BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Course NO: EEE 414

Course Title: Electric Service Design Laboratory

Section: G2

Group-02

Assignment on Fire Detection and Alarm System Design

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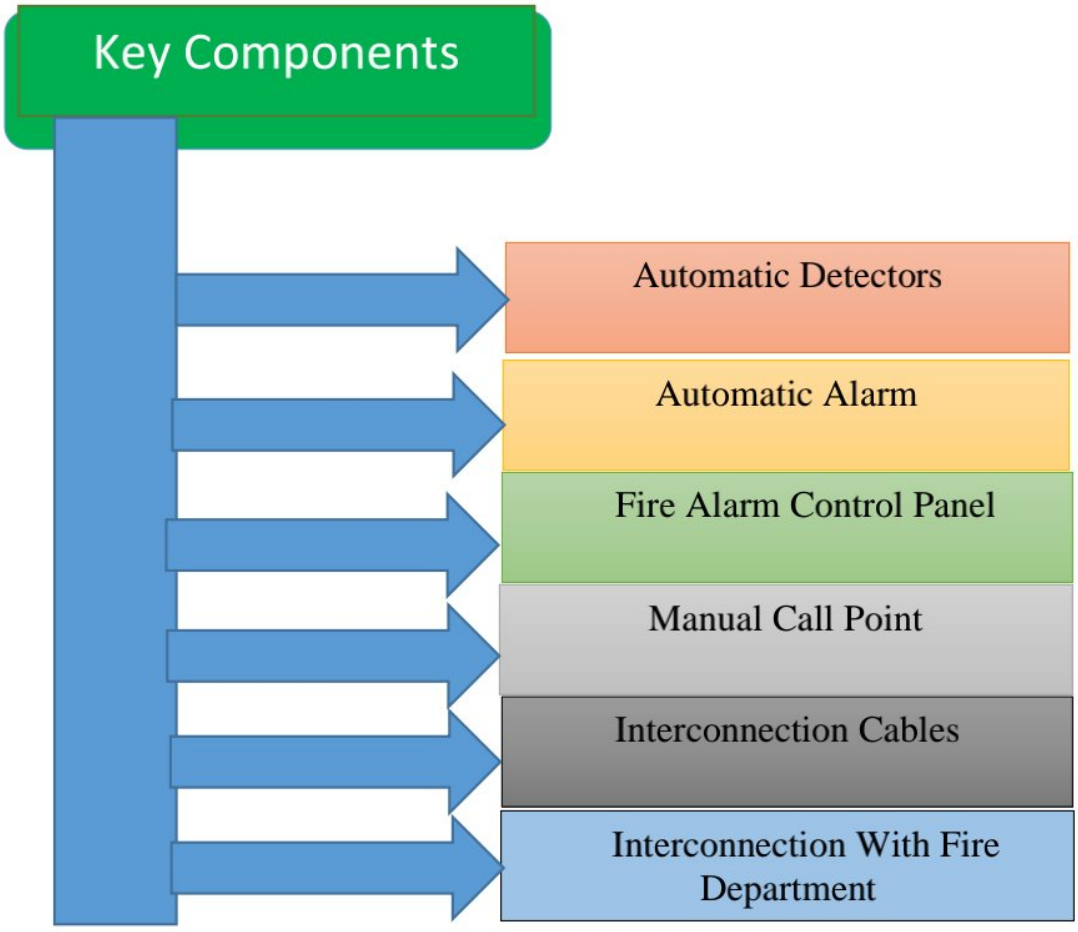
Introduction

Fire detection and alarm systems are essential tools used to protect people, property, and assets from the devastating effects of fire. These systems consist of a combination of devices and equipment designed to detect the presence of fire and alert occupants of a building, as well as emergency response personnel, to the potential danger. Fire detection and alarm systems are constantly evolving to include new technologies that enhance their effectiveness and reliability, and their proper design, installation, and maintenance are crucial in ensuring their optimal performance.

Key Component

To design, firstly we have to know about key components :



Design Steps

Here are the general steps for designing a fire detection and alarm system:

1. Identify potential fire hazards:

There are several probable sources of fire in a store room, including: Electrical equipment: Electrical equipment, such as power tools, extension cords, and lighting fixtures, can overheat or malfunction, causing a fire.

i) Flammable materials: Store rooms often contain flammable materials, such as cleaning supplies, solvents, and paint. These materials can ignite if they come into contact with a spark or flame.
ii) Combustible materials: Combustible materials, such as paper products, cardboard boxes, and wooden pallets, can also ignite if exposed to a spark or flame.
iii)Smoking: If smoking is allowed in or around the store room, cigarettes or other smoking materials can ignite flammable or combustible materials.

2. Determine the type of detectors:

There are different types of detectors :

i) Smoke detector

Fig : Smoke detector

Smoke detectors are an essential component of fire safety systems, as they can detect smoke and alert occupants of a building to a potential fire. This early warning can provide valuable time for people to evacuate the building and for emergency response to arrive on the scene. It is recommended to install smoke detectors on every level of a building, in each sleeping area, and outside of each sleeping area. So, we will use a smoke detector in this store room.

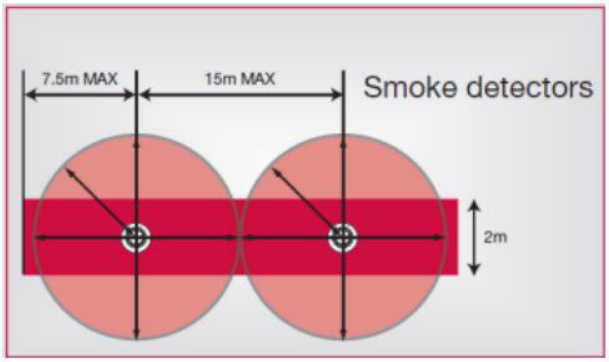


Fig : Coverage area of smoke detector

As one smoke detector will cover 15 m diameter. That means for 10*6 gorcery store room will need only one smoke detector

ii) Heat detector

Fig : Heat detector

Heat detectors are an important component of fire safety systems, as they can detect fires that may not produce smoke, such as electrical fires or fires in areas with poor ventilation. However, they are not a substitute for smoke detectors, as smoke detectors can detect fires at an earlier stage and provide a more immediate warning to occupants. So, we will use heat detector too.

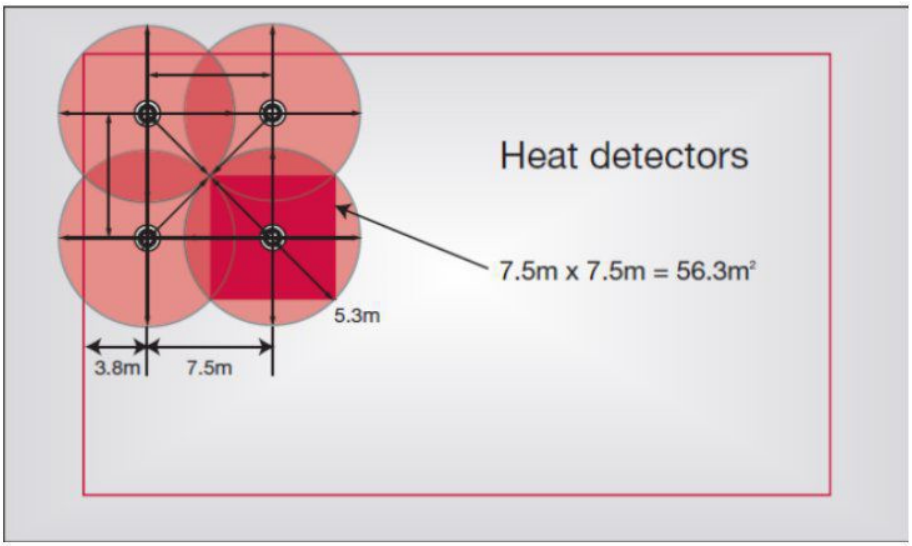


Fig : Heat detector coverage area

As from the picture it can seen one heat detector covers 7.5*7.5 sqm area. So for 10*6 grocery store room we would need 2 heat detectors.

iii) flame detectors

Fig : Flame detector

A flame detector is a device that detects the presence of flames or fires by sensing ultraviolet (UV), infrared (IR), or visible light emissions. Flame detectors are used in a variety of applications, including industrial processes, transportation systems, and buildings, to provide early warning of fires and prevent potential disasters

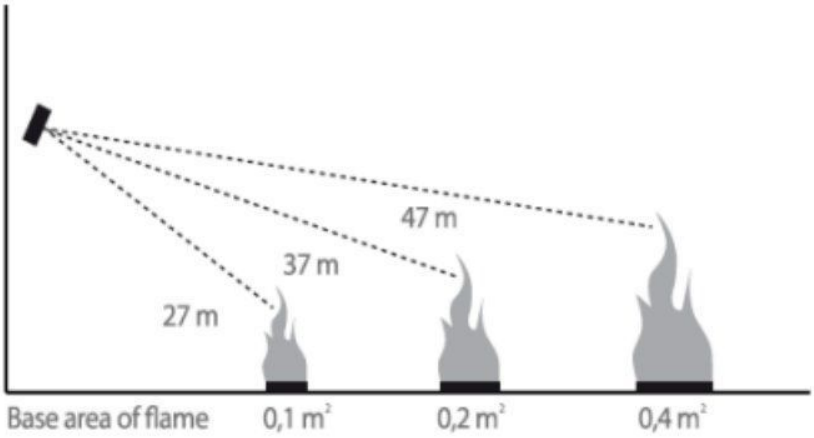


Fig : Coverage of flame detector

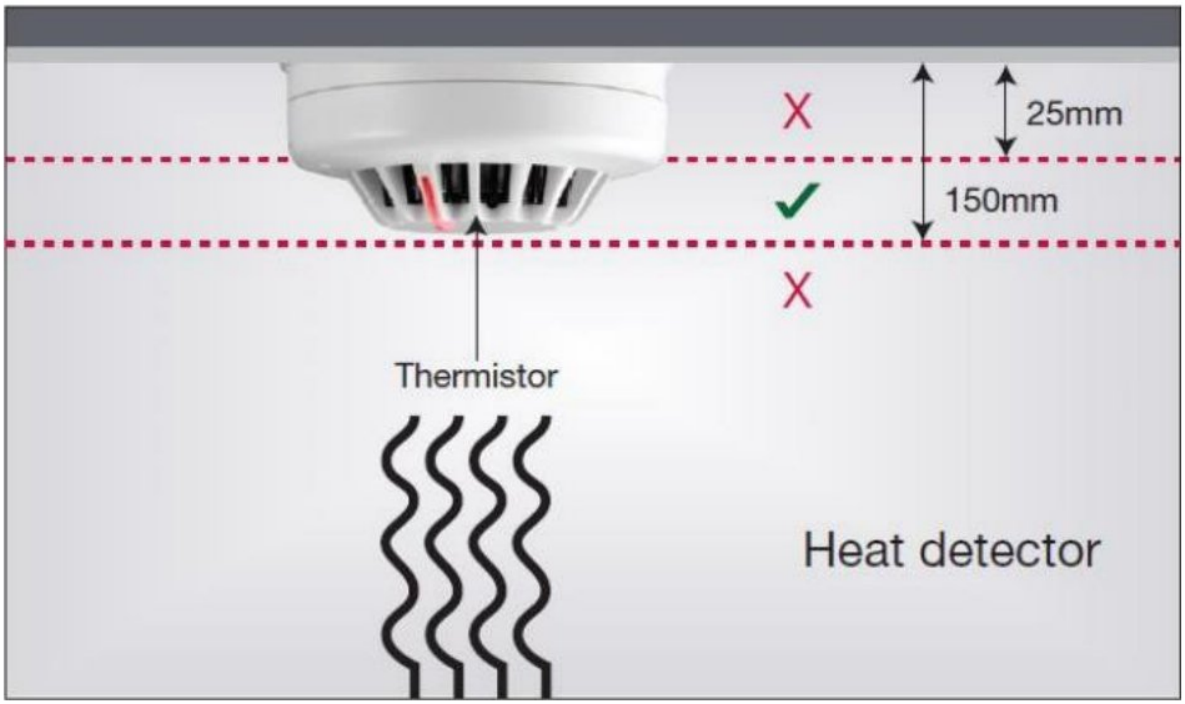
Assuming 0.1 sq.m base area of flame for 10*6 sq.m grocery store room we would need one flame detector.

3. Determine the location of detectors: The location of detectors is critical in ensuring that the system can detect a fire quickly and effectively. Detectors should be placed in areas where a fire is most likely to occur, such as near electrical panels and in areas where flammable materials are stored.

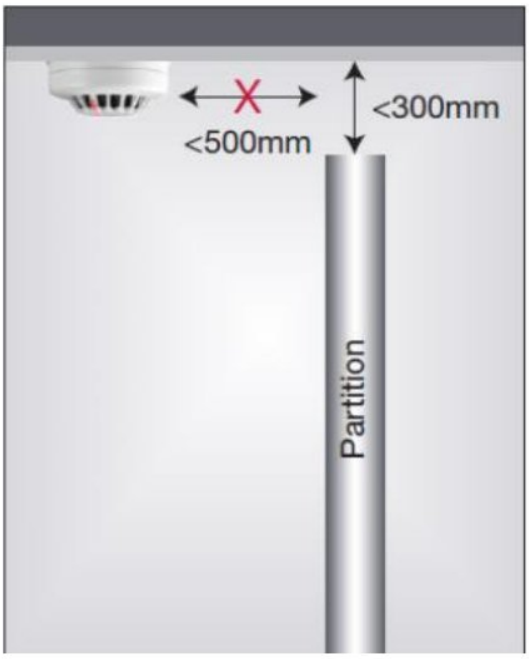
There should have some certain clearance between the detectors & ceiling, object, beam etc.

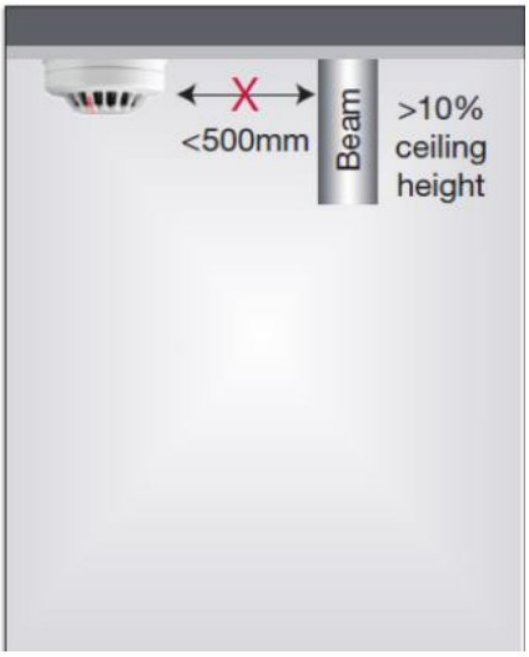
These things are shown below :

It indicates that the optical chamber of smoke detector should have a clearance of 25-600 mm from ceiling.

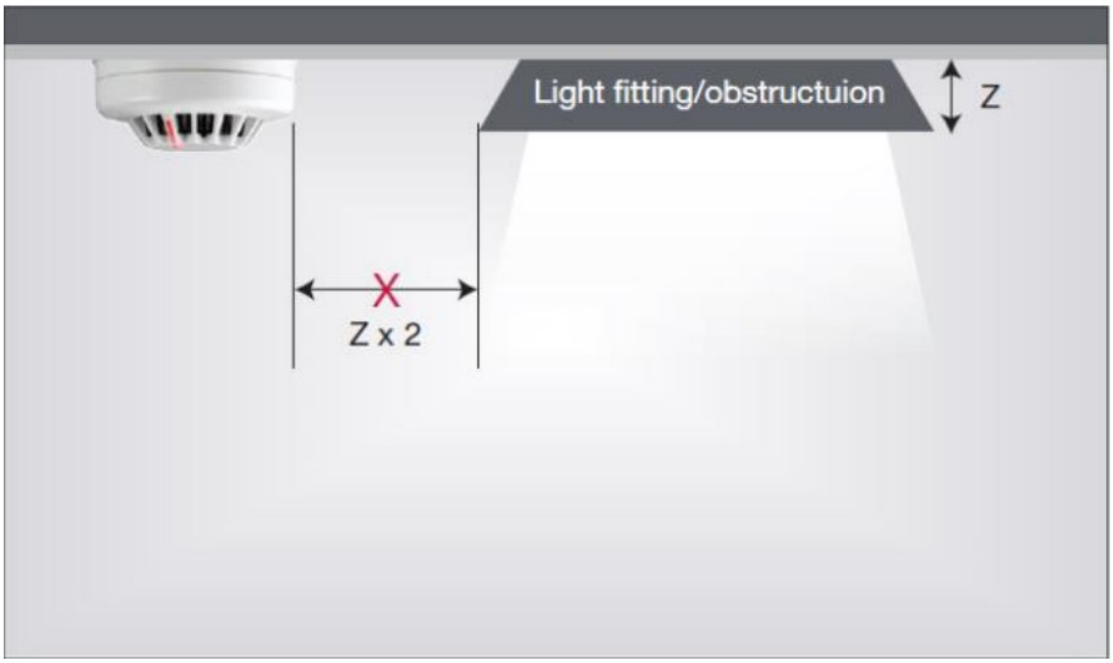


It indicates that the thermistor of heat detector should have a clearance of 25-150 mm from ceiling.





It indicates that the detector should have a clearance of greater than 500 mm from partition..



Similiarly, detector should have enough clearance from fittings like light, fan etc.

4. Determine the alarm system: A fire alarm system component such as a bell, horn, speaker, light or text display

that provides audible, tactile, or visible outputs, or any combination thereof. Typically, they may be categorized into three different types: (a) audible alarms (sounders), (b) visible alarm (strobes/beacons) and (c) voice speaker.

For a store room, we do not need any strobe , beacon & voice speaker . We only need an audible alarm.

Sounders

Sounder 's Typical sound level is 65 dB(A) and +5dB(A) above the maximum background sound level. It 's maximum sound level allowed is 120 dB(A). There are many types include bells, horns, chimes, sirens and electronic sounders. Also, pre-recorded voice message. Throughout the building, same sounder for fire alarm.

Types of sounders :

• Bells: Most common type and appropriate for most buildings.
• Horns: well suited to areas where a loud signal is needed.
• Chimes: where a soft alarm tone is preferred.
• Electronic: solid state sounders with mono or Multi-tone output normally in the range of 800 to 1000 Hz.
• Sirens: operating in the range of 1,200 to 1,700 Hz.
• Output level normally quoted by dB(A) at 1m.
• Location and number of sounders depend on the loss through barriers such as doors and decay of sound output with distance

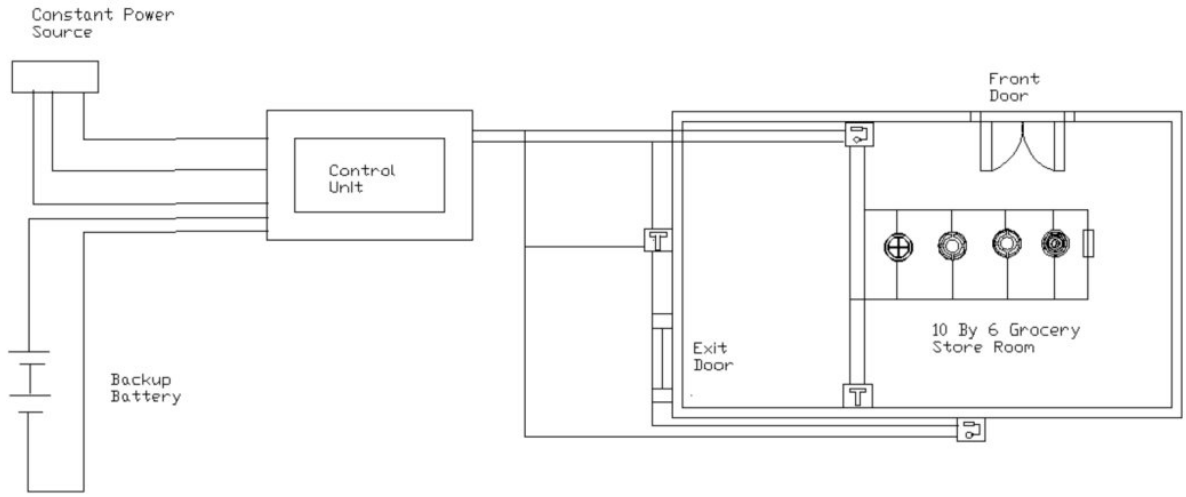
Here we will use 1 electronic sounder which will be controlled by detector or can be controlled manually by manual call point.

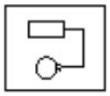
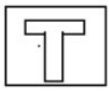
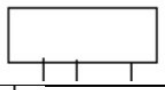
Fig : A call point & it's clearance from ground

Fig : Electronic bell

5.Design the control panel: The control panel is the central component of the fire detection and alarm system and is used to monitor the system, receive signals from detectors, and activate alarms and notification devices.

The Design:


Constant Power
Source
Control
Unit
Backup
Battery
Front
Door
Exit
Door
10 By 6 Grocery
Store Room

Symbol	Meaning
	Electronic Bell
	Call Point
	Heat Detector
	Smoke Detector
	Flame Detector
	Power Supply
	Resistor
	Backup Battery

Conclusion

In conclusion, fire detection and alarm systems play a critical role in protecting lives and property from fire damage. They are designed to detect the presence of fire or smoke, and alert people to evacuate the premises quickly and safely. The early warning provided by fire alarms can help minimize property damage and prevent injuries or fatalities.

There are various types of fire detection and alarm systems available in the market, ranging from conventional to addressable systems, which can be customized to meet the specific needs of different types of buildings and facilities. It is important to install and maintain fire detection and alarm systems in compliance with national and local regulations and standards to ensure their effectiveness.

While fire detection and alarm systems cannot prevent fires from occurring, they provide a reliable means of detecting fires early and triggering an appropriate response, which is essential to minimize damage and ensure the safety of occupants. Therefore, investing in a high-quality fire detection and alarm system is a crucial step in fire safety and should be considered a priority for all types of buildings and facilities.