

A Study on Fire Safety Systems in Commercial Buildings

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Abstract - Fire accidents in commercial buildings are a threatening one now a day. These accidents create heavy losses to lives and property. Therefore a proper attention must be paid to minimize fire loss. This project is a study of fire safety systems in commercial buildings (typically textile shops), the type of equipment and tools, also this study involves the cost estimation for implementation and maintenance of fire safety systems for a textile shop.

Key Words: fire accident, heavy loss, fire safety systems, cost estimation.

1. INTRODUCTION

Fire is the rapid oxidation of a material. It is an exothermic process which releases heat, light, and various reaction products. Fire helps in a lot of useful purposes for us but when it goes out of our control, it creates lot of destruction to life. Oxygen, heat fuel or combustible material and the chemical reaction are required at the same time to produce the fire. By removing any one of the elements in the fire triangle fire can be prevented or extinguished.

1.1 CLASSES OF FIRE

Class A	Ordinary combustibles
Class B	Flammable liquids
Class C	Gas fire
Class D	Combustible metals
Class E	Electrical equipments

1.2 FIRE HAZARDS

Fire safety of buildings should be considered from three aspects and protection should accordingly be provided against the following three types of fire hazards.

- Possibility of loss or damage to life, referred to as personal hazard.
- Possibility of fire occurring and spreading inside the building itself, referred to as internal hazard.
- Possibility of fire spreading from an adjoining building or buildings or from across a street or road, referred to as exposure hazard.

2. METHODOLOGY



3. FIRE SAFETY PROVISIONS

Fire safety measures are used to prevent the ignition of an uncontrolled fire after it starts. The two types of fire safety provisions are as follows

- Passive provisions
- Active provisions

3.1 PASSIVE PROVISIONS

Passive means it is building plan and design oriented. Any deficiency in the planning and the design will affect the architecture and construction value of the building during fire. It doesn't require any energy activation. If the type of construction and the use of construction materials are proper, the building itself or by virtue of its design with construction materials will react with the fire in such a way that it will not allow to spreading of fire and its other

products of heat, smoke toxic substances and fumes from the origination point to adjacent room or other floors or to the adjacent buildings.

nature of contents of building, the processes carried out therein and the types of fire which may occur shall taken into consideration while selecting the extinguishers.

3.1.1 OBJECTIVES OF PASSIVE PROVISIONS

- Accessibility and reach ability
- To give insulation effects against the fire, heat penetration
- To provide sufficient number of means of exits
- To enhance the integrity and stability of the building
- To provide protected means of escape
- To maximize time of safety, actual time required for evacuation

CLASS OF FIRE	TYPE OF EXTINGUISHER
Class A fires	Water extinguishers
Class B fires	Foam extinguishers
Class C fires	Co2 extinguishers
Class D fires	Special dry powder extinguishers
Class E fires	Co2 and ABC dry powder extinguishers

3.1.2 COMPONENTS OF PASSIVE PROVISIONS

- Building access
- Building material selection and construction
- Building design
- Building construction fire rating
- Building maintenance

3.2 ACTIVE PROVISIONS

The external components that are attached to the building, activated by external sources of energy at the time of fire in the building are called the active provisions.

3.2.1 OBJECTIVES OF ACTIVE PROVISIONS

- To provide immediate detection and give alarm of fire on its occurrence
- To provide immediate suppression effect on fire either automatically or manually on its notice
- To prevent the fire spread as well as to extinguish the fire at the incipient stage
- To reduce the destruction and loss due to fire
- To minimize time to hazard time required for reaching the maximum level of fire hazard

3.2.2 COMPONENTS OF ACTIVE PROVISIONS

The components of active fire safety provisions are as follows

- First aid extinguishers
- Fire hydrant system
- Wet riser system
- Automatic fire detection and fire alarm systems
- Sprinkler systems

4. ACTIVE PROVISIONS

4.1 EXTINGUISHERS

Various types of fire extinguishers are available but all are not equally effective on all types of fire. For this reason , the



Fig 1 Types of Extinguishers

Normally, extinguishers should be provided for every 625sq.ft. It can be mounted to the wall at a maximum height of 5ft. There are two main types of fire extinguishers: stored-pressure and cartridge-operated.

AVAILABLE SIZES AND REFILLING OF EXTINGUISHERS

TYPE	SIZE	VALIDITY
WATER	9 lit	1 year
	50 lit	
FOAM	9 lit	1 year
	50 lit	
DRY POWDER	500 g	3 years
	1 kg	
	2 kg	
	4 kg	
	6 kg	
	25 kg	
CO₂	2 kg	1 year
	4.5 kg	
	9 kg	
	25 kg	

4.2 FIRE ALARMS AND DETECTORS

This system consists of detector, ½ mile siren, manual call point, panel (4 zoom) with 12V battery. These alarms may be activated automatically from smoke detectors and heat detectors or may also be activated via manual fire alarm activation devices such as manual call points or pull stations. The fire detectors are of two types namely, heat detectors and smoke detectors. In case of heat detectors the sensing element is not less than 25mm and not more than 150 mm below the ceiling level and for smoke detectors, the sensing element should not be less than 25 mm and not more than 600 mm below the ceiling/ roof level.

HEAT DETECTORS

Heat detectors are the oldest type of automatic fire detection device. Heat detectors will detect the heat when the temperature of the surrounding reaches a fixed predetermined temperature.



Fig 2 Heat detectors

SMOKE ALARMS

Smoke alarms detect fires more rapidly than the heat detectors. The three types of smoke alarms are ionization, photoelectric and combination of both ionization and photoelectric. An ionization smoke alarm contains a small amount of radioactive material. When the smoke interrupts the current between the electrodes, sets off the alarm.

Photoelectric smoke alarms operate using a light source. When smoke crosses the path of the light beam, some light is scattered by the smoke particles, directing it at the sensor and thus activating the alarm.



Fig 3 Smoke alarms

4.3 FIRE HYDRANTS AND HOSE REELS SYSTEM

It is a component of active fire protection. These fire hydrants are provided on a ring main of 150mm dia. in the ground around the building periphery. The ring main gets water from underground tank with pressure so that available pressure at each hydrant is of order of about 3.5 to 4 kg/cm². This system consists of a hydrant valve (single or double), branch pipe, hose of lengths either 15m or 30m and a hose box (single door or double door).

5. COST ESTIMATION FOR INSTALLING FIRE SAFETY SYSTEM IN A TEXTILE SHOP

I have estimated the cost for installation of fire safety systems in a textile shop of 3500 sq.ft. with G+2 floors. In case of textile shop it requires a powder type extinguishers of 9 litres for every 625 sq.ft. and a hose reel drum at each floor. Based on its requirements the cost for installation was estimated to be Rs.34,500 which was 5.75% of its asset value.

6. CONCLUSION

- This project deals with the study of fire safety systems and its components.
- The fire safety system helps to detect and control the fire at its initial stage and thereby preventing the losses due to fire.
- Therefore by adopting these fire safety systems in buildings we can avoid the fire accidents and the losses caused due to it.

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