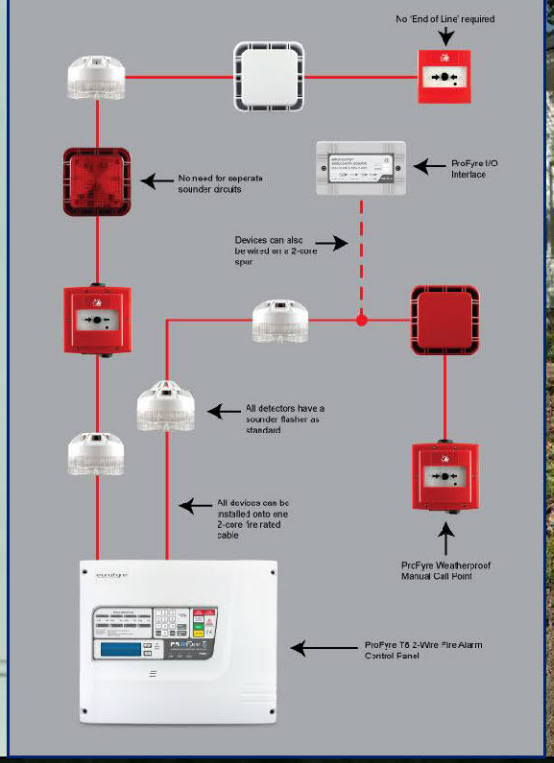

FIRE SAFETY INFRASTRUCTURE IN HOSPITALS

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HOSPITAL FIRE SAFETY INFRASTRUCTURE

Historical Overview

Fire has been a part of mankind's existence and survival.

Centuries of experience in handling fire incidents has enabled us, the Humans to evolve strategies on

"How to prevent and provide safe conditions with fire"

Each major fire, in the past, has taught us important lessons for fire safety. Most important, the Fire Safety Codes came into being and were enforced by common law in most of the countries.

Cleveland Clinic Hospital Fire in 1929, considered deadliest Hospital fire (129 dead) resulted in use of Safety Film for X-rays.

St. Anthony Hospital (USA) Fire in 1949 lead to provision of Fire barriers, smoke barriers, and fire resistant stairway in Hospitals.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Historical Overview

Hospital buildings are categorised as institutional buildings and have greater responsibility for safety of patients as well as staff, that it holds.

Hospital buildings have been facing the fire and life safety challenges ever since these came into being.

Deployment of modern Healthcare technologies like MGPS systems, increases these fire and life safety challenges.

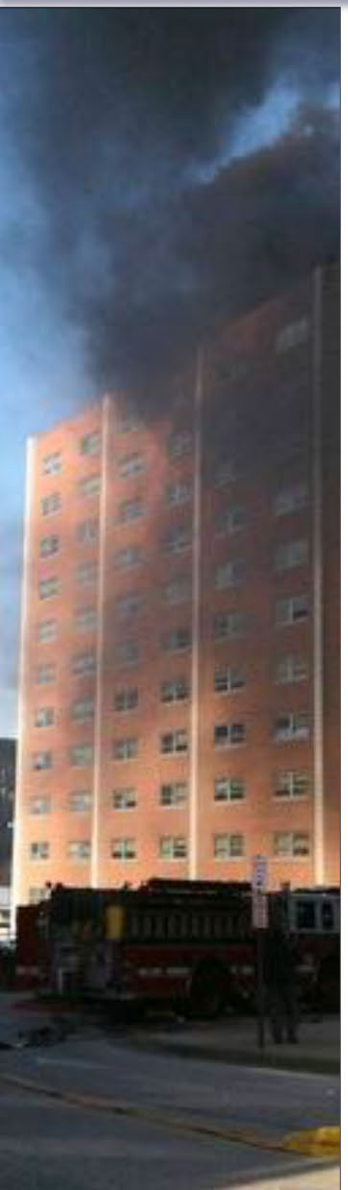
Hospital building design has been evolving to meet these challenges.

Also, in response to specific incidences of Fire, Fire Codes have been developed in most countries for Hospitals and Healthcare buildings.

These fire and life safety codes are also evolving.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Historical Overview



The basic principle for all fire safety regulations, in the event of fire is

"MOVE THE BUILDING OCCUPANTS TO A SAFE PLACE QUICKLY".

Second principle is to make the building fire safe, which means using such material that retard the spread of fire, thereby provides adequate time for the evacuation as envisaged in the basic principle.

Third principle is to provide adequate fire fighting capability to minimise the damage. Add to this, the fire detection capability of the system, so that fires can be detected early.

Last principle is to protect the man and material from effects of fire.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Historical Overview

In a NHS study, it was determined that 53% of all Hospital Fires are either

Predictable

or

Preventable

All Building Codes in all countries provide minimum standards for Safety, Health, and General Welfare including Structural Integrity, Mechanical Integrity (including sanitation, water supply, light, and ventilation), Means of Egress, Fire Prevention and Control, and Energy Conservation.

All Fire Codes require that Hospital buildings are adequately protected, exits are accessible & are properly sized, fire extinguishing systems & alarm systems are functioning properly.

All Fire Regulations, aim to reduce the loss of life and property by fire but when applied to Hospitals, they are more strict for Life safety so these are now known as **Fire & Life Safety Codes**.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Historical Overview

Historically, since the time of Roman emperor Augustusthe in 24 BC till early modern time of 1800, the fire-fighting was based on voluntary Fire Fighters who used buckets, passed from hand to hand to deliver water to the fire.

With the introduction of electricity into buildings in the late 1800's, fire events began to become more frequent.

In response, in 1812, textile mills in England, deployed Sprinkler systems to fight these frequent fires.

In 1872, the Sprinkler systems were upgraded to be automatic systems – detect fire and release water automatically.

In 1874, automatic sprinkler heads were provided.

In 1890, Grinnell designed a glass disk sprinkler head for his new automatic sprinkler system and deployed it. **These glass disk sprinkler heads are still in use in modern day installations.**

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Historical Overview

All Fire and Life safety codes have to be coordinated with hundreds of other building codes such as National Building Code, National Electrical Code to be fully effective

In March, 1895, a small group, representing sprinkler and fire insurance interests, got together to standardise the structure and deployment of the automatic sprinkler system.

This was the birth of National Fire Protection Association (NFPA) in USA which put together the **General Principles Governing Fire Protection.** Later, they published **NFPA 101, Life Safety Code**, which provides requirements for egress, fire protection, sprinkler systems, alarms, emergency lighting, smoke barriers, and special hazard protection.

It is the most popular Fire & Life Safety Standard of the world.

Then there are **ISO 13387- Fire Safety Engineering, HTM 05 – Healthcare Fire Safety in UK** and a number of other standards and codes for different aspects of Building construction, material, lighting, egress requirement, signage, etc.

Smoke inhalation is main cause of death

in victims of indoor fires

PHYSICAL FIRE SAFETY IN HOSPITALS

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Hospital Fires

The last major Hospital Fire in India was in AMRI, Kolkata when more than 90 persons lost their life.

In USA, fire departments respond to an estimated average of 6,240 structural fires in or on healthcare properties per year but total number of fatal causalities have not exceeded 5-6 per year. (Averaged for last 10 years)

In these incidents, 88% locations are fully NFPA compliant including installation of automatic sprinkler systems. Here, in 98% incidents, the sprinkler system operated and controlled the fire with minimal loss.

Cooking equipment is the reason for 61% of these fires, Laundry for another 10%. Smoking and Heating Equipment is responsible for 6% each of these fires. Electrical Installation malfunction is responsible for 4% of these fires.

It is noted that only 6% of these fires originate in Patient Rooms whereas 16% originate in Doctor's Offices.

….. NFPA report 2013

HOSPITAL FIRE SAFETY INFRASTRUCTURE

The Infrastructure

By Law, it is the Chief Fire Officer (CFO) of the City, who has jurisdiction over the Fire and Life Safety Infrastructure of all the city Buildings including Healthcare Buildings and is obligated to provide all needed Fire Fighting and Rescue Services.

The designated Fire Safety Officer, in large Hospitals, is trained by CFO, and co-ordinates with him at all times, especially in the event of a fire.

The Fire Safety Infrastructure as provided in Healthcare Buildings must meet the statutory provisions of building by-laws & at the same time complement Fire Fighting Capacity of Local Fire Service.

Fire Evacuation Plan of the Hospital is always provided to the Local Fire Service to make it familiar with the Building & its safety infrastructure.

Wherever feasible, the Fire Alarm System of the Hospital is extended to duty room of the Local Fire Service.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

The Infrastructure

All Fire Safety professionals must exercise adequate professional judgment when preparing the fire safety plans

The Fire Safety Infrastructure of Healthcare Organisations especially the Hospitals, has always been focused on the safety of patients, visitors and staff.

This requires implementation of a combination of following code compliant measures to achieve an acceptable level of Fire Safety along with a Fire Management Policy to minimise the fire incidences, keep the infrastructure in ready state and to ensure adequate response in case of a fire.

1. Fire Safe Design and Building Engineering
2. Fire Risk Assessment and Emergency Action Plan
3. Staff Training and Preparedness for Fire Fighting
4. Fire Alarm and Response System
5. Evacuation and Fire Fighting Systems

HOSPITAL FIRE SAFETY INFRASTRUCTURE

The Infrastructure

By convention And common logic the Insurance premium is reduced for buildings which provide these 5 provisions thus off setting the cost of the provisions

There are two main legislations in India, that impose statutory fire safety duties on all buildings including Hospitals and Healthcare Buildings.

First is the National Building Code-Part 4.

It focuses on the following 5 provisions as minimum functional fire safety requirements in a new building or an upgraded building.

1. Design Provision for generating early warning of a fire and provision of escape route to a place of safety for the occupants.
2. Design Provisions to prevent rapid spread of fire in the building and provision of fire fighting capabilities
3. Design Provisions to maintain stability of building structure for a reasonable period with fire-resisting construction
4. Provisions to prevent spread of fire between adjacent buildings
5. Provisions to provide access and facilities for the fire service

HOSPITAL FIRE SAFETY INFRASTRUCTURE

The Infrastructure

Responsibility for complying with the NBC provisions is with the Architects and for complying with the Local Fire Service By laws, it is on the Hospital's Fire Safety Officer

Second is the Local Fire Service By Laws (& Fire Safety Regulations).

While the Building Regulations focus on the physical facility, Fire Service By-laws focus on Fire Safety Management practices to ensure continued functioning of the provisions throughout the life of the building.

Fire Service By-laws require appointment of a Fire Safety Officer who is responsible for the planning, organisation, control, monitoring and review of all the preventative and protective arrangements.

The Fire Safety Officer must make an assessment of fire risk including the liability of use of any dangerous substance.

Then he or she must prepare & implement a Hospital Fire Safety policy which must state roles and responsibilities; for staff in the Hospital.

This policy shall provide for Fire Safety Training, conduct of Fire mock drills and co-ordination with Local Fire Service.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

The Infrastructure

The performance of key parameters of the fire safety system should be periodically audited

The Fire Safety Policy of the Hospital must

1. Reduce the risk of occurrence of fire and its spread on the premises
2. Eliminate or reduce risks resulting from use of dangerous substances on the premises
3. Provide means for detecting the fire, raising the alarm and communication with the external fire and emergency services
4. Provide appropriate fire-fighting equipment
5. Identify and notify escape routes and exits with proper signage
6. Provide fire safety training to staff
7. Maintain the fire safety services, equipment and devices
8. Disseminate adequate information to all occupants of building
9. Maintain the provisions deemed necessary for safety of fire-fighters

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safe Design and Building Engineering

IMPORTANT

In high rise buildings, use of lifts for evacuation under certain emergency conditions may be allowed by the Fire Warden

In India, National Building Code – Part 4, provides guidelines for minimum requirements for Fire & Life Safety in Building Engineering. It categorises Hospitals and allied Healthcare Buildings into Group C-1. (All buildings higher than 15 Meters are categorised as High Rise Buildings and require additional safety measure which are listed)

Important points are brought out hereunder

Occupant Load permitted is 15 M^2 Floor Area per person (USA 22.5 M^2)

OPEN SPACES :

- Entry Gate: **4.5 M minimum** (6 M preferred) **x 5 M High**
- Width of the Road abutting the plot: **12 M**
- Width of the motor able road around the Building: **6 M**
- Turning Radius for the Fire Truck: **9 M**
- Weight of the Fire Truck: **45 Tonnes**

Fire Safe Design and Building Engineering

IMPORTANT

When any building is used for more than one type of occupancy,

fire safety shall conform to the requirements of higher hazard

EXIT REQUIREMENTS - Healthcare Buildings

Minimum Number of Exits on every Floor: **2**

Unit Exit Width: **500 mm**

Minimum Size of Exit, Fire Doors, Patient Room Doors: **2 M,**

No. of Occupants per Unit Exit Width: **75 Door, 50 Ramp. 25 Stairway**

Travel Distance: **30 M –Type 1&2 & 22.5 M –Type 3&4 construction**

Increase by 50% for sprinkler protected building

Evacuation Time: **2.5 minutes for Type-1, 1 1/2 minutes for Type-2 and 1 minute for Type-3 construction**

Minimum clear width of Primary Exit Corridor: **2400 mm**

In case of Fire, all exit doors shall be in open position and all swing doors shall open into the path of exit.

The height of corridors and passageways shall not be less than 2.4 m

Fire Safe Design and Building Engineering

Compartmentation using construction to contain fire risks allows patients in Hospitals to remain in place during fire emergencies.

COMPARTMENTATION - Healthcare Buildings

Compartmentation leads to effective confinement and control of fire & smoke, to the area where fire incident has occurred and prevents the fire spreading to adjacent areas.

Such compartments are designated as Fire compartments, which, in turn can have rooms, etc. Each Fire compartment should have its own AHU or smoke venting duct, fresh air supply duct, etc.

Any area exceeding 500 M^2, (750 M^2, when sprinklers are provided) in a Hospital, shall be divided into compartments, by fire resistant walls of 2 Hour fire rating.

The fire separation walls shall be at distances not exceeding 40 M.

Where Compartmentation is not possible, the spacing of the sprinklers shall be suitably reduced.

Fire Safe Design and Building Engineering

The staircase shall terminate at ground floor in a ventilated lobby and the basement shall be accessed by a separate staircase.

STAIRWAYS REQUIREMENTS - Healthcare Buildings

Minimum clear width of any Staircase: **2000 mm**

Minimum width of tread without nosing: **300 mm**

Maximum height of riser: **150 mm**

Maximum number of risers per flight: **15**

Height of Handrail **1000 mm** (As measured from the center of the tread)

Minimum Headroom under the Staircase and its landing: **2200 mm**

Lifts shall not open in the stairways.

All exit way marking signs should be flush with the wall.

No Electrical Shaft, AC ducts, Gas pipelines shall open in the stairways or pass through it.

The floor indication board, size 500 x 500 mm, shall be placed on the wall immediately facing the flight of stairs and nearest to the landing.

Fire Safe Design and Building Engineering

IMPORTANT

Always evacuate the handicapped persons to safe areas like refuge areas and subsequently to final exit ways

REFUGE AREA REQUIREMENTS - Healthcare Buildings

In high rise Hospital buildings, which are 24 M or more, in height, where total evacuation of occupants is not contemplated in one go, refuge areas are provided, after every 15 M height, on the periphery of the floor or preferably on a cantilever projection.

These are open to air. at least on one side and are protected with suitable railings.

Size of the refuge area is 15 M^2 or an area equivalent to 0.3 M^2 per person to accommodate the occupants of two consecutive floors, whichever is higher.

Access to refuge areas shall always be either level horizontal exit or by providing a 1 in 10 slope ramp.

The doors to refuge areas shall be operable at all times from both sides.

Emergency Escape Lighting in Hospitals is provided to bridge the period between mains failure and start of generator supply.

EMERGENCY ESCAPE LIGHTING - Healthcare Buildings

Emergency Escape Lighting is a primary life safety system which assists evacuation of building occupants in emergency by clearly indicating the escape routes & illuminating the exit signs.

It is intended to perform the following.

- To indicate clearly and unambiguously the escape routes
- To provide illumination along such routes to allow safe movement towards and through the exits provided
- To ensure that fire alarm call points and fire fighting equipment provided along escape routes can be readily located
- To permit operations concerned with safety measures

Required duration of the Escape Lighting is 90 (preferred 180) minutes.

Illuminance required along the centre line of escape route is 1 Lux.

Fire Safe Design and Building Engineering

The exit sign should be placed at points of emphasis within 2 M of the actual exit at a height of 2 – 2.5 M from floor.

EMERGENCY ESCAPE LIGHTING - Healthcare Buildings

Essential Locations for Emergency Escape Lighting

1. All entrances, public waiting areas, primary corridors, Wards & OTs
2. At all defined exits & outside the building to a place of safety
3. At each exit door intended to be used in an emergency
4. Near Stairways so that each flight of stairs receives direct light
5. Near any change of level on the escape route
6. At each change of direction on the escape route
7. At each intersection of corridors
8. Near each First Aid Post
9. Near Fire Call Point and each Fire Fighting Equipment

Optional Locations for Emergency Escape Lighting

1. At all offices & rooms seating more than 4 persons
2. At all windowless rooms
3. All Lift Cars (inside)
4. All large (more than 8 M^2) Toilets, Lobbies and Closets and all small Toilets, Lobbies, Closets without borrowed (reflected) light
5. All control rooms, switch rooms, plant rooms and generator rooms

Fire Safe Design and Building Engineering

Proper Fire Resistance Rating helps in preventing the rapid spread of fire, smoke & fumes, which may otherwise contribute to the loss of lives and property

FIRE RESISTANCE RATING - Healthcare Buildings

Fire Resistance Rating (FRR) is the length of time, expressed in hours, that a building structure or material can withstand complete combustion, during a standard fire test.

Most of the building codes specify these values for different materials along with the time and temperature curves.

The FRR is used to classify the construction into four categories,

Type - 1: Fire Resistive Construction, designed to hold fire for an extended amount of time. These are usually High rise or mid rise buildings and are most suitable for Hospitals.

Type - 2: Non-Combustible Construction, these are usually commercial buildings, NBC compliant, have metal roofs, are mid rise. These are also suitable for Hospitals.

Type - 3: Ordinary Construction, low rise, have non-combustible walls and a wooden roof, the interior building elements can be of any material, these form most of the buildings in cities.

Type - 4: Heavy Timber or wood frame Construction, these are generally the old, low rise buildings for residential use.

Fire Safe Design and Building Engineering

Fire Rating of smoke extraction duct serving the basements shall be equal to smoke evacuation time for that area as served by the duct

FIRE RESISTANCE RATING - Healthcare Buildings

The standard Fire Resistance Rating for Hospitals Construction are;

- Smoke Barriers for Compartmentation: **1 Hour**
- Stairway & Lift Shaft Enclosure: **2 Hours**
- Refuse Chute Enclosure: **2 Hours**
- Fire Doors for Wall openings & Stairways in Fire Zones: **2 Hours**
- Wall and Floor Penetrations Covers: **2 Hours**
- Filler Material: **1 Hour**
- Landing Doors in Lift Enclosures: **1 Hour**
- Fire inspection Panels & Doors in Electrical Shafts: **2 Hours**
- Louvers, wherever provided: **½ Hour**
- Glass in Façade: **1 Hour**
- Roof Assemblies (Preferred) : **1 Hour**

In fully sprinkler protected Hospitals, ability to limit transfer of smoke is more important than Fire Resistance Rating of corridor doors and walls.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safe Design and Building Engineering

FIRE CONTROL ROOM - Healthcare Buildings

For all high rise or large Hospital Buildings, there shall be a Control Room (16 to 20 M^2) on the entrance floor (Ground Floor) of the building, under control of the Hospital's Fire Safety Officer.

It shall be provided with main Fire Control and Alarm Panel, the Fire protection ancillary panels (for automatic sprinkler system or other fixed fire protection system etc.), communication system, a direct hot line to local fire brigade office, Public Address System and all floor plans.

It will have adequate secondary electrical power and UPS power for its equipment.

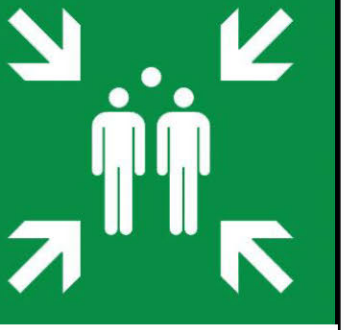
It can double up as the security control room of the Hospital and can also accommodate other building utility monitoring panels.

FIRE SAFETY SIGNAGE

FIRE SAFETY IN HOSPITALS

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Signage



By Law, the Employer is required to carry out a formal risk assessment to determine the need for **Fire Safety Signs** in the place of work.

In India, **"IS:12349-1988** Fire Protection-safety Signs" has been the Standard, whereas in Europe "**Health and Safety (Safety Signs and Signals) Regulations 1996"** has been the operative standard.

ISO 7010:2011, which prescribes safety signs for the purposes of accident prevention, fire protection, Health Hazard Information and emergency evacuation is the new operative standard, since 2012.

Signs provide an important means of communicating information relating to safety, in a universally understood language of graphics and symbols called Pictograms.

Fire Safety Signage

PROVISION OF EXIT SIGNS

Fire escape signs are provided to guide the building occupants from wherever they are in a building, via a place of relative safety (the escape route) to the place of ultimate safety (the assembly area).

It is the duty of the employers to provide safety signs, in circumstances where the risk to the health and safety of employees, identified through the risk assessment exists in the workplace.

There is no need for providing safety signs when there is no significant risks to the health and safety of employees.

Fire escape signs are not needed on the main route into or out of a building but all alternative escape routes and complicated escape routes need to be signed.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Signage

Prohibition Signs

Warning Signs

STANDARDISATION:

Safety signs are divided into categories according to the type of message they are intended to convey.

Each category is assigned a specific format and set of colours.

Prohibition Signs

Signs prohibiting an activity consist of a circular red band and single diagonal cross bar descending from left to right at an angle of 45 degrees. The background should be white with the pictogram indicating the nature of the command in black.

Warning Signs

Signs warning of a particular hazard consist of a black band in the shape of an equilateral triangle. The background within the band should be yellow with the pictogram indicating the type of hazard in black positioned centrally on the sign.

Fire Safety Signage

Mandatory Signs

Safe Condition Signs

STANDARDISATION

Mandatory Signs

Signs indicating mandatory requirements consist of a blue circle with the pictogram or text in white positioned centrally.

Safe Condition Signs

Safe condition signs consist of a green rectangle or square with the pictogram or text in white positioned centrally.

Fire Safety Signage

Supplementary Information Signs

Fire Fighting Equipment Signs

STANDARDISATION

Supplementary Information Signs

These are signs used to provide additional information.

The colour should be green where the information supplements a safe condition sign, red where It supplements a fire equipment sign or yellow to supplement a warning sign.

Fire Fighting Equipment Signs

Fire equipment signs consist of a red rectangle or square with the pictogram in white positioned centrally on the sign.

These signs are used to mark the location of fire fighting equipment and fire alarm activation points.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Signage

COMBINATION SIGNS

Combination Signs that identify the hazard and indicate the risk control measure are also needed for risk reduction management

Combination Signs are also deployed to display appropriate notices, in clear and precise format to support good fire safety management.

ILLUMINATION OF SIGNS

Exit signs should be legible at all material times.

When required, following means of illumination are provided.

Lamps external to the sign; Lamps contained within the sign;

Internally illuminated signs; Self luminous signs with no external power.

Signs made from **PHOTOLUMINESCENT MATERIALS** are acceptable for Emergency Way-finding Guidance Systems.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Signage

KEY ELEMENTS OF ESCAPE ROUTE SIGNING

Sign Height (Graphical Symbol Height):

All escape route signs are required to be observed from a distance so the ratio of Height of sign to the distance is very Important.

Based on a illuminance of 100 lux, the standard ratio is 1: 170

(Reference to BS 5499-4:2000)

Symbol Height (h)	72mm	108mm	144mm
Recommended Sign	Fire exit 100 x 300mm	Fire exit 150 x 450mm	Fire exit 200 x 600mm
Max Viewing Distance	12.2 metres	18.3 metres	24.4 metres

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Signage

Other Locations: As per good practice

MOUNTING HEIGHT: (Reference: **BS ISO 16069 : 2004**)

Sign mounting height ensures efficient and safe evacuation from a building by organising escape route signs, along an escape route, in a progressive, continuous, predictable manner to become the **Way Guidance System**. Signs should be sited at 2 (max up to 2.5) M from the floor when positioned above doors or when suspended from the ceiling & at 1.7 (max up to 2.0) M from the floor when positioned on walls;

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Signage

Standardised Directional Arrow

Actual Exit Sign

Directional Arrows
NOT USED

KEY ELEMENTS OF ESCAPE ROUTE SIGNING

Direction of Egress and Escape:

Escape route signs take priority over other signs.

The use of standardised directional arrows within escape route signs is to ensure that egress is intuitive and efficient.

The actual exit signs should not have arrows.

The use of directional arrows by themselves is no more accepted.

Other Fire Safety Signs and Notices

All building occupants, including persons with special needs, need to be provided with relevant fire safety information to ensure effective evacuation and as part of Hospital's Personal Emergency Evacuation Plan (PEEP).

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Signage

Manual Alarm Call Point

KEY ELEMENTS OF ESCAPE ROUTE SIGNING

Other Fire Safety Signs includes the following

- "Use Stairs in Emergency" in Lift Lobbies above the lift call button
- Manual Alarm Call Point
- Fire action notices positioned at every Fire Alarm Call Point
- The procedure to adopt in the event of Fire Alarm Activation
- Assembly Point Signs
- Floor Numbering Signs
- Stair and Lift Identification (on top of Lifts) Number Signs
- Stair re-entry
- Fire Escape Plan

"Essential for Protection" Notices including Fire Safety Plan

FIRE

~

WHEN IT OCCURES, IT STARTS TO SPREAD IN UNDER 3 MINUTES

FIRE SAFETY MANAGEMENT IN HOSPITALS

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Management

Hospitals must make employees aware of the FIRE HAZARDS of the materials and processes with which they work

While **Physical Fire Precautions** within a building are intended to provide protection to building occupants, effective **Fire Safety Management** has to ensure that incidence of fire is minimised.

Fire Safety Management, in a Hospital environment, needs to ensure that sufficient number of suitably trained staff is available, the emergency action plans have been rehearsed, the fire safety precautions are observed, the physical fire safety infrastructure is periodically audited and maintained in a state of readiness; and thus adequate risk mitigation is achieved.

Unlike other organisations, in Hospitals, the patient and patient attendants, who constitute 50% of occupant population cannot be trained but need to be protected.

Fire Safety Management

PROCESS OF FIRE SAFETY MANAGEMENT – in Hospitals

Fire Safety Management involves the study of the human behaviour, facility compartmentalisation, fire suppression and investigation of fire and its related emergencies.

Hospital Buildings must be constructed in accordance with the applicable building code.

Then the Buildings must be maintained in accordance with the current fire code, which is enforced by the local Fire Service Department.

All Hospital Fire incidences are investigated in detail and the Lessons learned are applied not only to Management practices but also to Building Codes and Fire Service regulations.

When deciding on what fire protection is appropriate for a given situation, the types of fire hazards, listed hereunder, are assessed.

Fire Safety Management

The classification quoted is the Standard in Europe and Australia

TYPES OF FIRE

Class A Fires: These involve flammable solids such as wood, cloth, rubber, paper, and some types of plastics.

Class B Fires: These involve flammable liquids or liquefiable solids such as petrol, oil, paint, waxes & plastics, but not cooking fats or oils

Class C Fires: These involve flammable gases, such as natural gas, hydrogen, propane, butane, etc.

Class D Fires: These involve combustible metals, such as sodium, magnesium, and potassium

Class E Fires: These involve any of the Class A and B fires materials, but when used with an electrical appliances, wiring, or other electrically energized objects. It can lead to a risk of electrical shock if a conductive agent is used to control the fire.

Class F Fires: These involve high temperature fires of the fats or oils which far exceeds that of other flammable liquids, making normal extinguishing agents ineffective.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Management

In Hospital the patients, which includes disabled people & children; and the attendants, require assistance from Healthcare staff, for their safety in the event of a fire.

PROCESS OF FIRE SAFETY MANAGEMENT – in Hospitals

Chief Fire Officer (CFO) of the City, when deemed necessary, can ask any Hospital to appoint a Fire Safety Officer for the Hospital. (In Delhi, it is under section 29 of the Delhi Fire Service Act)

Most of Fire Service Acts impose following duties on Fire Safety Officer.

1. Make a general assessment of the Fire Risk and identify occupants as well as places at special risk. It will include a specific assessment of use of dangerous substances.
2. Plan and enforce measures to reduce the risk of fire and the risk of the spread of fire in the Hospital premises.
3. Provide means for detecting the fire, raising the alarm and communication with the external fire and emergency services
4. Provide appropriate fire-fighting equipment

HOSPITAL FIRE SAFETY INFRASTRUCTURE

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Most of Fire Service Acts impose following duties on Fire Safety Officer.

5. Identify and notify escape routes and exits, provide proper signage, issue all needed safety notices
6. Provide fire safety training to staff including conduct of mock drills
7. Maintain the fire safety services, equipment and devices
8. Disseminate fire safety information to all occupants of building
9. Appoint sufficient persons to assist in undertaking the preventative and protective fire safety measures.
10. Maintain the provisions deemed necessary for safety of fire-fighters

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Safety Management

Establish the command chain & An incident reporting. Protocol to be followed after the incident is over.

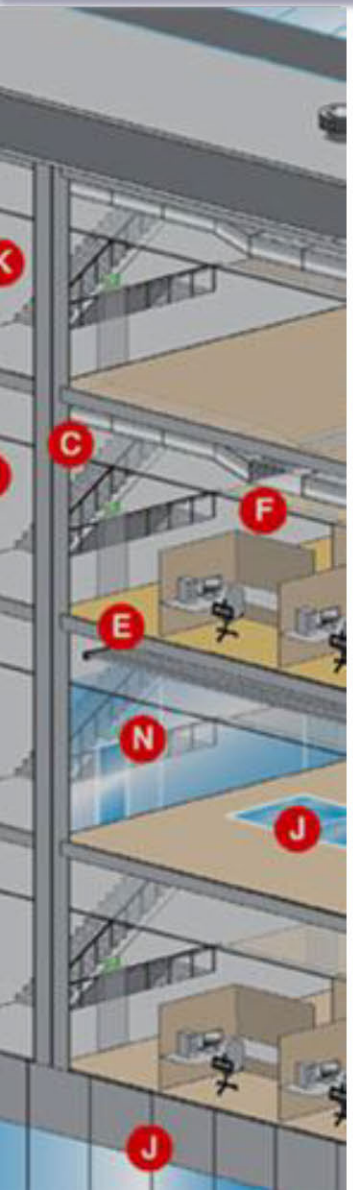
PROCESS OF FIRE SAFETY MANAGEMENT – in Hospitals

Develop **Fire Safety Protocols** to address the following issues:

- Risk Assessments; Fire Prevention; Fire Safety Strategies
- Emergency Planning and Procedures
- Fire Safety Training of Hospital Staff; Fire Safety Manuals
- Fire Detection and Alarm Systems
- Maintenance of Fire Equipment; Fire Extinguishers; Fire Stops
- Portable Appliance, Compartmentation, etc.
- Medical Gases Safety
- Laundry & Kitchen Safety
- Electric and HVAC Installation Safety
- Safety of aall Parking Spaces
- Site and Building Security
- Corrective Construction and Refurbishments (if required)

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Protection



There are essentially two types of fire protection, **Passive and Active**.

Passive Fire Protection (PFP) relates to protecting the building structure against collapse and to prevent fire spread to other parts of the building form the origin of a fire.

while **Active Fire Protection** (AFP) refers to systems activated either mechanically or electronically in the event of a fire.

Passive Fire Protection

The aim of PFP systems is to ensure that a fire is contained within a specified fire compartment as well as ensuring that the load bearing capacity of the fire exposed structure does not reach the critical level.

It is an integral element of structural fire protection in buildings.

PFP seeks to slow down the spread of fire by means of fire-resistant walls, floors and doors, Fire Stop, internal finishes, fire dampers, etc.

Fire Protection

Active Fire Protection

It is an integral part of any fire safety strategy, characterised by systems requiring a certain degree of activation in order to work, deployed to increase personal safety and limiting structural damage of building.

Fire Detection

Fire is detected by locating smoke, flames or heat detectors
In turn, alarm is sounded to initiate action like evacuation.
It can also alert the local fire department, de-energising magnetic hold-open devices on fire doors, opening vents in stairways, etc.

Fire Suppression

Manual Suppression means are use of fire extinguishers or standpipes, while Automatic means are automatic fire sprinklers, gaseous agents or foam flooding systems.

Smoke And Heat Extraction Systems

These systems are designed to ventilate heat and smoke through natural openings before flashover occurs or to avoid flashover.

Fire Risk Assessment

Establish the command chain & An incident reporting. Protocol to be followed after the incident is over.

It requires following activities

1. Identification of the Fire Hazards
   - Sources of ignition
   - Sources of fuel
   - Sources of oxygen
2. Identification of the people at risk
   - People in and around the premises
   - People especially at risk
3. Mitigation of the Fire Risk
   - Evaluate the risk of a fire occurring
   - Evaluate the risk to people from fire
   - Remove or reduce fire hazards - post assessment
   - Remove or reduce risks to people by providing
     - Fire Detection and warning systems
     - Fire fighting Equipment and Systems
     - Escape routes, Refuge Areas, properly signed
     - Escape routes, with escape lighting
     - Information Signs and notices
     - Maintenance Schedules for all Systems

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Fire Risk Assessment

It requires following activities

4. Record, plan, inform, instruct and train
   - Record significant findings and action taken in the event of a fire
   - Prepare an emergency plan to mitigate similar fires
   - Inform and instruct relevant people, in the Hospital and in Local Fire Service
   - Update training structure and manuals
5. Review
   - Keep assessment under review
   - Revise where necessary, periodically and after every major Fire incident.

Fires can be prevented by complying with Fire Safety Codes as well as Codes for design & installation of Electrical, Lighting, HVAC Systems. It also requires complying with all instructions for design, installation and operation of equipment, as provided for Cooking, Laundry, CSSD, Refrigeration and Medical Gases Pipeline System.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Protection

With chronic shortage of water (even for drinking purposes) all over our country, providing adequate water supply for fire fighting is a major problem

All Healthcare buildings depending upon the height shall be protected by a combination of fire extinguishers, wet riser, down comer, automatic sprinkler installation, high / medium velocity water spray, foam, gaseous or dry powder systems.

First aid Fire Fighting Equipment which consist of fire buckets, portable fire extinguishers, hose-reels, etc. should be readily available. These shall be operated by all staff members in the incipient stage.

Static Water Storage Tanks: It is calculated as 2250 L x 60 minutes + mandatory storage. Typically, underground tank of 100,000 to 150,000 L and overhead tank of 5,000 to 20,000 L are required depending upon Height and Floor Area of the Hospital Building. It will be increased depending upon the availability of water.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Protection

When properly designed, installed and maintained, SPRINKLER SYSTEMS is the best option for providing cost-effective life safety and property protection

Wet Pipe, Automatic Sprinklers with an average discharge flow of 225 - 375 lpm water, shall be installed in all floors of all Hospital Buildings higher than 15 M, in all Basements with Area 200 M^2 or more, in low rise Hospital Buildings, in all interstitial areas above false ceiling if the height is 800 mm or more above the false ceiling.

Automatic High Velocity Water Spray system with a discharge flow of 10 lpm/m^2 floor area, are for protection of indoor oil cooled transformers.

Fixed Foam Installation is required for protection of indoor oil storage area as required for any oil fired device like a boiler or a furnace.

Fire Extinguisher / Extinguishing systems using Carbon Dioxide, Halon or Halon Alternatives are required for protection of electrical and other special installations.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Detection & Alarm System

Conventional Type

Addressable Type

Manual or Automatic Fire Detection & Alarm System are required to be installed in all Hospitals.

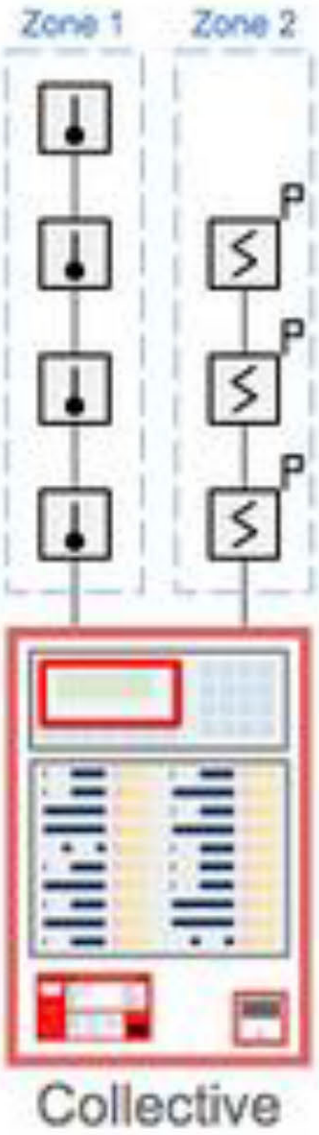
The first electric Fire Detection and Alarm System was patented in 1890 by Francis Robbins Upton in USA.

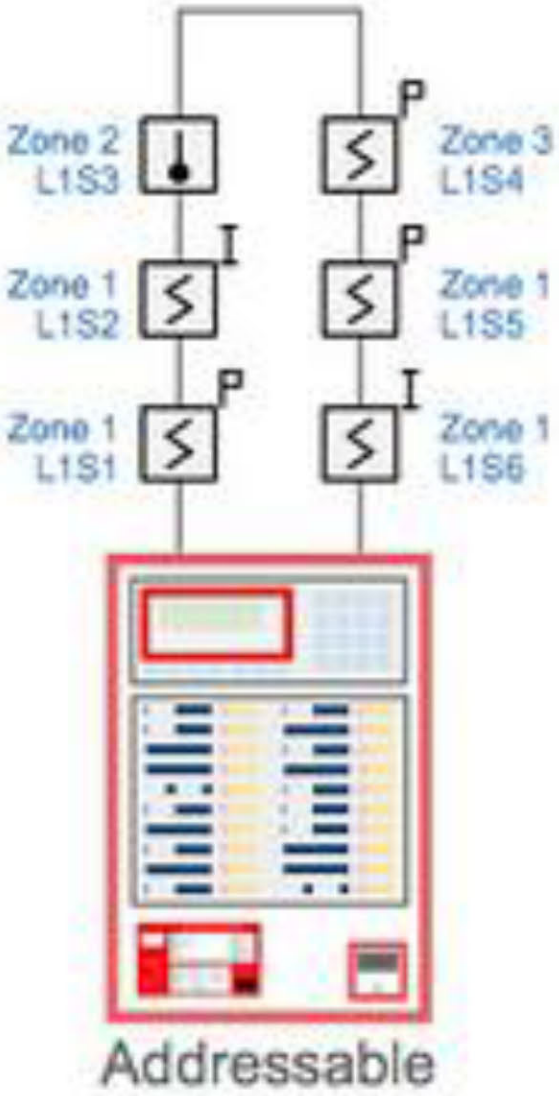
The main function of a Fire Detection system is to monitor each circuit, zone or point for any abnormal condition, display that condition and to operate the planned output. The output can be a fire alarm to warn the building occupants, notify the fire brigade, activate controls, etc.

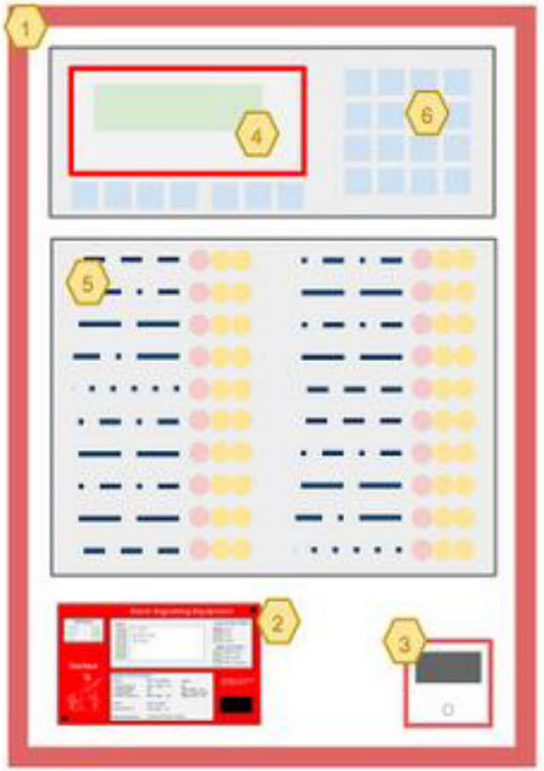
The system can be a conventional system or an Addressable Analog (Intelligent), Fire Detection System, where each device has a unique address and establishes a two way communication with the control panel. The later is preferred for Hospitals, as it has least maintenance requirements.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

Fire Detection & Alarm System







1. Fire Indicator Panel
2. Alarm Signalling Equipment
3. Manual Call Point
4. Fire Fighters Interface
5. Zone Status Indication
6. User Controls

Other Fire Safety Parameters in Hospitals

When locating the Automatic Sprinklers, the layout should be co-ordinated with furniture layout and it should not be located over the patient position in the wards and over the operating table in the operating rooms.

No open flame devices including lighting devices shall be used in any place of Hospital. Exception may be made for ceremonial purposes or on stage, when these are part of a theatrical performance, under restrictions & supervision.

For high rise hospital buildings above 60 m in height, provision for helipad should be made for helicopter based evacuation.

HOSPITAL FIRE SAFETY INFRASTRUCTURE

THE LAST WORD

Even the Hospital accreditation standards check for Fire Safety Code compliance

Fire can cause irreparable losses, particularly in any Hospital as these buildings have a large number of patients, doctors, staff, etc.

Therefore utmost care needs to be taken by planners, employees & Healthcare workers in any hospital.

The Building Codes and local Firs Services codes are effective in providing Life and Fire Safety and should be followed in letter and spirit.

In addition, all Hospitals must have effective Fire Safety Policy.

All Hospital staff should periodically be trained.

The Local Fire Service Head also has a responsibility for Fire Safety of the Hospitals, therefore Local Fire Service must always be associated in all trainings and mock drills and kept up to date through Hospital's Fire Safety Officer.

THANK YOU

Creating value for healthcare providers, hospital owners and investors by devising comprehensive healthcare systems

A PRESENTATION BY

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