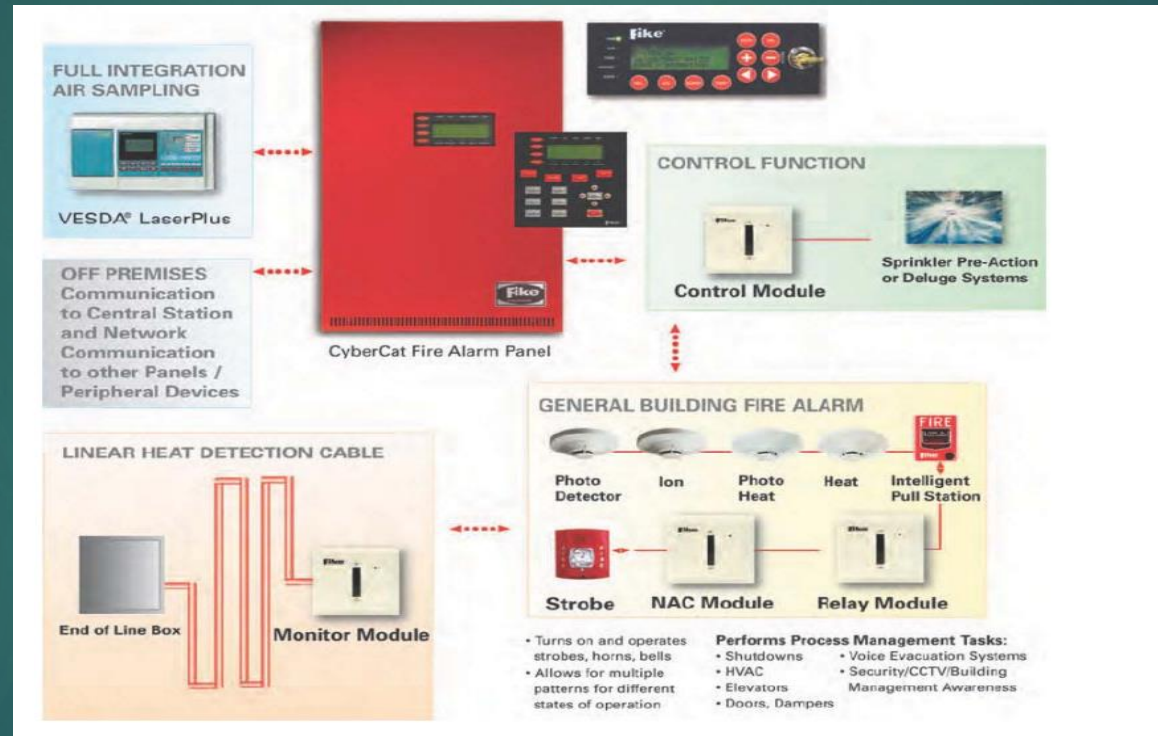


Fire Alarm System

NFPA-72



NFPA
72
National Fire Alarm
and Signaling Code
2022



Naqash Kazmi (CFPS®) NFPA
CERTIFIED FIRE PROTECTION SPECIALIST(CFPS®)

Fire Alarm System.



Fire Alarm System is designed to alert us to an emergency so that we can take action to protect ourselves, staff and the general public.

Whatever the method of detection is, if the alarm is triggered, sounders will operate to warn people in the building that there may be a fire and to evacuate.

Fire Alarm Systems

A fire detection and alarm system is a key element among the fire protection features of any building. Protection goal actually embraces a combination of all three primary goals:

- (1) life safety
- (2) property protection, and
- (3) Mission protection.

Types of Signals

The three most basic fire alarm panel signals are trouble, supervisory, and alarm

Fire Alarm Supervisory Signal

A *supervisory signal* indicates that action is needed in connection with the operation of other fire protection systems that are being monitored by the fire alarm system. Such systems may include extinguishing or suppression systems, such as automatic sprinkler systems, carbon dioxide systems, dry chemical systems, foam systems, and gaseous agent systems

Fire Alarm Trouble Signal

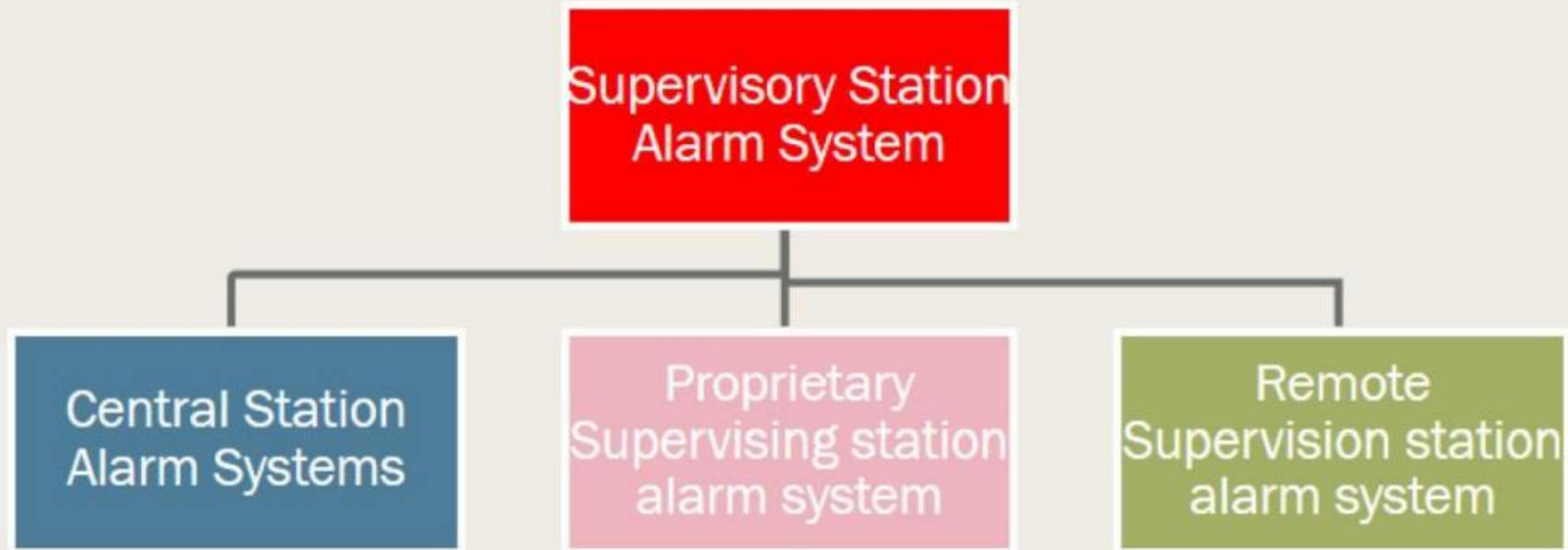
A fire alarm trouble signal is generally yellow and indicates there's an operational issue. Some fire alarm panels may indicate the type of fire alarm trouble and its location e.g, Batteries, Power alarms.

Fire Alarm Signal

A **red** fire alarm signal indicates there's an emergency that requires immediate attention.
e.g, Fire or Smoke Alarms,

Supervising station :

It's a facility that receives signals from alarm systems and is staffed at all times with personnel that can respond to the signals.



Different Types of Fire Alarm Systems



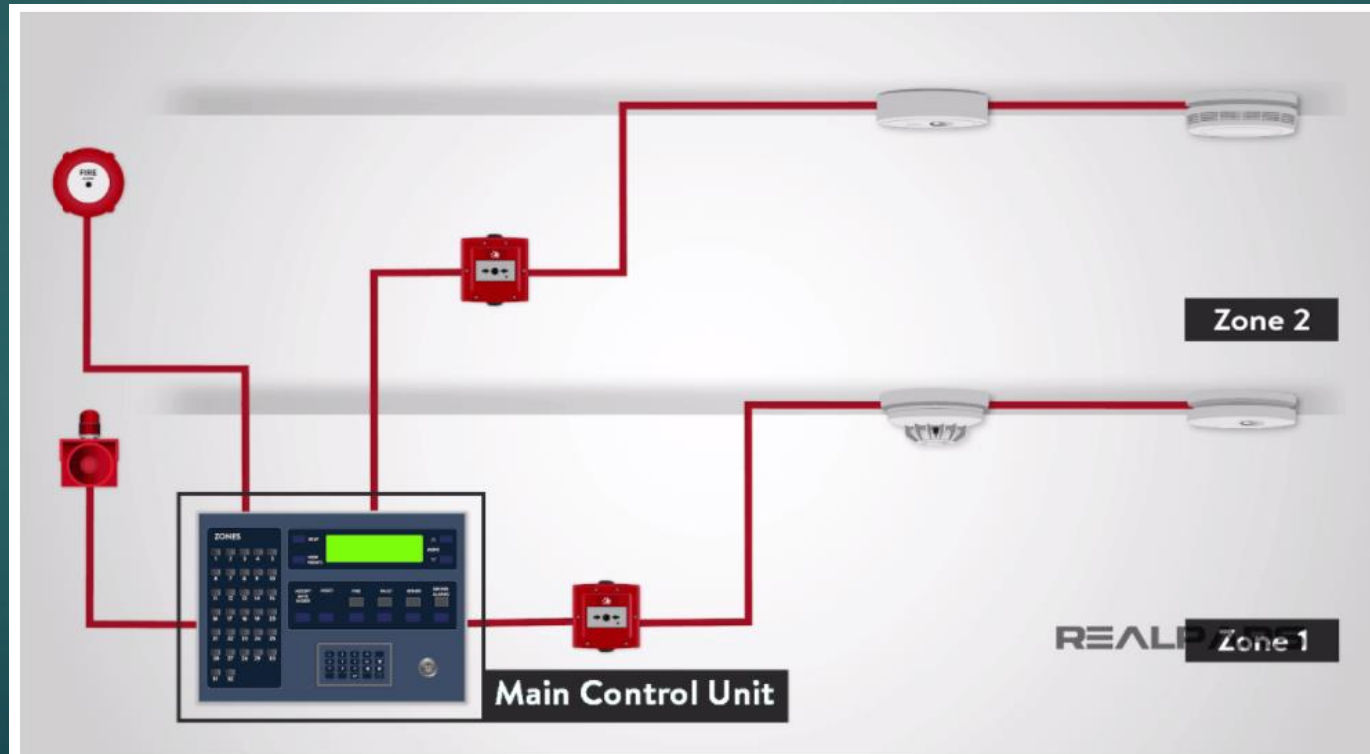
Fire Alarm Systems can be broken down into two main types;

- ▶ Conventional
- ▶ Addressable

Conventional Fire Alarm Systems



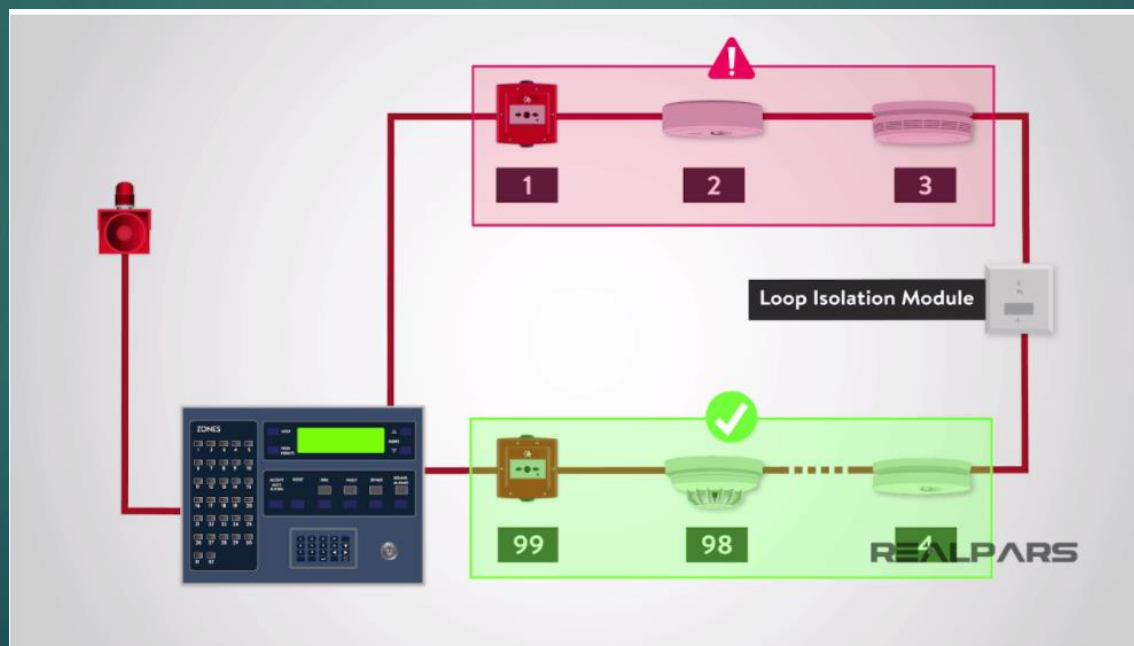
In a Conventional Fire Alarm System, physical cabling is used to interconnect several call points and detectors, the signals from which are wired back to the main control unit.



Addressable Fire Alarm Systems



The detection principle of an Addressable System is the same as a Conventional System except that each detector is given a set Address (usually by means of a dip-switch) and the Control Panel can then determine exactly which detector or call point has initiated the alarm.

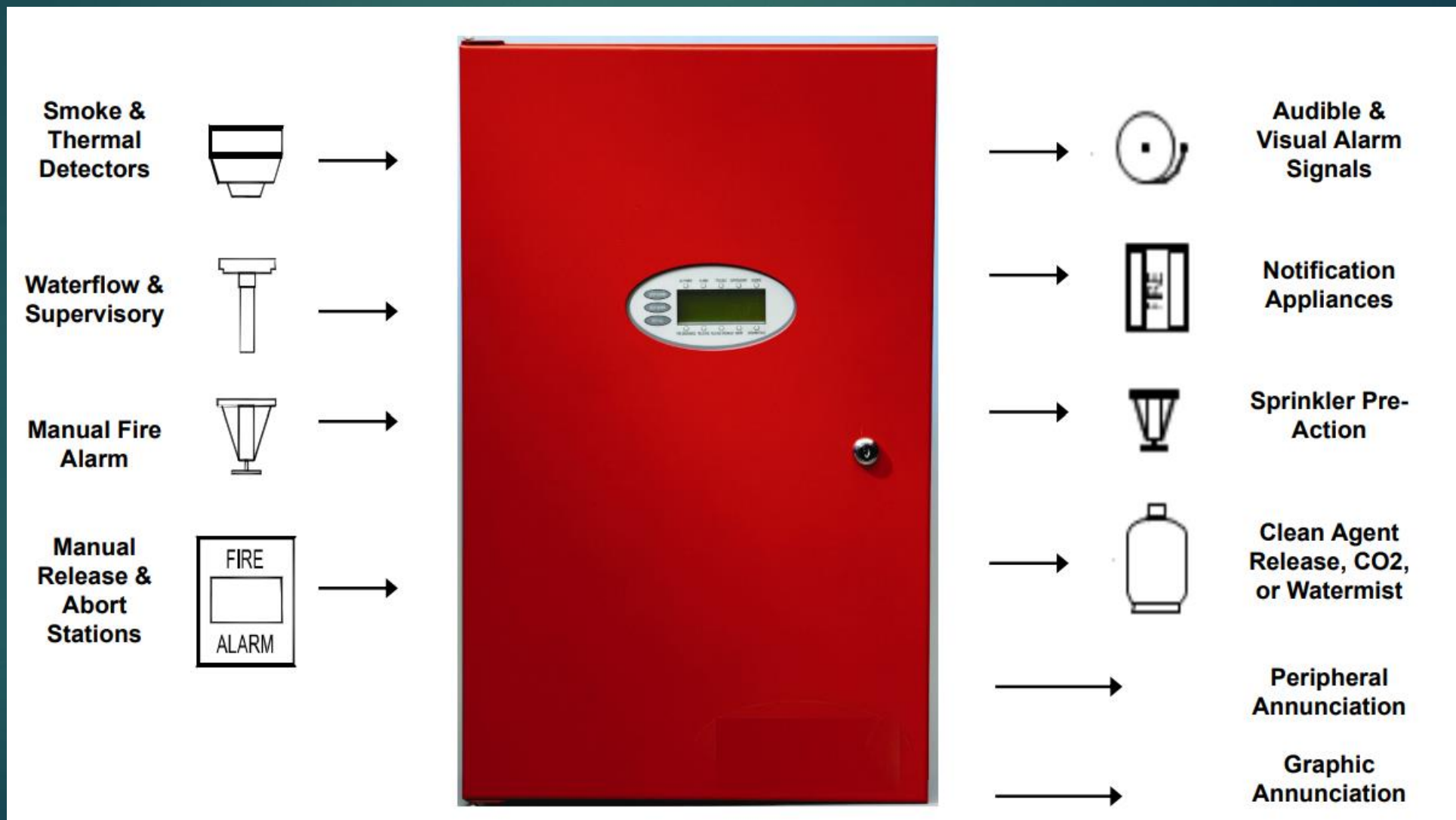


Component of Fire Alarm System



- ▶ Fire Alarm Control Panel
- ▶ Detector
- ▶ Sounder / Horn Strobe
- ▶ Manual Call Points
- ▶ Pipes and Cables

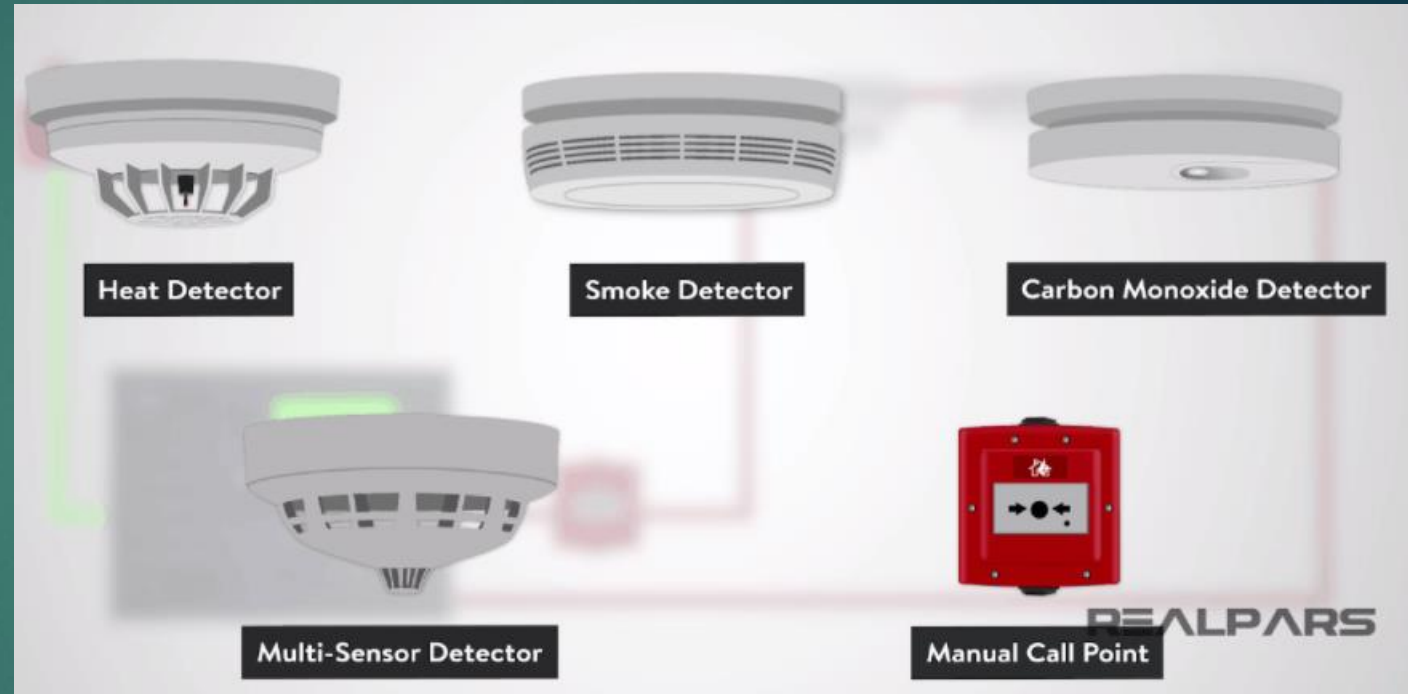
Fire Alarm Control Panel



Different Types of Fire Alarm Detectors



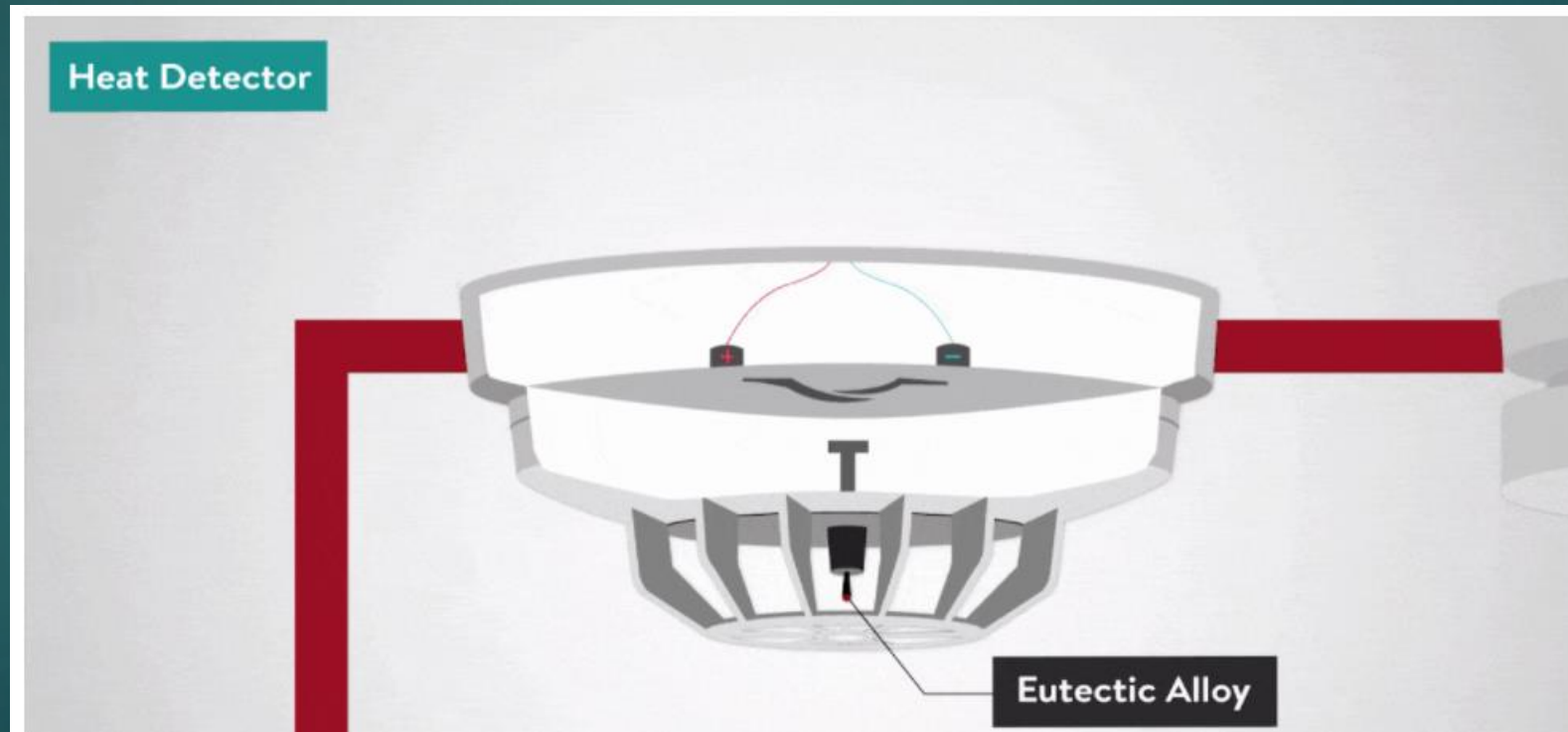
- ▶ Heat detectors
- ▶ Smoke detectors
- ▶ Carbon Monoxide detectors
- ▶ Multi-sensor detectors
- ▶ Manual Call Points



Heat Detectors



Heat detector can either work on a fixed temperature basis, where it will trigger an alarm if the temperature exceeds a pre-set value or they can work on the rate of change in temperature.



Smoke Detectors



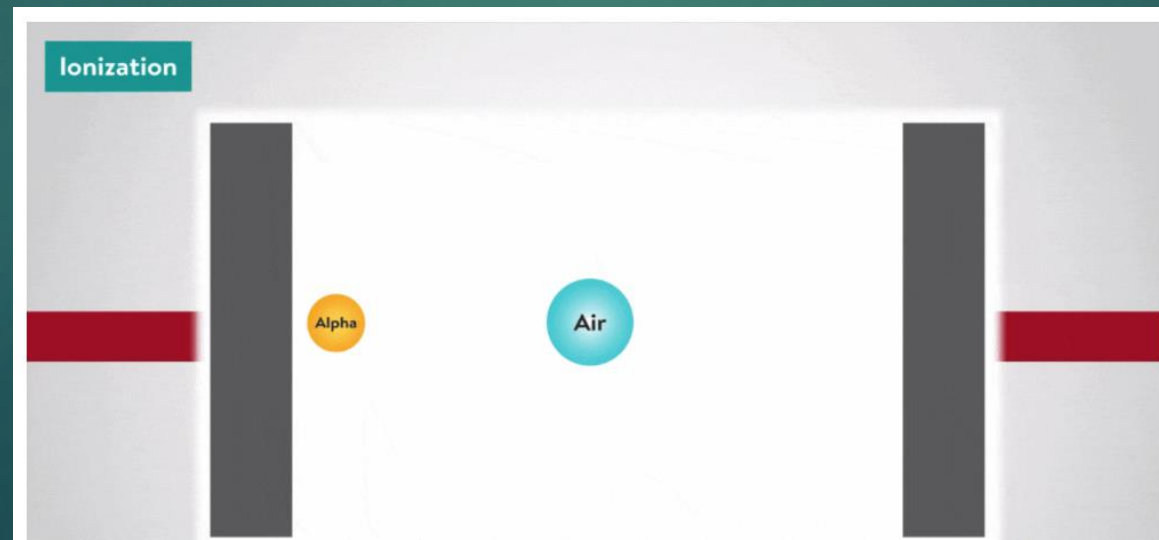
There are three basic types of smoke detectors including:

- ▶ Ionization
- ▶ Light Scattering
- ▶ Light Obscuring

Ionization Smoke Detector



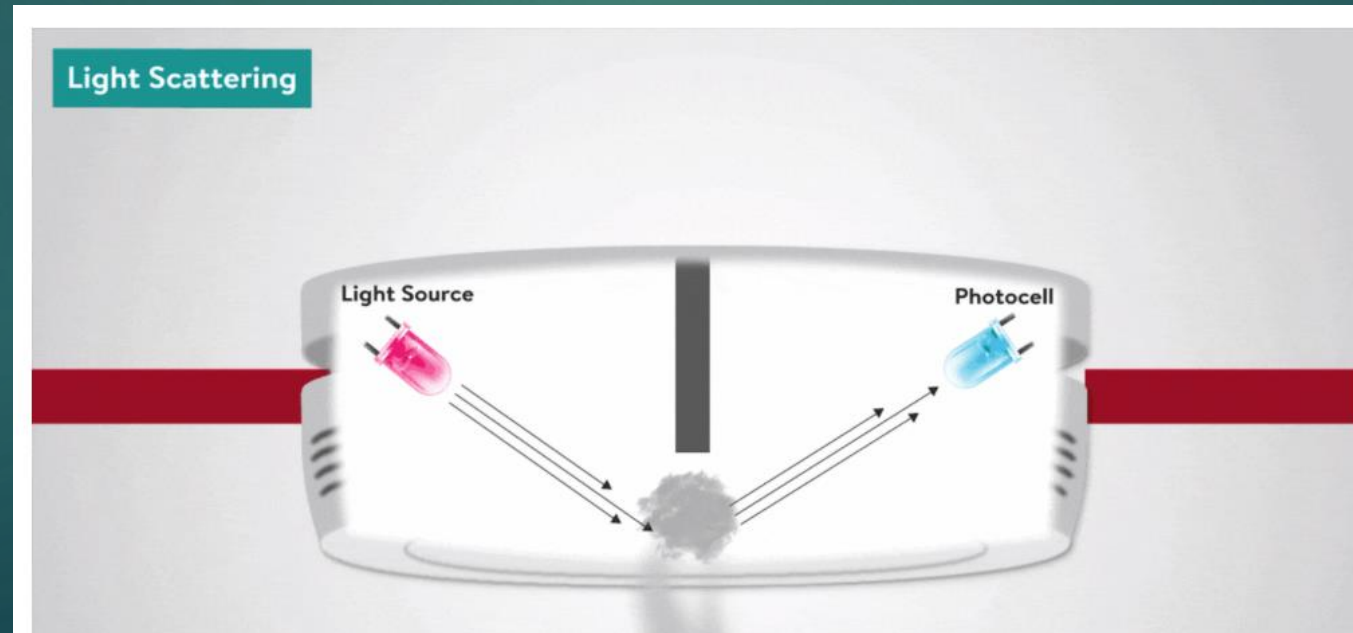
- ▶ Ionization Smoke detector generally contains two chambers. The first is used as a reference to compensate for changes in ambient temperature, humidity or pressure.
- ▶ The second chamber contains a radioactive source, usually alpha particle, which ionizes the air passing through the chamber where a current flows between two electrodes.
- ▶ When smoke enters the chamber the current flow decreases. This drop in current flow is used to initiate an alarm.



Light Scattering Smoke Detector



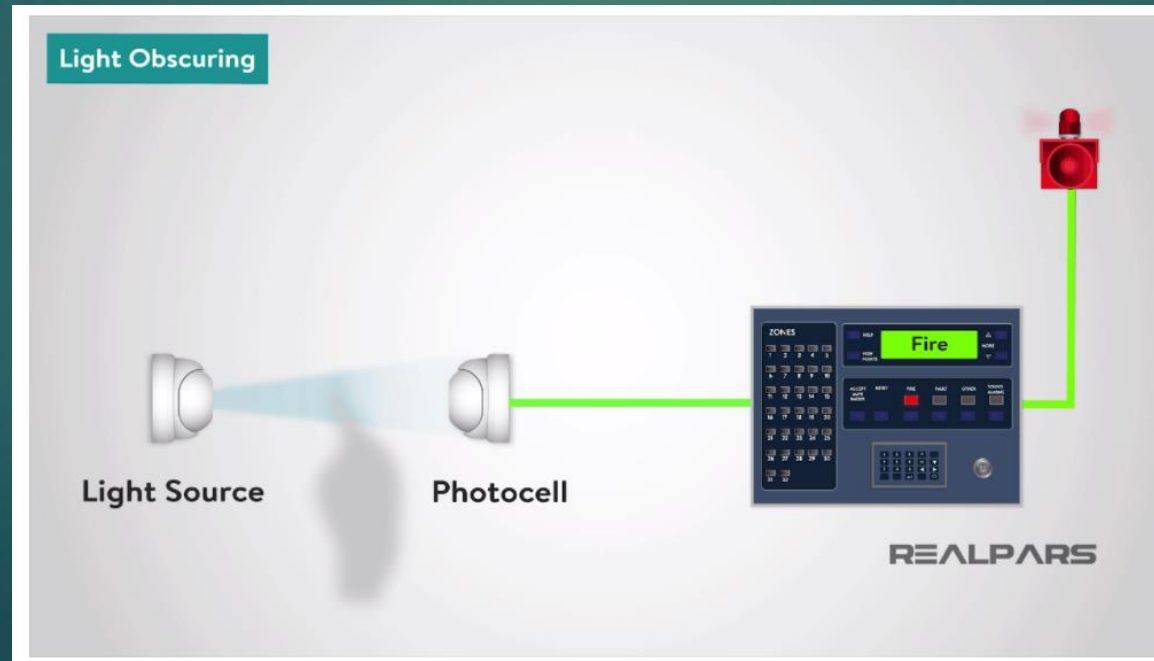
- ▶ The light scattering smoke detector operates on the a photocell and light source are separated from each other by a darkened chamber such that the light source does not fall on the photocell.
- ▶ The passage of smoke into the chamber causes the light from the source to be scattered and fall on the photocell. The photocell output is being used to initiate an alarm.



Light Obscuring Smoke Detector



- ▶ In the Light obscuring smoke detector, smoke interferes with a light beam between a light source and photocell. The photocell measures the amount of light it receives.
- ▶ The variation in photocell output, is being used to initiate an alarm.
- ▶ This type of fire detection equipment can be used to protect large areas with the light source and photocell positioned some distance apart.



Carbon Monoxide Detectors



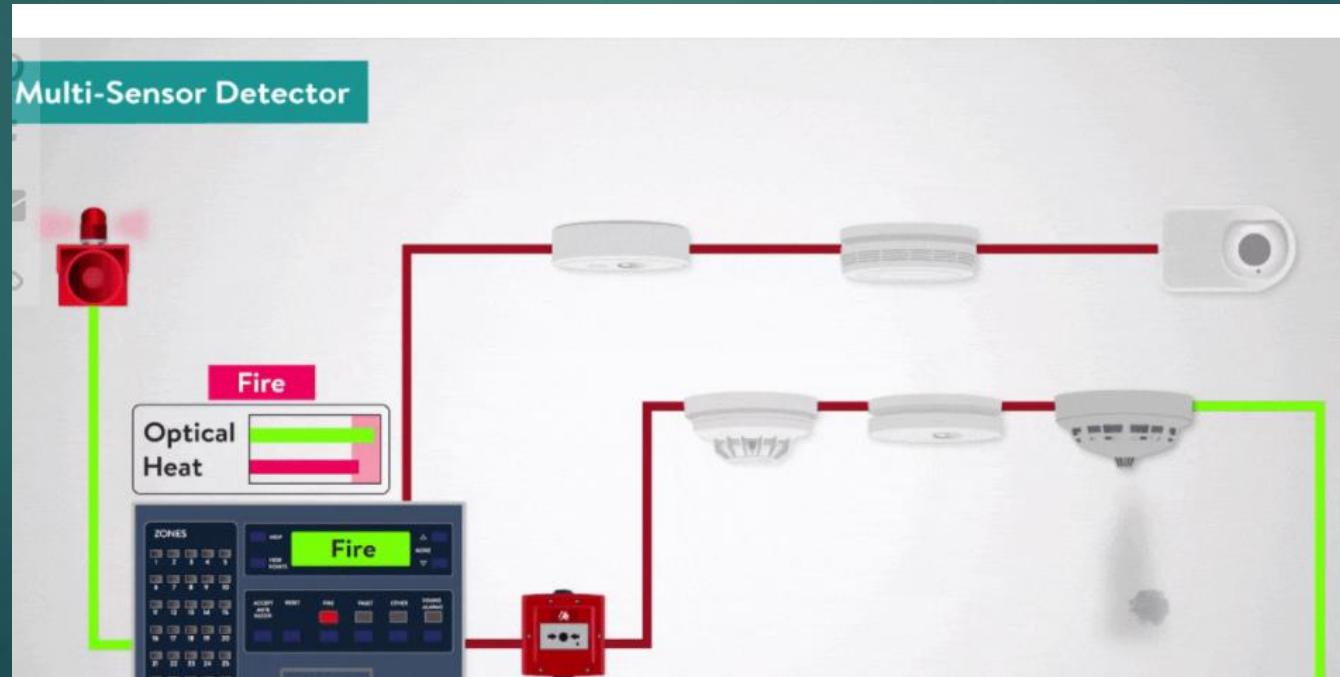
- ▶ Carbon monoxide detectors are known also as CO fire detectors are electronic detectors used to indicate the outbreak of fire by sensing the level of carbon monoxide in the air.
- ▶ Carbon monoxide is a poisonous gas produced by combustion.
- ▶ In this instance, these detectors are not the same as Carbon monoxide detectors used in the home for protecting residents against carbon monoxide produced by incomplete combustion in appliances such as gas fires or boilers.



Multi-Sensor Detectors



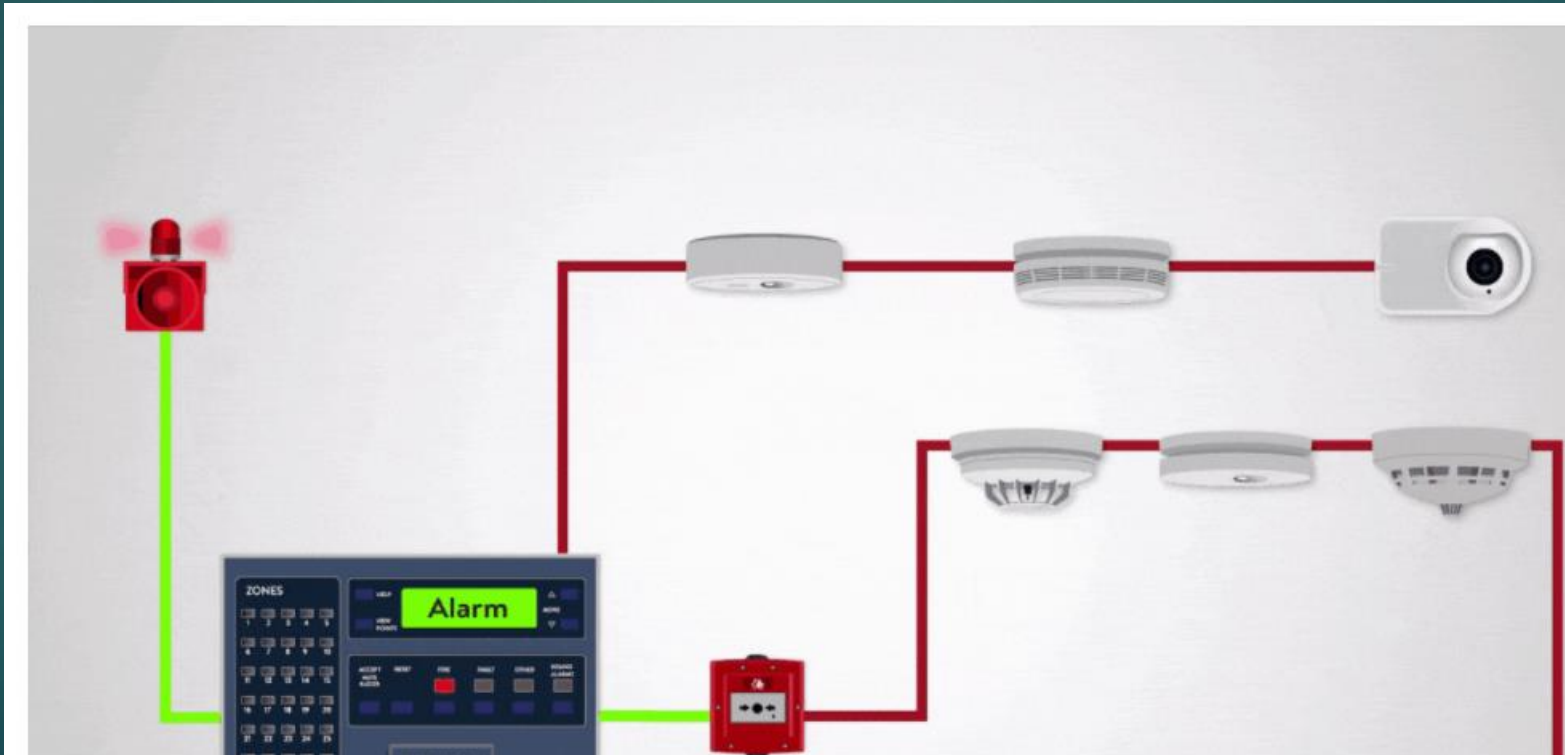
- ▶ The Multi-sensor detectors combine inputs from both optical and heat sensors and process them using a sophisticated algorithm built into the detector circuitry.
- ▶ When polled by the control panel the detector returns a value based on the combined responses from both the optical and heat sensors. They are designed to be sensitive to a wide range of fires.



Manual Call Points

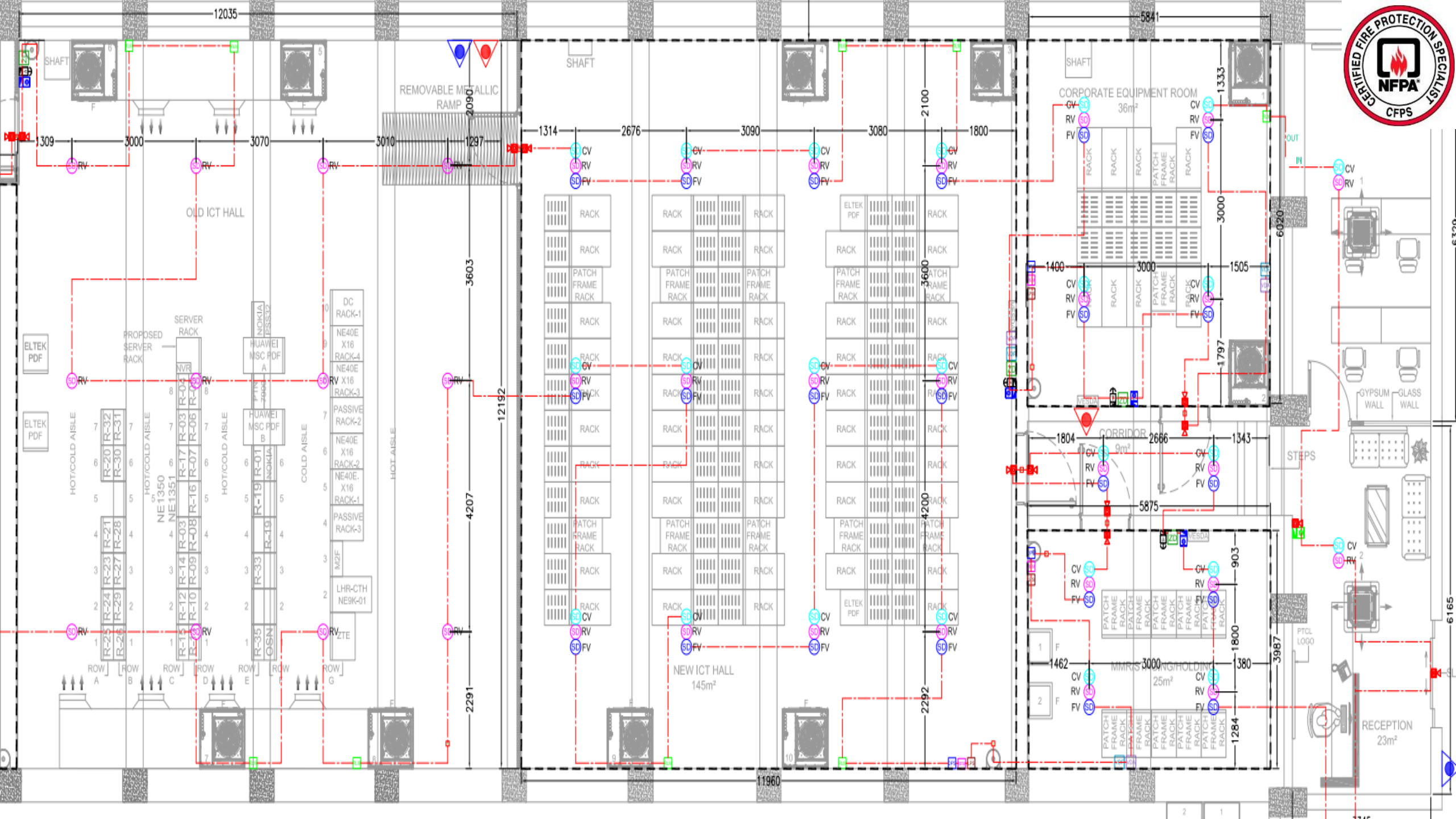


- ▶ A Manual Call Point or Break Glass Call Point is a device which enables personnel to raise the alarm by breaking the frangible element on the fascia; this then triggers the alarm.





Designing Of Fire Alarm System According to the NFPA 72





Fire Alarm Control Panel Location.

Fire alarm control panel should be placed at emergency control rooms.

- ▶ A new requirement for the 2019 edition of NFPA 72 also specifies the maximum and minimum mounting heights for control equipment as 6 ft (1.8m) and 15 in. (375 mm), respectively

Heat Detector Spacing



Table A.17.6.3.1.1 Test Spacing for Spot-Type Heat Detectors

Test Spacing		Maximum Test Distance from Fire to Detector (0.7D)	
		ft	m
50 × 50	15.2 × 15.2	35.0	10.7
40 × 40	12.2 × 12.2	28.0	8.5
30 × 30	9.1 × 9.1	21.0	6.4
25 × 25	7.6 × 7.6	17.5	5.3
20 × 20	6.1 × 6.1	14.0	4.3
15 × 15	4.6 × 4.6	10.5	3.2

Δ Table 17.6.3.5.1 Heat Detector Spacing Reduction Based on Ceiling Height

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
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

Smoke Detector Spacing



- (1) The distance between smoke detectors shall not exceed a nominal spacing of 30 ft (9.1 m) and there shall be detectors within a distance of one-half the nominal spacing, measured at right angles from all walls or partitions extending upward to within the top 15 percent of the ceiling height.
- (2)* All points on the ceiling shall have a detector within a distance equal to or less than 0.7 times the nominal 30 ft (9.1 m) spacing ($0.7S$).

Smoke Detector Spacing Based on Air Movement



△ 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 ²	m ²
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	900	84
9	6.7	900	84
10	6	900	84

Smoke/Heat Detector Spacing

FIGURE A.17.6.3.1.1(g) Detector Spacing, Rectangular Areas.

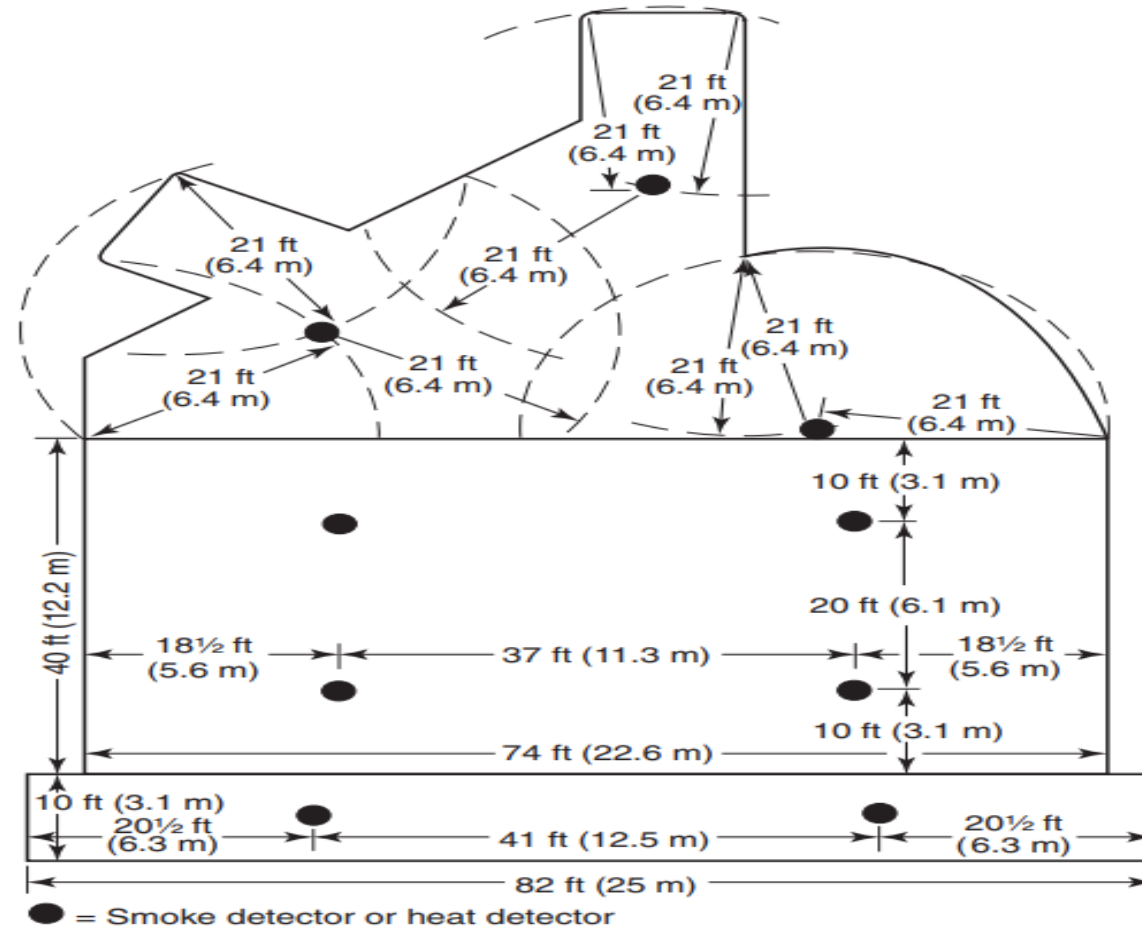


FIGURE A.17.6.3.1.1(h) Smoke or Heat Detector Spacing Layout in Irregular Areas.

Installation Details of Detectors

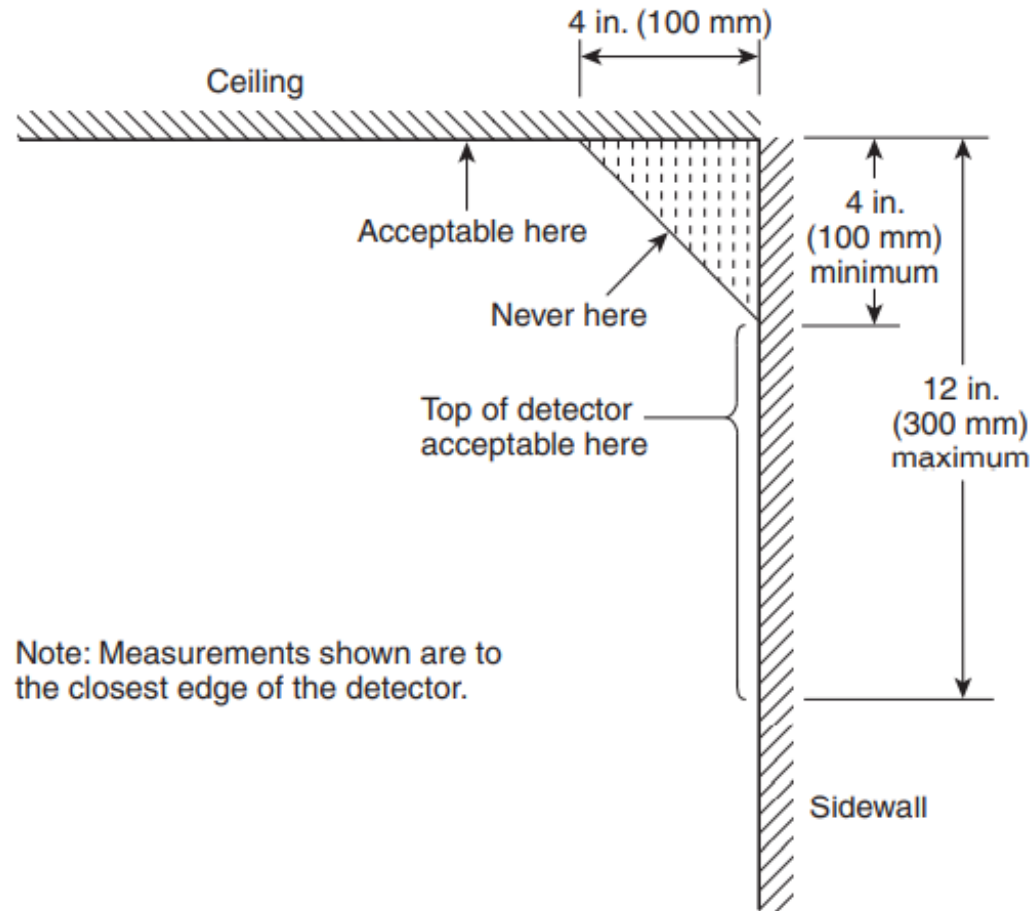
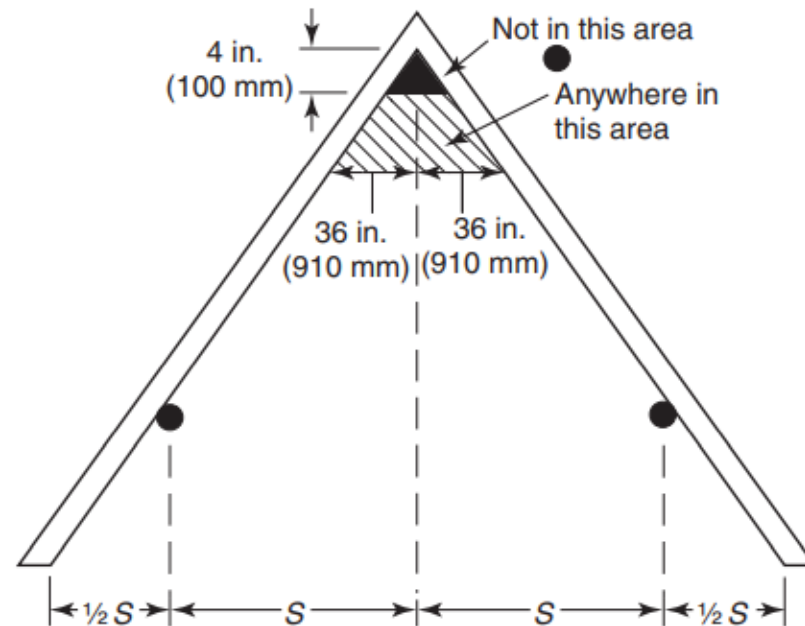


FIGURE A.17.6.3.1.3.1 Example of Proper Mounting for Heat Detectors.

Installation Details of Detectors



S = Space between detectors
● = Smoke detector or heat detector

FIGURE A.17.6.3.4(a) Smoke or Heat Detector Spacing Layout, Sloped Ceilings (Peaked Type).

Installation Details of Detectors

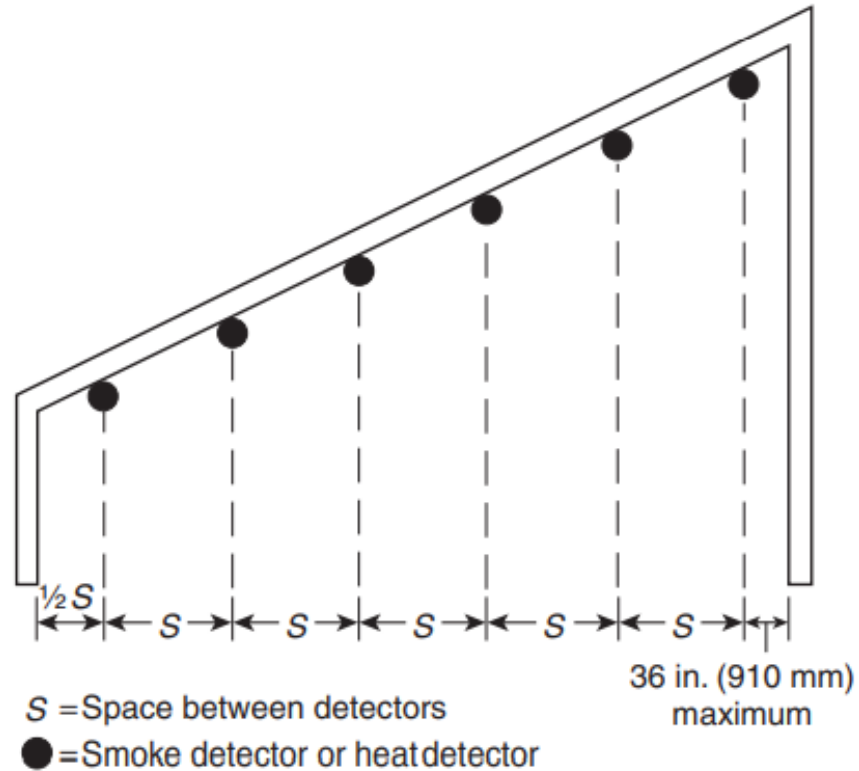


FIGURE A.17.6.3.4(b) Smoke or Heat Detector Spacing Layout, Sloped Ceilings (Shed Type).

Installation of **AUDIBLE NOTIFICATION APPLIANCES**

Public Mode Audible Requirement



Alert general public of a space or area

- A sound level at least **15dB above the average ambient sound level or 5 dB above the maximum sound level** having a duration of at least **60 seconds**, whichever is greater, measured 5 ft (1.5 m) above the floor in the area required to be served by the system using the A-weighted scale (dBA).



Private Mode Audible Requirement

Instances where general occupant notification is not desirable

- A sound level at least **10dB above the average ambient sound level or 5 dB above the maximum** sound level having a duration of at least 60 seconds, whichever is greater, measured 5 ft (1.5 m) above the floor in the area required to be served by the system using the A-weighted scale (dBA).

Sleeping area Required minimum 75dBA.

NFPA 72 audible signal requirements for awaking sleeping persons.

- 5 dB above maximum ambient sound for 60 seconds or more
- 15 dB above average ambient sound level
- Minimum 75 dBA

Required at pillow

Inspection and Testing of Detectors

Visual inspection (semiannually)

Test frequency (annually)

Test Method



Fire Alarm System- **Inspection**

14.3 - Inspections

- Inspections are permitted to be scheduled around scheduled shut downs if approved by the AHJ
- Intervals may be extended up to 18 months

Fire Alarm System- **Inspection**

Inspections

- The visual inspection shall ensure that there are no changes that affect equipment performance
- Inspection should take a “common sense” approach

Fire Alarm System- **Testing**

- 14.4.4.3 - Smoke detector sensitivity testing
- Within 1 year after installation
- Then check every other year; except...
- After the second test if the detector is within its listed sensitivity range the frequency can be extended to 5 years



Fire Alarm System- **Testing**

• 14.4.4.3 - Smoke detector sensitivity testing

Smoke detector sensitivity testing methods

- ✓ Calibrated test method
- ✓ Manufacturer's calibrated sensitivity test equipment
- ✓ Listed control equipment that can perform sensitivity testing
- ✓ Listed control equipment that warn of a detector outside of its listed range



TAHANK YOU

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- ▶ CERTIFIED FIRE PROTECTION SPECIALIST(CFPS®)