sound level (60-second duration)
- Greatest governs

Table A.18.4.4 Average Ambient Sound Level According to Location	
Location	Average Ambient Sound Level (dBA)
Business occupancies	54
Educational occupancies	45
Industrial occupancies	88
Institutional occupancies	50
Mercantile occupancies	40
Mechanical rooms	51
Piers and water-surrounded structures	40
Places of assembly	60
Residential occupancies	35
Storage occupancies	30
Thoroughfares, high-density urban	70
Thoroughfares, medium-density urban	55
Thoroughfares, rural and suburban	40
Tower occupancies	35
Underground structures and windowless buildings	40
Vehicles and vessels	50

### 3. Notification Appliances

#### Audible Appliances (§18.4)

Public Mode (§18.4.4):

- Measured 5-feet above floor
- AHJ can allow reduction/elimination if visible notification is provided



### 3. Notification Appliances

#### Audible Appliances (§18.4)

☐ Private Mode (§18.4.5):

- Sound level  $\geq 10\text{dBA}$  average ambient, or...
- $5\text{dBA}$  above maximum sound level (60-second duration)
- Greatest governs
- Measured 5-feet above floor
- AHJ can allow reduction/elimination if visible notification is provided



### 3. Notification Appliances

#### Audible Appliances (§18.4)

☐ Sleeping Areas (§18.4.6):

- Sound level  $\geq 15\text{dBA}$  average ambient, or...
- $5\text{dBA}$  above maximum sound level (60-second duration), or...
- A sound level of at least  $75\text{dBA}$
- Greatest governs... measured at pillow
- Shall produce low frequency alarm
  - $520\text{ Hz} \pm 10\%$
  - Must be listed for low frequency

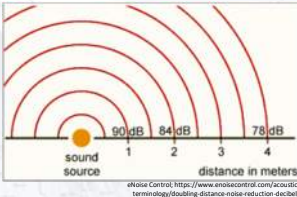


### 3. Notification Appliances

#### Audible Appliances (§18.4)

☐ Sound Guidelines:

- Doubling power to appliance  $\rightarrow +3\text{dB}$
- Halving power to appliance  $\rightarrow -3\text{dB}$
- Doubling distance from appliance  $\rightarrow -6\text{dB}$
- **Example:** Mercantile Occupancy (40dB)
  - Audible coverage =  $40 + 15 = 55\text{dB}$
  - 55dB must be provided at all locations
  - Assume room is 80'x80'; Nameplate value is at 10-feet
  - 10-feet =  $(x-6)\text{dB}$ ; 20-feet =  $(x-12)\text{dB}$ ; 40-feet =  $(x-18)\text{dB}$
  - Appliance =  $55 + 18 = 73\text{dB}$

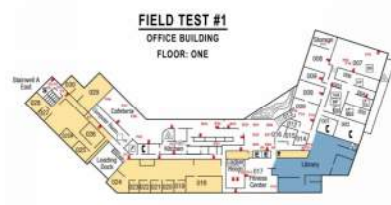


### 3. Notification Appliances

#### Audible Appliances (§18.4)

☐ Voice Intelligibility (§18.4.11):

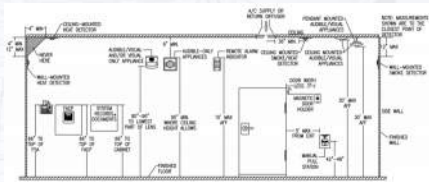
- This applies to emergency voice alarm/communication systems and mass notification systems.
- Voice intelligibility must be provided within the acoustically distinguishable spaces (ADS)
- Quantitative measurements are not required



### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- ❑ **Appliance Location (§18.5.5):**
  - Wall-mounted: Between 80"-96" above finished floor
  - Low ceilings: Mounted within 6" of ceiling
    - Coverage reduced by (Actual height / 80")



### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- ❑ **If per Tables 18.5.5.5.1(a) or (b)...**
  - A single visible notification appliance, or...
  - Two groups of appliances in same room or adjacent space – requires synchronization of strobes
  - > 2 appliances or groups in same room/space that flash in synchronization



### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

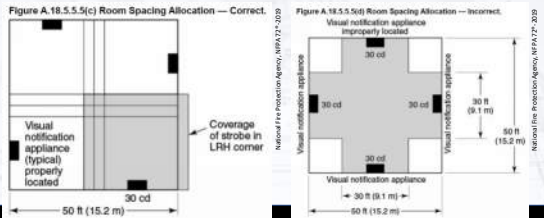
Maximum Room Size	One Visual Notification Appliance per Room	Minimum Required Light Output (Effective Intensity [cd])	Four Visual Notification Appliances per Room (One per Wall)
m	Room		Watt
25 x 25 (7.6 x 7.6)	1	NA	NA
25 x 30 (7.6 x 9.1)	1	NA	NA
30 x 30 (9.1 x 9.1)	1	NA	NA
30 x 35 (9.1 x 10.7)	1	NA	NA
35 x 35 (10.7 x 10.7)	1	NA	NA
35 x 40 (10.7 x 12.2)	1	NA	NA
40 x 40 (12.2 x 12.2)	1	NA	NA
40 x 45 (12.2 x 13.7)	1	NA	NA
45 x 45 (13.7 x 13.7)	1	NA	NA
45 x 50 (13.7 x 15.2)	1	NA	NA
50 x 50 (15.2 x 15.2)	1	NA	NA
50 x 55 (15.2 x 16.8)	1	NA	NA
55 x 55 (16.8 x 16.8)	1	NA	NA
55 x 60 (16.8 x 18.3)	1	NA	NA
60 x 60 (18.3 x 18.3)	1	NA	NA
60 x 65 (18.3 x 19.8)	1	NA	NA
65 x 65 (19.8 x 19.8)	1	NA	NA
65 x 70 (19.8 x 21.3)	1	NA	NA
70 x 70 (21.3 x 21.3)	1	NA	NA
70 x 75 (21.3 x 22.9)	1	NA	NA
75 x 75 (22.9 x 22.9)	1	NA	NA
75 x 80 (22.9 x 24.4)	1	NA	NA
80 x 80 (24.4 x 24.4)	1	NA	NA
80 x 85 (24.4 x 25.9)	1	NA	NA
85 x 85 (25.9 x 25.9)	1	NA	NA
85 x 90 (25.9 x 27.4)	1	NA	NA
90 x 90 (27.4 x 27.4)	1	NA	NA
90 x 95 (27.4 x 29.0)	1	NA	NA
95 x 95 (29.0 x 29.0)	1	NA	NA
95 x 100 (29.0 x 30.5)	1	NA	NA
100 x 100 (30.5 x 30.5)	1	NA	NA
100 x 105 (30.5 x 32.0)	1	NA	NA
105 x 105 (32.0 x 32.0)	1	NA	NA
105 x 110 (32.0 x 33.5)	1	NA	NA
110 x 110 (33.5 x 33.5)	1	NA	NA
110 x 115 (33.5 x 35.1)	1	NA	NA
115 x 115 (35.1 x 35.1)	1	NA	NA
115 x 120 (35.1 x 36.6)	1	NA	NA
120 x 120 (36.6 x 36.6)	1	NA	NA
120 x 125 (36.6 x 38.1)	1	NA	NA
125 x 125 (38.1 x 38.1)	1	NA	NA
125 x 130 (38.1 x 39.6)	1	NA	NA
130 x 130 (39.6 x 39.6)	1	NA	NA
130 x 135 (39.6 x 41.1)	1	NA	NA
135 x 135 (41.1 x 41.1)	1	NA	NA
135 x 140 (41.1 x 42.7)	1	NA	NA
140 x 140 (42.7 x 42.7)	1	NA	NA
140 x 145 (42.7 x 44.2)	1	NA	NA
145 x 145 (44.2 x 44.2)	1	NA	NA
145 x 150 (44.2 x 45.7)	1	NA	NA
150 x 150 (45.7 x 45.7)	1	NA	NA
150 x 155 (45.7 x 47.2)	1	NA	NA
155 x 155 (47.2 x 47.2)	1	NA	NA
155 x 160 (47.2 x 48.8)	1	NA	NA
160 x 160 (48.8 x 48.8)	1	NA	NA
160 x 165 (48.8 x 50.3)	1	NA	NA
165 x 165 (50.3 x 50.3)	1	NA	NA
165 x 170 (50.3 x 51.8)	1	NA	NA
170 x 170 (51.8 x 51.8)	1	NA	NA
170 x 175 (51.8 x 53.3)	1	NA	NA
175 x 175 (53.3 x 53.3)	1	NA	NA
175 x 180 (53.3 x 54.9)	1	NA	NA
180 x 180 (54.9 x 54.9)	1	NA	NA
180 x 185 (54.9 x 56.4)	1	NA	NA
185 x 185 (56.4 x 56.4)	1	NA	NA
185 x 190 (56.4 x 57.9)	1	NA	NA
190 x 190 (57.9 x 57.9)	1	NA	NA
190 x 195 (57.9 x 59.4)	1	NA	NA
195 x 195 (59.4 x 59.4)	1	NA	NA
195 x 200 (59.4 x 60.9)	1	NA	NA
200 x 200 (60.9 x 60.9)	1	NA	NA
200 x 205 (60.9 x 62.5)	1	NA	NA
205 x 205 (62.5 x 62.5)	1	NA	NA
205 x 210 (62.5 x 64.0)	1	NA	NA
210 x 210 (64.0 x 64.0)	1	NA	NA
210 x 215 (64.0 x 65.5)	1	NA	NA
215 x 215 (65.5 x 65.5)	1	NA	NA
215 x 220 (65.5 x 67.0)	1	NA	NA
220 x 220 (67.0 x 67.0)	1	NA	NA
220 x 225 (67.0 x 68.6)	1	NA	NA
225 x 225 (68.6 x 68.6)	1	NA	NA
225 x 230 (68.6 x 70.1)	1	NA	NA
230 x 230 (70.1 x 70.1)	1	NA	NA
230 x 235 (70.1 x 71.6)	1	NA	NA
235 x 235 (71.6 x 71.6)	1	NA	NA
235 x 240 (71.6 x 73.1)	1	NA	NA
240 x 240 (73.1 x 73.1)	1	NA	NA
240 x 245 (73.1 x 74.6)	1	NA	NA
245 x 245 (74.6 x 74.6)	1	NA	NA
245 x 250 (74.6 x 76.2)	1	NA	NA
250 x 250 (76.2 x 76.2)	1	NA	NA
250 x 255 (76.2 x 77.7)	1	NA	NA
255 x 255 (77.7 x 77.7)	1	NA	NA
255 x 260 (77.7 x 79.2)	1	NA	NA
260 x 260 (79.2 x 79.2)	1	NA	NA
260 x 265 (79.2 x 80.7)	1	NA	NA
265 x 265 (80.7 x 80.7)	1	NA	NA
265 x 270 (80.7 x 82.3)	1	NA	NA
270 x 270 (82.3 x 82.3)	1	NA	NA
270 x 275 (82.3 x 83.8)	1	NA	NA
275 x 275 (83.8 x 83.8)	1	NA	NA
275 x 280 (83.8 x 85.3)	1	NA	NA
280 x 280 (85.3 x 85.3)	1	NA	NA
280 x 285 (85.3 x 86.8)	1	NA	NA
285 x 285 (86.8 x 86.8)	1	NA	NA
285 x 290 (86.8 x 88.4)	1	NA	NA
290 x 290 (88.4 x 88.4)	1	NA	NA
290 x 295 (88.4 x 89.9)	1	NA	NA
295 x 295 (89.9 x 89.9)	1	NA	NA
295 x 300 (89.9 x 91.4)	1	NA	NA
300 x 300 (91.4 x 91.4)	1	NA	NA
300 x 305 (91.4 x 92.9)	1	NA	NA
305 x 305 (92.9 x 92.9)	1	NA	NA
305 x 310 (92.9 x 94.4)	1	NA	NA
310 x 310 (94.4 x 94.4)	1	NA	NA
310 x 315 (94.4 x 95.9)	1	NA	NA
315 x 315 (95.9 x 95.9)	1	NA	NA
315 x 320 (95.9 x 97.5)	1	NA	NA
320 x 320 (97.5 x 97.5)	1	NA	NA
320 x 325 (97.5 x 99.0)	1	NA	NA
325 x 325 (99.0 x 99.0)	1	NA	NA
325 x 330 (99.0 x 100.6)	1	NA	NA
330 x 330 (100.6 x 100.6)	1	NA	NA
330 x 335 (100.6 x 102.1)	1	NA	NA
335 x 335 (102.1 x 102.1)	1	NA	NA
335 x 340 (102.1 x 103.6)	1	NA	NA
340 x 340 (103.6 x 103.6)	1	NA	NA
340 x 345 (103.6 x 105.1)	1	NA	NA
345 x 345 (105.1 x 105.1)	1	NA	NA
345 x 350 (105.1 x 106.7)	1	NA	NA
350 x 350 (106.7 x 106.7)	1	NA	NA
350 x 355 (106.7 x 108.2)	1	NA	NA
355 x 355 (108.2 x 108.2)	1	NA	NA
355 x 360 (108.2 x 109.7)	1	NA	NA
360 x 360 (109.7 x 109.7)	1	NA	NA
360 x 365 (109.7 x 111.2)	1	NA	NA
365 x 365 (111.2 x 111.2)	1	NA	NA
365 x 370 (111.2 x 112.8)	1	NA	NA
370 x 370 (112.8 x 112.8)	1	NA	NA
370 x 375 (112.8 x 114.3)	1	NA	NA
375 x 375 (114.3 x 114.3)	1	NA	NA
375 x 380 (114.3 x 115.8)	1	NA	NA
380 x 380 (115.8 x 115.8)	1	NA	NA
380 x 385 (115.8 x 117.3)	1	NA	NA
385 x 385 (117.3 x 117.3)	1	NA	NA
385 x 390 (117.3 x 118.8)	1	NA	NA
390 x 390 (118.8 x 118.8)	1	NA	NA
390 x 395 (118.8 x 120.4)	1	NA	NA
395 x 395 (120.4 x 120.4)	1	NA	NA
395 x 400 (120.4 x 121.9)	1	NA	NA
400 x 400 (121.9 x 121.9)	1	NA	NA
400 x 405 (121.9 x 123.4)	1	NA	NA
405 x 405 (123.4 x 123.4)	1	NA	NA
405 x 410 (123.4 x 124.9)	1	NA	NA
410 x 410 (124.9 x 124.9)	1	NA	NA
410 x 415 (124.9 x 126.4)	1	NA	NA
415 x 415 (126.4 x 126.4)	1	NA	NA
415 x 420 (126.4 x 127.9)	1	NA	NA
420 x 420 (127.9 x 127.9)	1	NA	NA
420 x 425 (127.9 x 129.4)	1	NA	NA
425 x 425 (129.4 x 129.4)	1	NA	NA
425 x 430 (129.4 x 130.9)	1	NA	NA
430 x 430 (130.9 x 130.9)	1	NA	NA
430 x 435 (130.9 x 132.4)	1	NA	NA
435 x 435 (132.4 x 132.4)	1	NA	NA
435 x 440 (132.4 x 133.9)	1	NA	NA
440 x 440 (133.9 x 133.9)	1	NA	NA
440 x 445 (133.9 x 135.4)	1	NA	NA
445 x 445 (135.4 x 135.4)	1	NA	NA
445 x 450 (135.4 x 136.9)	1	NA	NA
450 x 450 (136.9 x 136.9)	1	NA	NA
450 x 455 (136.9 x 138.4)	1	NA	NA
455 x 455 (138.4 x 138.4)	1	NA	NA
455 x 460 (138.4 x 139.9)	1	NA	NA
460 x 460 (139.9 x 139.9)	1	NA	NA
460 x 465 (139.9 x 141.4)	1	NA	NA
465 x 465 (141.4 x 141.4)	1	NA	NA
465 x 470 (141.4 x 142.9)	1	NA	NA
470 x 470 (142.9 x 142.9)	1	NA	NA
470 x 475 (142.9 x 144.4)	1	NA	NA
475 x 475 (144.4 x 144.4)	1	NA	NA
475 x 480 (144.4 x 145.9)	1	NA	NA
480 x 480 (145.9 x 145.9)	1	NA	NA
480 x 485 (145.9 x 147.4)	1	NA	NA
485 x 485 (147.4 x 147.4)	1	NA	NA
485 x 490 (147.4 x 148.9)	1	NA	NA
490 x 490 (148.9 x 148.9)	1	NA	NA
490 x 495 (148.9 x 150.4)	1	NA	NA
495 x 495 (150.4 x 150.4)	1	NA	NA
495 x 500 (150.4 x 151.9)	1	NA	NA
500 x 500 (151.9 x 151.9)	1	NA	NA
500 x 505 (151.9 x 153.4)	1	NA	NA
505 x 505 (153.4 x 153.4)	1	NA	NA
505 x 510 (153.4 x 154.9)	1	NA	NA
510 x 510 (154.9 x 154.9)	1	NA	NA
510 x 515 (154.9 x 156.4)	1	NA	NA
515 x 515 (156.4 x 156.4)	1	NA	NA
515 x 520 (156.4 x 157.9)	1	NA	NA
520 x 520 (157.9 x 157.9)	1	NA	NA
520 x 525 (157.9 x 159.4)	1	NA	NA
525 x 525 (159.4 x 159.4)	1	NA	NA
525 x 530 (159.4 x 160.9)	1	NA	NA
530 x 530 (160.9 x 160.9)	1	NA	NA
530 x 535 (160.9 x 162.4)	1	NA	NA
535 x 535 (162.4 x 162.4)	1	NA	NA
535 x 540 (162.4 x 163.9)	1	NA	NA
540 x 540 (163.9 x 163.9)	1	NA	NA
540 x 545 (163.9 x 165.4)	1	NA	NA
545 x 545 (165.4 x 165.4)	1	NA	NA
545 x 550 (165.4 x 166.9)	1	NA	NA
550 x 550 (166.9 x 166.9)	1	NA	NA
550 x 555 (166.9 x 168.4)	1	NA	NA
555 x 555 (168.4 x 168.4)	1	NA	NA
555 x 560 (168.4 x 169.9)	1	NA	NA
560 x 560 (169.9 x 169.9)	1	NA	NA
560 x 565 (169.9 x 171.4)	1	NA	NA
565 x 565 (171.4 x 171.4)	1	NA	NA
565 x 570 (171.4 x 172.9)	1	NA	NA
570 x 570 (172.9 x 172.9)	1	NA	NA
570 x 575 (172.9 x 174.4)	1	NA	NA
575 x 575 (174.4 x 174.4)	1	NA	NA
575 x 580 (174.4 x 175.9)	1	NA	NA
580 x 580 (175.9 x 175.9)	1	NA	NA
580 x 585 (175.9 x 177.4)	1	NA	NA
585 x 585 (177.4 x 177.4)	1	NA	NA
585 x 590 (177.4 x 178.9)	1	NA	NA
590 x 590 (178.9 x 178.9)	1	NA	NA
590 x 595 (178.9 x 180.4)	1	NA	NA
595 x 595 (180.4 x 180.4)	1	NA	NA
595 x 600 (180.4 x 181.9)	1	NA	NA
600 x 600 (181.9 x 181.9)	1	NA	NA
600 x 605 (181.9 x 183.4)	1	NA	NA
605 x 605 (183.4 x 183.4)	1	NA	NA
605 x 610 (183.4 x 184.9)	1	NA	NA
610 x 610 (184.9 x 184.9)	1	NA	NA
610 x 615 (184.9 x 186.4)	1	NA	NA
615 x 615 (186.4 x 186.4)	1	NA	NA
615 x 620 (186.4 x 187.9)	1	NA	NA
620 x 620 (187.9 x 187.9)	1	NA	NA
620 x 625 (187.9 x 189.4)	1	NA	NA
625 x 625 (189.4 x 189.4)	1	NA	NA
625 x 630 (189.4 x 190.9)	1	NA	NA
630 x 630 (190.9 x 190.9)	1	NA	NA
630 x 635 (190.9 x 192.4)	1	NA	NA
635 x 635 (192.4 x 192.4)	1	NA	NA
635 x 640 (192.4 x 193.9)	1	NA	NA
640 x 640 (193.9 x 193.9)	1	NA	NA
640 x 645 (193.9 x 195.4)	1	NA	NA
645 x 645 (195.4 x 195.4)	1	NA	NA
645 x 650 (195.4 x 196.9)	1	NA	NA
650 x 650 (196.9 x 196.9)	1	NA	NA
650 x 655 (196.9 x 198.4)	1	NA	NA
655 x 655 (198.4 x 198.4)	1	NA	NA
655 x 660 (198.4 x 199.9)	1	NA	NA
660 x 660 (199.9 x 199.9)	1	NA	NA
660 x 665 (199.9 x 201.4)	1	NA	NA
665 x 665 (201.4 x 201.4)	1	NA	NA
665 x 670 (201.4 x 202.9)	1	NA	NA
670 x 670 (202.9 x 202.9)	1	NA	NA
670 x 675 (202.9 x 204.4)	1	NA	NA
675 x 675 (204.4 x 204.4)	1	NA	NA
675 x 680 (204.4 x 205.9)	1	NA	NA



### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- ❑ §18.5.5.5.5: If 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.



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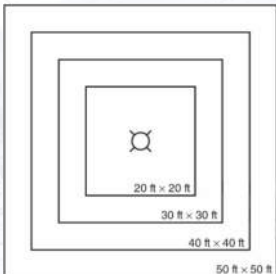
### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

Notice maximum ceiling height of 30-feet is noted! §18.5.5.5.6 → Suspended or wall-mounted

Table 18.5.5.5.1(b) Room Spacing for Ceiling-Mounted Visual 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	45
50 × 50	15.2 × 15.2	10	3.0	75
20 × 20	6.1 × 6.1	20	6.1	30
30 × 30	9.1 × 9.1	20	6.1	45
40 × 40	12.2 × 12.2	20	6.1	75
50 × 50	15.2 × 15.2	20	6.1	105
20 × 20	6.1 × 6.1	30	9.1	105
30 × 30	9.1 × 9.1	30	9.1	150
40 × 40	12.2 × 12.2	30	9.1	210
50 × 50	15.2 × 15.2	30	9.1	315
30 × 30	9.1 × 9.1	40	12.2	150
40 × 40	12.2 × 12.2	40	12.2	210
50 × 50	15.2 × 15.2	40	12.2	315
60 × 60	18.3 × 18.3	40	12.2	420
70 × 70	21.3 × 21.3	40	12.2	525

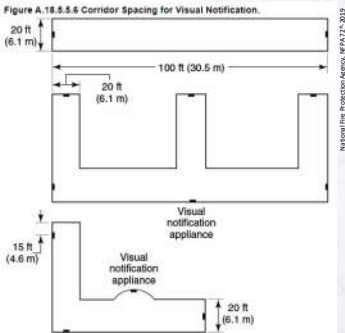


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### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- ❑ Corridors (§18.5.5.6):
- ≤ 20-feet in width
  - Rated ≥ 15cd
  - Within 15-feet of ends of corridor
  - Spacing ≤ 100-feet
  - Interruptions (i.e., fire door) → treat as separate corridors



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### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- ❑ Sleeping Rooms (§18.5.5.8):
- Visible notification within 15-feet of pillow
  - Within 2-feet of ceiling → 177cd
  - >2-feet from ceiling → 110cd

Table 18.5.5.8.3 Effective Intensity Requirements for Sleeping Area Visual Notification Appliances

Distance from Ceiling to Top of Lens		Minimum Intensity (cd)
in.	mm	
≥24	≥610	110
<24	<610	177



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### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- IBC 907.5.2.3:
  - Required in public use and common areas
  - Groups I-I & R-I → Per Table 907.5.2.3.2
  - Group R-2 → Shall have capability to support

(F) TABLE 907.5.2.3.2  
VISIBLE ALARMS

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



### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- Lighting Guidelines:

Lumens/ft² = Candela

15 cd → 15cd → 0.0375 lumens/ft²  
20' x 20' 400ft²

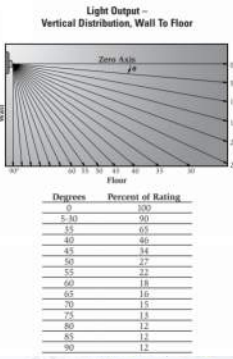
Minimum required by §18.5.5.7.1



### 3. Notification Appliances

#### Visual Appliances (§18.5-18.7)

- Lighting Guidelines:
  - UL 1971 requires a polar light distribution pattern to enhance the likelihood of alerting the deaf and hard of hearing throughout the area.
  - Polar refers to how light intensity is measured both horizontally and vertically. → i.e., viewing angles from 0° to 180°



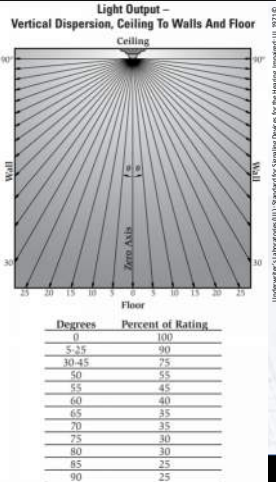
Ceiling Height = 20 ft.  
Square Room Size (length x width) = 25 ft. x 25 ft.  
Candela of Model = 75 cd

EXAMPLE #1 – Distance calculation when the distance along the floor is less than 1/2 the room length.  
Angle = 30°  
Per UL 1971, Effective Candela = 75% x 75cd  
Effective Candela = 56.25 cd

Distance to point in profile:

$$\text{Distance} = \frac{\text{Ceiling Height}}{(\cos((\text{Angle} \times \pi) / 180^\circ))}$$
$$\text{Distance} = \frac{20 \text{ ft.}}{(\cos((30^\circ \times \pi) / 180^\circ))}$$
$$\text{Distance} = 23.09 \text{ ft.}$$

Lumens/Square Foot  
= 56.25 cd  
(23.09 ft.)²  
= 0.106 lumens/square foot  
Conclusion: 0.106 is greater than 0.0375 lumens/square foot minimum UL 1971 requirement.



Coiling Height = 20 ft.  
Square Room Size (length x width) = 25 ft. x 25 ft.  
Candela of Model = 75 cd

**EXAMPLE 2** – Distance calculation when the distance along the floor is greater than 1/2 the room length.

Angle = 60°  
Per UL 1971, Effective Candela = 40% x 75cd  
Effective Candela = 30 cd

Distance to point in profile:

$$\text{Distance} = \frac{1/2 \text{ Room Length}}{(\cos ((90^\circ - \text{Angle}) \times \pi / 180^\circ))}$$
$$\text{Distance} = \frac{12.5 \text{ ft.}}{(\cos ((30^\circ) \times 3.14159 / 180^\circ))}$$
$$\text{Distance} = 14.43 \text{ ft.}$$

**Lumens/Square Foot**

$$= \frac{30 \text{ cd}}{(14.43 \text{ ft.})^2}$$
$$= 0.144 \text{ lumens/square foot}$$

Conclusion: 0.144 is greater than 0.0375 lumens/square foot minimum UL 1971 requirement.

**Light Output – Vertical Dispersion, Ceiling To Walls And Floor**

Degrees	Percent of Rating
0	100
5-25	90
30-45	75
50	55
55	45
60	40
65	35
70	35
75	30
80	30
85	25
90	25

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## 4. Communications & Monitoring

### Supervising Station (Chapter 26)

☐ **Options:**

- Central Station Service (§26.3)
- Proprietary Supervising Station (§26.4)
- Remote Supervising Station (§26.5)

☐ **What do the plans tell us?**

16. PROVIDE OFF-SITE MONITORING AS REQUIRED BY THE INTERNATIONAL FIRE CODE, SECTION 907.6.6 AND THE LOCAL AUTHORITY HAVING JURISDICTION.

19. Central Station & Service Company

ICS  
6680 VIA DEL ORO  
SAN JOSE, CA 95119  
(408) 491-6000  
UL# UUFX.S24927

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## 5. Battery Calculations

### Background

☐ **Documentation:** §7.2.1, Item #7

☐ **Sources:** §10.6.4 → Two independent and reliable sources

- Primary → Typically electric utility
- Secondary → Typically battery or emergency generator

☐ **Secondary:** §10.6.7

- Sufficient to operate system for **24 hours**, and...
- Be able to support alarm condition for **5 minutes**
  - Emergency voice/evac & mass notification systems → **15 minutes**
- Shall have **20%** safety margin

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## 5. Battery Calculations

### What to Verify

☐ Are all appliances included?

☐ Are both standby and emergency conditions considered?

☐ Is the 20% safety margin included?


☐ Do the size of batteries calculated match what is specified?

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### Calculations

Standby Current (amps)				Secondary Alarm Current (amps)			
Device	Qty	Current Draw	Total	Qty	Current Draw	Total	
Main Control Board	1	0.120000	= 0.120000	1	0.200000	= 0.200000	
IP Transmitter	1	0.091000	= 0.091000	1	0.135000	= 0.135000	
Annunciator	1	0.150000	= 0.150000	1	0.150000	= 0.150000	
<b>Addressable Devices</b>							
Projected Beam Detector	1	0.002000	= 0.002000	1	0.004500	= 0.004500	
Spot Type Smoke Detector	31	0.000300	= 0.009300	1	0.009100	= 0.009100	
Addressable Heat Detector	6	0.000400	= 0.002400	1	0.009100	= 0.009100	
Monitor Module	8	0.000400	= 0.003200	1	0.009000	= 0.009000	
Manual Fire Alarm Box	12	0.000300	= 0.003600	1	0.009000	= 0.009000	
Output Relay	2	0.001450	= 0.002900	1	0.002000	= 0.002000	
<b>Output Circuits</b>							
NAC Output #1		0.005000	= 0.005000		0.510000	= 0.510000	
NAC Output #2		0.005000	= 0.005000		0.622000	= 0.622000	
<b>Total Standby Load 0.396800</b>				<b>Total Alarm Load 2.003370</b>			
<b>Required Standby Current Load 24 hours</b>							
Total Standby Current 0.3968 Amps x 24 = 9.5232 AH							
<b>Required Alarm Time in Minutes</b>							
Total Alarm Load 2.0034 Amps x 5 Minutes = 0.0166875 AH							
Total Current Load 9.5398875 AH							
Multiply by the Safety Factor 1.2 = 11.447865 AH							
<b>Total Ampere Hours Required 11.60 AH</b>							

Automatic Fire Alarm Association (AFAA) → free worksheet: <https://afaa.org/resources/>




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## 6. Voltage Drop Calculations

### Background

- Documentation: §7.2.1, Item #8 → Required for notification appliances
- These calculations follow Ohm's Law:  $V = IR$ 
  - V = Voltage
  - I = Current
  - R = Resistance
- $V_{load} = V_{terminals} - (I_{load} * 2 * R_{wire})$ 
  - $I_{load}$  = total current draw on circuit (Amperes)
  - $R_{wire}$  = resistance on one conductor from the controls to the appliance (Ohms)
  - L = circuit length in feet




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## 6. Voltage Drop Calculations

**Example:**

- Notification circuit is 850-feet long
- #14 AWG copper-coated conductors
- Mfr → Each 6 appliances = 0.078 A
- Voltage at FACU = 24 V
- $I_{load} = (6)(0.078) = 0.468 A$  (assumes “end of line”)
- NEC Table 8 → #14 AWG resistance = 3.19 Ohms/1,000 feet
- $R_{wire} = (850\text{-feet})(3.19 \text{ Ohms}/1,000 \text{ feet}) = 2.71 \text{ Ohms}$
- $V_{load} = 24 - (0.468 * 2 * 2.71) = 21.46 V$





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## 6. Voltage Drop Calculations

### How to Verify

- Automatic Fire Alarm Association (AFAA) → free worksheet: <https://afaa.org/resources/>



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## 163

## 164

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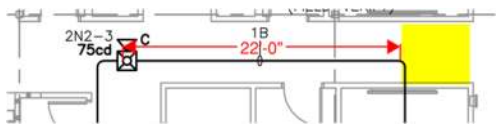
- ❑ A “test plan” should be provided, noting the expected scope of testing. (§7.6)
- ❑ A documentation cabinet, labeled **“SYSTEM RECORDS DOCUMENTS”**, should be placed near FACU (§7.7.2)
- ❑ A completed “System Record of Completion” form should be provided to AHJ (§7.2.1, Item #13)
- ❑ Acceptance test notification? (IFC 901.6)
- ❑ Other systems → Integrated testing (IFC 901.6.2)

F1. Please provide manufacturer's data sheets to show that all fire alarm appliances are appropriate listed as required by IFC 907.1.3.
F2. While manufacturer's data sheets are provided for many of the proposed fire alarm appliances, no information was included for the Firelite SD365 smoke detector or Firelite H365 heat detector. Please address. [IFC 907.1.3]
F3. The quantity of notification appliances used in the RPS-1 standby battery calculations do not match what is shown on the fire alarm drawings. Please revise the calculations to account for any additional demands needed for the Secondary Power Supply. [Section 7.4.10, Item #1, of NFPA 72]

## Sample Comments

F4. Please provide a stamp and signature showing that a State of California C-10 licensed contractor or licensed fire protection engineer has designed the proposed fire alarm system. [Section 10.5.1.3 of NFPA 72]

F5. **Sheet FA-X:** The 75cd hallway "2N2-3" notification appliance is spaced greater than 22'-6" in the area outside the Men's Restroom 5210 and Offices 5216 and 5216. Please revise the layout, or provide another appliance, to provide a notification appliance within 15-feet of the end of the corridor as required by Section 18.5.5.5 of NFPA 72 and Table 18.5.5.4.1(a).



## Sample Comments

F6. Please revise the battery and voltage drop calculations to account for the additional appliances that will be required as noted within this comment letter. It should also be confirmed that the wiring size (gauge) is still appropriate. [Sections 7.4.10 (Items #1 & 2), 10.6.7.2.1, and 10.6.7.2.1.1 of NFPA 72]

F7. As the project includes a Group E occupancy with an occupant load more than 50, the fire alarm system is required to incorporate an emergency voice/alarm communication system in accordance with IFC 907.2.3 and 907.5.2.2. Please address.

F8. **Sheet FA-X:** Heat detectors are provided throughout the parking garage area, yet no listed spacing for the detectors has been provided. Please provide clear information noting the listed spacing and verify prior to resubmittal that the Heat Detector coverage is in accordance with Section 17.6.3.1.1 of NFPA 72.

## Sample Comments

F9. IFC 903.4.2, and Section 16.11.2.1 of NFPA 13, require an audible device on the exterior of the building in an "approved" location. Please specify a listed exterior appliance above the FDC.

F10. No notification appliances are shown throughout the self-storage facility. All self-storage facilities three stories or greater require occupant notification throughout in accordance with IFC 907.2.10. Please address.

F11. **Sheet FA-X:** The smoke detector coverage shown in the Buss Center and Gallery areas is insufficient. Please revise the plans to provide smoke detector coverage complying with Section 17.7.3.2.3.1 of NFPA 72. Namely, smoke detectors shall not exceed 15-feet from any wall, spacing between appliances does not exceed 30-feet, or that all points on the ceiling are within a distance equal to or less than 0.7 times the nominal 30-foot spacing (0.7S). Please address.

## Sample Comments

F12. **Sheet FA-X:** No notification appliances are shown in the corridor area as required by Section 18.5.5.5 of NFPA 72. Please address.

F13. **Sheet FA-X:** Notification appliance "NC#1-7" is spaced greater than that permitted for a 15cd wall-mounted appliance. Please increase the effective light output intensity (cd) to comply with Table 18.5.5.4.1(a) of NFPA 72 or provide additional appliances as needed.

F14. **Sheet FA-X:** Visible alarm notification appliances must be provided in both public use and common use areas per IFC 907.2.3.1. While not for public use, the office kitchen area is considered common use and requires visible notification. Please address.

# Sample Comments

F15. **Sheet FA-X:** No notification appliances are shown for the Elevator Lobby Corridor area (as shown below). Please revise the drawings to show notification appliances located and spaced in accordance with Section 18.5.5.5.5 of NFPA 72.



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# Sample Comments

F16. **Sheet FA-X:** Please clarify the Scope of Work on the Fourth Floor. It is difficult to determine where work is being completed. Scope of Work indicates that work is to only be performed in the Restrooms, however, there appears to be work being performed in Pantry 402, Break Area 403, etc. Please clarify. [Section 7.2.1, Item #1, of NFPA 72]

F17. **Sheet FA-X:** The riser diagram for Circuit #2 lists a 15cd "WP Wall Horn Strobe" while the plans and voltage drop calculations consider a 115cd appliance. Please clarify.

F18. Please clarify on the plans that the fire code official will be notified prior to conducting the final acceptance test of the fire alarm system as required by IFC 901.6.

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# PART 5 Example Projects



Adobe Stock\_355213290



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# Example #1: FSS Monitoring

## PROJECT SCOPE:

PROVIDE AND INSTALL NEW SPRINKLER MONITORING SYSTEM TO MONITOR THE SPRINKLER SYSTEM. THIS INCLUDED SMOKE DETECTOR ABOVE FACP, MANUAL STATIONS AND NOTIFICATION DEVICES AT THE EXIT.

OCCUPANCY CLASSIFICATION: M

TYPE OF CONSTRUCTION: V-B

NUMBER OF STORIES: 1 STORY & A MEZZANINE

SPRINKLER PROTECTION: YES,

ALTERNATIVE PROTECTION: NOT APPLICABLE

TYPE OF SYSTEM: MANUAL, AUTOMATIC FIRE ALARM SYSTEM

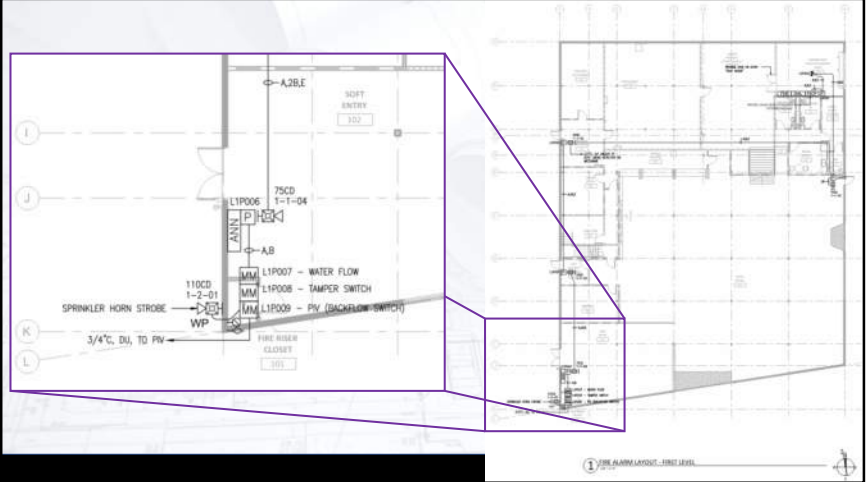


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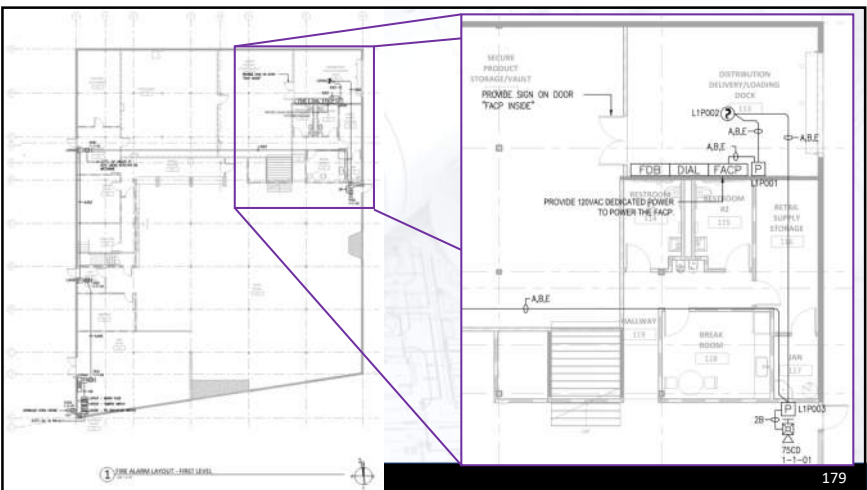


Example #1: FSS Monitoring

FIRE ALARM SEQUENCE OF OPERATION									
CAUSE	ALARM					CONTROL			
	1	2	3	4	5	6	7	8	9
ALARM CONDITION									
SMoke DETECTOR	*	*	*	*	*				
WATER FLOW DETECTOR	*	*	*	*	*				
FIRE SPRINKLER FLOW SWITCH	*	*	*	*	*				
SUPERVISORY CONDITION									
BACKWATER DETECTOR	*	*	*	*	*				
FIRE SPRINKLER PIV (BACKFLOW SWITCH)	*	*	*	*	*				
FIRE SPRINKLER TAMPER SWITCH	*	*	*	*	*				
TRouble CONDITION									
20 POWER FAILURE	*	*	*	*	*				
SYSTEM TROUBLE	*	*	*	*	*				
FIRE ALARM TROUBLE (UPON)	*	*	*	*	*				
SHORTS OR GROUNDING ON	*	*	*	*	*				
REPAIRS OR SIGNALING CIRCUITS	*	*	*	*	*				



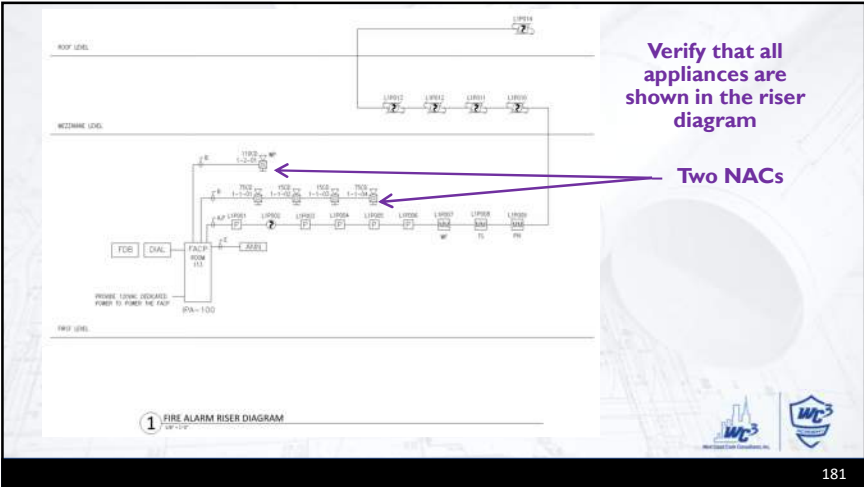
1 FIRE ALARM LAYOUT - FIRST LEVEL



1 FIRE ALARM LAYOUT - FIRST LEVEL



2 FIRE ALARM LAYOUT - ROOF LEVEL



BATTERY STANDBY CALCULATION						
Rev				Panel ID:	FACP - IPA 100	
6	Project Name: Airfield Supply Company Project Number: 223055					
QTY	PART #	DESCRIPTION	STANDBY	ALARM	TOTAL STANDBY	TOTAL ALARM
Panel Equipment						
1	IPA 100	Intelligent Fire Alarm Control Panel	0.13000	0.20000	0.13000	0.20000
1	HW-AV-LTE	Honeywell CLSS Pathway Communicator	0.06000	0.20000	0.06000	0.20000
1	UD-2000	Digital Alarm Communicator	0.01600	0.02300	0.01600	0.02300
1	PAD200-PD	Addressable Photoelectric Smoke Detector Head	0.000300	0.000300	0.00030	0.00030
5	PAD200-Ductr	Analog Addressable Duct Detector	0.000500	0.000500	0.00250	0.00250
3	PAD100-MIM	Addressable Mini Single Input Module	0.000300	0.000300	0.00090	0.00090
5	PAD100-PSDA	Addressable Dual Action Manual Pull Station	0.000200	0.000200	0.00100	0.00100
2	PZRL / PZWL	Horn Strobe, 15cld, Wall, Temporal High, 2-wire	0.00000	0.05400	0.00000	0.10800
2	PZRL / PZWL	Horn Strobe, 75cld, Wall, Temporal High, 2-wire	0.00000	0.12100	0.00000	0.24200
1	PZRK	Horn Strobe, 110cld, Wall, Temporal High, 2-wire, Outdoor	0.00000	0.21200	0.00000	0.21200
STANDBY AH HOURS:				24	5.05680	
ALARM AH MINUTES:				6		0.08248
STANDBY & ALARM AH COMBINED:					5.13928	
[PER NFPA 72 2022 10.6.7.2.1(1)] BATTERY SAFETY MARGIN:					20%	1.02786
ADDITIONAL BATTERY SAFETY MARGIN:					0%	0.00000
TOTAL AH RATED BATTERIES REQUIRED:					6.16713	
BATTERIES SUPPLIED:					(2) 8 Ah	PA



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VOLTAGE DROP CALCULATION (LUMP SUM)				
Rev 6	Project Name: Airfield Supply Company		Circuit ID: NAC 1	
Project Number: 223055				
QTY	PART #	DESCRIPTION	CURRENT	TOTAL CURRENT
Peripheral Devices				
2	PZRL / PZWL	Horn Strobe, 15cld, Wall, Non-temporal High, 2-wire	0.05400	0.10800
2	PZRL / PZWL	Horn Strobe, 75cld, Wall, Non-temporal High, 2-wire	0.12100	0.24200
			Subtotal [Σ]	0.35000
			Circuit Length (Feet)	250
			Wire AWG	14
			Terminal Block (TB) or Circuit ID Maximum Current Available (amps)	0.00
			(Per NEC Table 8 Conductor Properties: Copper, Solid, Uncoated 75C/105F) ohm/ft	3.07
			[Wire Length x ohm/ft] Resistance [R]	0.788
			[I] x [R] = [V] (No greater than 4.4v Volts Drop)	0.269
			(Per NFPA 72 2022 10.3.5 (1) 80% of 24VDC Calculated Supply Voltage	26.4
			(No greater than 10% Calculated Voltage Drop %	1.32%
			(16-32VDC operating range, per UL) Calculated End of Line Voltage	20.131
			Calculated Maximum Allowable Circuit Length (Feet)	1993

NAC #1

VOLTAGE DROP CALCULATION (LUMP SUM)				
Rev 6	Project Name: Airfield Supply Company		Circuit ID: NAC 2	
Project Number: 223055				
QTY	PART #	DESCRIPTION	CURRENT	TOTAL CURRENT
Peripheral Devices				
1	PZRK	Horn Strobe, 110cld, Wall, Temporal High, 2-wire, Outdoor	0.21200	0.21200
			Subtotal [Σ]	0.21200
			Circuit Length (Feet)	250
			Wire AWG	14
			Terminal Block (TB) or Circuit ID Maximum Current Available (amps)	0.00
			(Per NEC Table 8 Conductor Properties: Copper, Solid, Uncoated 75C/105F) ohm/ft	3.07
			[Wire Length x ohm/ft] Resistance [R]	0.788
			[I] x [R] = [V] (No greater than 4.4v Volts Drop)	0.183
			(Per NFPA 72 2022 10.3.5 (1) 80% of 24VDC Calculated Supply Voltage	26.4
			(No greater than 10% Calculated Voltage Drop %	0.90%
			(16-32VDC operating range, per UL) Calculated End of Line Voltage	20.237
			Calculated Maximum Allowable Circuit Length (Feet)	3291

NAC #2



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## Example #1: FSS Monitoring

### Thoughts

- Pretty comprehensive design
- Need to spend time reviewing notes
- No information was provided on supervising station.

F1. IFC 903.4.1 requires all alarm, supervisory, and trouble signals to be transmitted to an approved supervising station. Please clarify on the plans how this off-site supervision will be provided. If an Underwriters Laboratories Central Station Monitoring Service will be provided, please provide the UL listing number.

## Example #2: New System

- GENERAL NOTES:**
- SCOPE OF WORK: THIS PROJECT SHALL INCLUDE THE INSTALLATION OF A NEW FIRE ALARM SYSTEM FOR SPRINKLER MONITORING, ELEVATOR RECALL, AND FULL NOTIFICATION COVERAGE THROUGHOUT THE BUILDING.
- PROJECT CODE ANALYSIS:**
- BUILDING INFORMATION:
- A) OCCUPANCY CLASSIFICATION(S): B
  - B) OCCUPANCY LOAD(S): 180
  - C) SPRINKLERS: YES
  - D) CONSTRUCTION TYPE: V-B
  - E) BUILDING HEIGHT: 2 STORIES (BASEMENT)
  - F) PROJECT SQUARE FOOTAGE: 17,475 SQFT.
  - G) APPLICABLE CODES:
    - 2021 INTERNATIONAL FIRE CODE
    - 2019 NFPA 72
  - H) CIRCUIT CLASSIFICATION: POWER LIMITED

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- THESE DRAWINGS ARE DIAGNOMATIC. REFER TO THE ARCHITECTURAL DRAWINGS FOR EXACT DIMENSIONS.
- INSTALLATION SHALL COMPLY WITH NEC, NFPA 72 AND ALL OTHER APPLICABLE CODES AS REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION.
- WIRING DEPICTED ON THESE PLANS IS SCHEMATIC - ACTUAL WIRE LOCATIONS MAY DIFFER FROM THESE PLANS. WIRING SHALL BE PERFORMED AS ACTUAL BUILDING CONSTRUCTION CONDITIONS ALLOW AND TO MINIMIZE PENETRATIONS THROUGH AREA SEPARATION WALLS AND FIRE WALLS, THE USE OF A RACEWAY IS PERMITTED AS LONG AS NO 110V OR HIGHER VOLTAGE CABLES ARE IN THE SAME RACEWAY.
- FIRE RATINGS SHALL BE MAINTAINED FOR ALL PENETRATIONS THROUGH FIRE-RATED CONSTRUCTION.
- POWER FOR ALL FIRE ALARM PANELS AND FIRE ALARM POWER SUPPLIES MUST BE PROVIDED BY A DEDICATED AC BRANCH CIRCUIT. THE LOCATION OF THE BRANCH CIRCUIT BREAKER SHALL BE PERMANENTLY IDENTIFIED AT THE CONTROL UNIT, MECHANICALLY PROTECTED, ACCESSIBLE ONLY TO AUTHORIZED PERSONNEL AND SHALL BE RED AND LABELED "FIRE ALARM CIRCUIT CONTROL" IN ACCORDANCE WITH NFPA 72. ELECTRICAL CONTRACTOR SHALL PERFORM LOAD CALCULATIONS TO DETERMINE SIZE OF WIRING AND BREAKERS FOR ALL FIRE ALARM AC BRANCH CIRCUITS BASED ON THE INFORMATION PROVIDED IN THE BATTERY CALCULATIONS FOR THE FIRE ALARM EQUIPMENT.
- POWER-LIMITED AND NONPOWER-LIMITED CIRCUIT WIRING MUST REMAIN SEPARATED IN CABINET. ALL POWER-LIMITED CIRCUIT WIRING MUST REMAIN AT LEAST 0.25" AWAY FROM ANY NONPOWER-LIMITED CIRCUIT WIRING. FURTHERMORE, ALL POWER-LIMITED AND NONPOWER-LIMITED CIRCUIT WIRING MUST ENTER AND EXIT THE CABINET THROUGH DIFFERENT KNOCK OUTS AND/OR SEPARATE CONDUITS.
- WHEN UTILIZING CLASS "A" CIRCUITS, SEPARATE OUTGOING AND RETURN CONDUCTORS OF CLASS "A" CIRCUITS BY A MINIMUM OF 12" WHERE RUN VERTICALLY AND 48" WHERE RUN HORIZONTALLY.
- WHEN UTILIZING SHIELDED CABLE THE SHIELDS THROUGH AND INSULATE AT EACH JUNCTION BOX. INSULATE AND TAPE BACK AT END.
- ALL FIRE ALARM CABLEING SHALL BE ACCEPTABLE TO THE FIRE ALARM EQUIPMENT MANUFACTURER FOR THE INTENDED PURPOSE. CABLES USED IN VERTICAL RUNS SHALL BE TYPE FPLP OR FPLR. CABLE SPLICES OR TERMINATIONS SHALL BE MADE IN LISTED FITTINGS, BOXES, ENCLOSURES, FIRE ALARM DEVICES, OR UTILIZATION EQUIPMENT. WHERE INSTALLED EXPOSED, CABLES SHALL BE ADEQUATELY SUPPORTED AND INSTALLED IN SUCH A WAY THAT MAXIMUM PROTECTION AGAINST PHYSICAL DAMAGE IS AFFORDED BY BUILDING CONSTRUCTION, 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.
- SMOKE DETECTORS SHALL NOT BE INSTALLED UNTIL AFTER CONSTRUCTION CLEAN-UP IS COMPLETED AND FINAL.
- LOCATE SMOKE DETECTORS A MINIMUM OF THREE (3) FEET FROM MECHANICAL DIFFUSERS, WALL-MOUNTED SMOKE DETECTORS SHALL BE LOCATED A MAXIMUM OF 12" FROM CEILING.
- PROVIDE SYNCHRONIZATION OF ALL VISUAL NOTIFICATION APPLIANCE CIRCUITS. PROVIDE ALL REQUIRED SYNC MODULES. PROVIDE A MULTI-SYNC MODE SLAVE CONNECTION BETWEEN ALL SYNC MODULES.
- VERIFY ALL FIELD SELECTABLE AUDIBILITY SETTINGS OF NOTIFICATION APPLIANCES WITH FIRE ALARM CONTRACTOR.
- UPON COMPLETION OF THE FIRE ALARM SYSTEM INSTALLATION AND PROGRAMMING, THE INSTALLING CONTRACTOR SHALL PERFORM FINAL TESTING OF THE ENTIRE SYSTEM PER ALL APPLICABLE CODES, AND SHALL COORDINATE AND PERFORM A FINAL FIRE ALARM SYSTEM INSPECTION.
- PROVIDE OFF-SITE MONITORING AS REQUIRED BY THE INTERNATIONAL FIRE CODE, SECTION 907.6.6 AND THE LOCAL AUTHORITY HAVING JURISDICTION.
- INSTALLING CONTRACTOR SHALL, PHYSICALLY LABEL ALL INITIATING DEVICES AND NOTIFICATION APPLIANCE CIRCUIT END OF LINE (WHEN WIRING CLASS "B"), THESE LABELS SHALL BE IN PLACE PRIOR TO START-UP AND TESTING.
- ROOMS CONTAINING CONTROLS FOR AIR-CONDITIONING SYSTEMS, SPRINKLER RISERS AND VALVES OR OTHER FIRE DETECTION, SUPPRESSION OR CONTROL ELEMENTS SHALL BE IDENTIFIED WITH PERMANENTLY MOUNTED SIGNS WITH LETTERING NOT LESS THAN 2 INCHES TALL WITH A PRINCIPAL STROKE OF NOT LESS THAN 3/8 INCH. LETTERS SHALL CONTRAST WITH BACKGROUND.

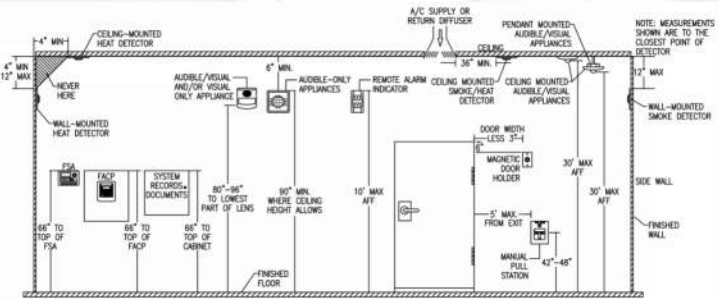
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FIRE ALARM SYMBOL LEGEND					
SYMBOL	DESCRIPTION	MANUF. & PART #	MOUNTING	MOUNT IN	QTY
FACP	FIRE ALARM CONTROL PANEL	FIRELITE - ES-200H	WALL - TOP @ 66"	CABINET INCLUDED	1
COM	FIRE ALARM COMMUNICATOR	NAPCO - SLE-170V-FIRE	WALL - TOP @ 66"	CABINET INCLUDED	1
DOC	DOCUMENT BOX	SPACE AGE ELEC. - SSJ00K72	WALL - TOP @ 66"	CABINET INCLUDED	1
SD	SMOKE DETECTOR	FIRELITE - 5030S	CEILING	4 SQ. DEEP W/ SINGLE GANG MUD RING - MOUNTED FLUSH	5
HD	HEAT DETECTOR	FIRELITE - H3MS	CEILING	4 SQ. DEEP W/ SINGLE GANG MUD RING - MOUNTED FLUSH	1
MM	MONITOR MODULE	FIRELITE - MMF-300	FIELD VERIFY	4 SQ. DEEP - MOUNTED FLUSH	3
RM	RELAY MODULE	FIRELITE - CRF-300	FIELD VERIFY	4 SQ. DEEP - MOUNTED FLUSH	4
PS	PULL STATION	FIRELITE - BG-12LX	WALL @ 48"	4 SQ. DEEP W/ SINGLE GANG MUD RING - MOUNTED FLUSH	1
SV	SPRINKLER VALVE TAPHER		FIELD VERIFY	BY OTHERS	1
WT	SPRINKLER WATERFLOW		FIELD VERIFY	BY OTHERS	1
CS	CEILING MOUNT SMOKE / STROBE	SYSTEM SENSOR - PCSRL	CEILING	4 SQ. DEEP W/ SINGLE GANG MUD RING - MOUNTED FLUSH	30
CS	CEILING MOUNT SMOKE	SYSTEM SENSOR - SCRL	CEILING	4 SQ. DEEP W/ SINGLE GANG MUD RING - MOUNTED FLUSH	2
ST	STROBE	SYSTEM SENSOR - SRL	WALL 80"-96"	4 SQ. DEEP W/ SINGLE GANG MUD RING - MOUNTED FLUSH	7
HS	HORN / STROBE (WEATHERPROOF)	SYSTEM SENSOR - P2PK	WALL 80"-96"	4 SQ. DEEP W/ SINGLE GANG MUD RING - MOUNTED FLUSH	1
ABBREVIATION		DESCRIPTION			
E	EXISTING	AWG	AMERICAN WIRE GAUGE		
G	WITH GUARD	TWP	TWISTED PAIR		
P	PENDANT MOUNT	TWP	TWISTED SHIELDED PAIR		
R	RESIDENTIAL (10N)	FPLP	FIRE POWER LIMITED PLENUM		
S	STANDARD BIDS	FPLR	FIRE POWER LIMITED RISER		
W	WEATHERPROOF				
OK	END OF LINE DEVIATOR				
ESL	END OF LINE RELAY				

Are appropriate manufacturer's cut sheets provided for each device proposed?

Are any devices not included in the legend?

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OPERATIONS MATRIX

FIRE ALARM INPUT	FIRE ALARM OUTPUT									
SMOKE DETECTORS	•	•	•	•	•	•	•	•	•	•
HEAT DETECTORS	•	•	•	•	•	•	•	•	•	•
PULL STATIONS	•	•	•	•	•	•	•	•	•	•
PRIMARY REDCALL FUL, ELEV LOBBY SMOKE DET	•	•	•	•	•	•	•	•	•	•
ALTERNATE REDCALL FUL, ELEV LOBBY SMOKE DET	•	•	•	•	•	•	•	•	•	•
TOP OF ELEV SHUTT SMOKE DET	•	•	•	•	•	•	•	•	•	•
TOP OF ELEV SHUTT HEAT DET	•	•	•	•	•	•	•	•	•	•
WATERFLOW SWITCHES	•	•	•	•	•	•	•	•	•	•
VALVE SUPERVISORY SWITCHES	•	•	•	•	•	•	•	•	•	•
FIRE ALARM AC POWER FAIL	•	•	•	•	•	•	•	•	•	•
FIRE ALARM LOW BATTERY	•	•	•	•	•	•	•	•	•	•
OPEN CIRCUIT	•	•	•	•	•	•	•	•	•	•
GROUND FAULT	•	•	•	•	•	•	•	•	•	•
NAC SHORT CIRCUIT	•	•	•	•	•	•	•	•	•	•
LOSS OF AC TO BUILDING	•	•	•	•	•	•	•	•	•	•

Is the proposed sequence of operations appropriate?

Are all devices covered?




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Verify that all appliances are shown in the riser diagram

Four NACs



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FACP Battery Calculation


PROJECT NAME: BROWN JONES OFFICE BUILDING				
Required Standby Time:	24 hours			
Required Alarm Time:	5 minutes			
System Manufacturer:				
AC Branch Current:				
Maximum NAC Output:	1.25 Amps @ 120V			
Panel Max:	0.50 Amps			
Panel Min:	1.25 Amps			
Regulated Load in Standby:				
Device Type	Model	Number of Devices	Current (Amps)	Total Current (Amps)
FACP MANIPULATOR	ES-200X	1	0.141000	0.141000
COMMAND CENTER	SLC-100-FIRE	1	0.071000	0.071000
SMOKE DETECTOR	SD-100	5	0.000000	0.000000
HEAT DETECTOR	HDS-100	1	0.000000	0.000000
MANIPULATOR	MAN-300	3	0.000000	0.000000
RELAY MODULE	REL-300	4	0.000000	0.000000
PULL STATION	PS-100	1	0.000000	0.000000
TOTAL STANDBY LOAD: 0.212000				
Regulated Load in ALARM:				
Device Type	Model	Number of Devices	Current (Amps)	Total Current (Amps)
FACP MANIPULATOR	ES-200X	1	0.250000	0.250000
COMMAND CENTER	SLC-100-FIRE	1	0.000000	0.000000
SMOKE DETECTOR	SD-100	5	0.000000	0.000000
HEAT DETECTOR	HDS-100	1	0.000000	0.000000
MANIPULATOR	MAN-300	3	0.000000	0.000000
RELAY MODULE	REL-300	4	0.000000	0.000000
PULL STATION	PS-100	1	0.000000	0.000000
TOTAL ALARM LOAD: 0.250000				
Battery Requirements:				
Standby Load	0.212000	Required Standby Time in Hours	24	5.088000
Alarm Load	0.250000	Required Alarm Time in Hours	0.083333	0.020833
Total Required Capacity (Before derating factor): 5.108833				
Derating Factor	0.8			
TOTAL REQUIRED CAPACITY (AFTER DERATING): 6.386042				
BATTERIES TO BE PROVIDED: 6 - 12V				

Are all devices listed?

Is alarm duration appropriate?

Is safety margin applied?

Are sufficient batteries specified to meet the demand?



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### Sample Comments

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Adobe Stock 2441446

## Final Thoughts

- ☐ Chapter 7 of NFPA 72 is key → Have they provided everything?
- ☐ Are appropriate listings for each appliance provided?
- ☐ Are all appliances shown in the riser diagram and in the battery and voltage drop calculations?
- ☐ Are initiation appliances located correctly?
- ☐ Are notification appliances located correctly?
- ☐ Are all supervised appliances/systems considered?



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## Final Thoughts

- ☐ Comment letters should reference the applicant and permit number, note the date received and date of comments, and provide reviewer contact information.
- ☐ Comments should be clear, reference the code section, and courteous.
- ☐ Never be complacent – keep learning
- ☐ Do you have the tools to succeed?
- ☐ Checklists are great for learning, but also to remember what to check for items not seen every day.



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## Final Thoughts

- ☐ Key indicators of a good review are:
  - Minimal phone calls and emails asking for clarification
  - Applicant responses resolve the original comments
    - If not, did the original comment make sense and give proper direction?
  - Over time are submittals from regular applicants getting cleaner?
  - Can a different reviewer perform the re-check easily and quickly?
- ☐ Ideas for improvement:
  - Find a mentor, within your jurisdiction or elsewhere
  - Job shadow other plan reviewers from time to time.
  - Get feedback from inspectors
  - Self evaluations, or formal evaluations.



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## Any Questions?

**Rob Neale, CFPS**  
801.682.5031  
robn@wc-3.com  
<http://www.wc-3.com>



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