10 Fire Protection (FP) – Special Areas Design

This FP design guideline written for healthcare facilities, is a consolidated document listing out the design requirements for all new construction and major renovation healthcare projects.

For FP Systems, the protection of the healthcare facilities and its occupancies are of prime importance when discussing fire and life safety. But more so in healthcare facilities, the continued operation is also as important.

The FP must not jeopardize the continued operation of a healthcare facility and incur any huge capital costs due to equipment replacement.

The impact of FP strategy on major imaging equipment in healthcare facility is very huge if not assessed correctly.

The requirements outlined in these guidelines are not intended to conflict with Federal Regulations, Local Municipality Laws, Executive Orders, or the needs of the end users.

This document is intended for the Architect/Engineer (A/E) and others engaged in the design and renovation of health facilities. Where direction described in applicable codes are in conflict, the A/E shall comply with the more stringent requirement. The A/E is required to make themselves aware of all applicable codes.

The document should be read in conjunction with other parts of the Health Facility Guidelines (Part A to Part F) & the typical room data sheets and typical room layout sheets.

General

- The aim of this section of the guidelines is to promote the correct design of fire-fighting systems for healthcare facilities for the following areas:
  - Burn Units
  - Imaging Department
  - Operating Theatres
  - Endoscopy Procedure Rooms
  - Day Surgery Rooms
  - Dental Procedure Rooms
- The systems below are the systems that are to be used in healthcare facilities, but not only limited to these systems.
- As per NFPA Code (depending on the complexity/level of the healthcare facility departmental functions), the following fire protection system shall be used (but not limited to):
  - Sprinkler System (Active & Dry)
  - Standpipe System
  - Hose Reels System
  - Clean Agent System
  - Deluge System
  - Foam System
- Healthcare facilities relay heavily on a continued operation of the facility and its equipment post controlled fire extinguishing scenarios. Therefore, the correct fire protection system should be used with this objective in mind.

Design Criteria

- The design, installation and commissioning of the fire-fighting protection system shall be as per NFPA or local AHJ requirements. Wherever there is a conflict between international and local codes, the local codes shall take precedence.

Sprinkler Systems

- As per FF strategy, all areas within a facility need to be fire protected.
- Certain areas will require certain fire extinguishing systems that will work best for safety of inhabitants and the hospital operator costing concerns.
- Rooms with huge capital cost equipment, such as medical imaging units, Bunker areas etc.,

should not be provided with a wet pipe sprinkler system for fire protection. Gas suppression system should be used in these areas or pre-action system.

- Both pre-action and Gas suppression can be provided in the same room, with the gas suppression system extinguishing first completely before the pre-action system starts its extinguishing process (if the fire is still active)

Pre-Action Systems

- In healthcare facilities, pre-action sprinkler systems are used for areas that a fire scenario event will be very disruptive to the operation of the healthcare facility. In cases disruption to these areas via an automatic sprinkler system may be hazardous or in some cases life threatening.
- The system is usually installed in the following areas in healthcare facilities:
  - Operating Theatres
  - Endoscopy Procedure Rooms
  - Day Surgery Rooms
  - Dental Procedure Rooms
  - Burn Units
  - Imaging Rooms
- Pre-action systems should be a double interlocking system. This means that the system will have both a preceding and supervised event such as heat or smoke detectors as well as an automatic sprinkler activation. Figure 10.1 below shows a pre-action valve arrangement with an addressable panel. Generally, these types of systems operate faster and reduce fire and damage compared to the standard automatic sprinkler systems.

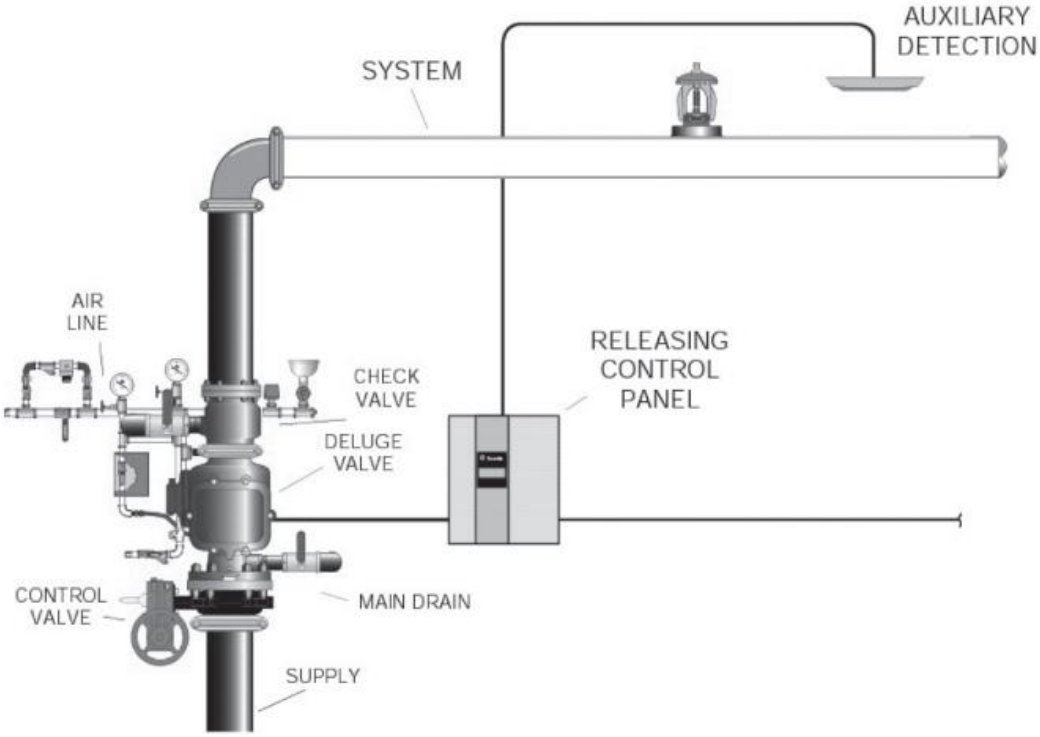

Figure 10.1 – Pre-Action Valve Setup

- In operating theatres, audio alarms and strobe lighting shall be removed and replaced with light indication alarm fitting (non-audible) as part of the surgical panel

Clean Agent System

- Clean agent systems are designed to be chemical inhibitors that react with the transient products of combustion. They are made to eliminate the chain reaction of combustible elements by reducing the oxygen content in a room, attacking one of the elements of the fire triangle. Oxygen levels are reduced below the point of a reaction for combustion to be

maintained. This is done with use of an inert gases.

- Inert gases have a low level of toxicity and in the healthcare facilities they are used for fire-fighting services in patient and healthcare operator staff occupied major medical equipment rooms. Therefore, it is important to ensure that the inert gas concentration does not exceed the limits of No Observed Adverse Effect Level (NOAL) as per the limits set out in NFPA-2001, which is 43%.
- As per NFPA 2001, the maximum exposure limit should only be 5 minutes. Any personnel in the area where clean agent system is to be used will be required to evacuate in the count down time between the fire and the release of the clean agent.
- A clean agent system does allow for an emergency push button cancellation in case of a false alarm or if the fire within the space has been contained.
- The system can also be designed for time delay to give patients, staff, and visitors to evacuate the area prior to the system being extinguished.
- In healthcare facilities the following rooms will require a clean agent system.
  - Server Room
  - UPS Room
  - CT Scan Room
  - CT Scan Room
  - CT Scan Equip Room
  - MRI Equipment Room
  - Chemo-Emboli Station Room
  - Computer Equip Room
  - SPECT Scanning Room
  - PET Scanning Room
  - Computer Equipment Room
  - Main Electrical Room
  - MRI-LINAC
  - Medical Records
  - Burns Unit (If water will cause more damage to the patient)
- Burn Unit patients are at risk of infection if water is discharged from sprinkler system while they are in the space (not all patients, critical patients only)
- Clean agent cylinders should not be located in the same room, where clean agent ceiling nozzles will be discharged. If the cylinders are to be located in the same room, they shall be in a fire rated enclosure.
- A clean agent system can be used with a pre-action sprinkler system.

Deluge Water Systems

- In healthcare facilities, deluge systems are used on external liquid oxygen and LPG storage systems. The pipes are installed to surround the storage vessel containing hazardous flammable liquids.
- Deluge systems sprinkler systems provide high flow and high volume of discharge over the hazardous area in a fire scenario in the quickest time possible.

Foam System

- In healthcare facilities foam fire extinguishing system are used for special hazard areas. They should not be used for medical gas plant/systems or electrical rooms.
- Foam, mostly a mass of air- or gas-filled bubbles formed by chemical or mechanical means, is most useful in controlling fires involving flammable liquids with a low flash point and specific gravity that are lighter than water. The mass of bubbles forms a cohesive blanket that extinguishes the fire by excluding air and cooling the surface and by separating the fuel from the fire. This strategy is used for Oil fueled Generators.

Spray Fog/Mist System

- For Multi person Hyperbaric Chambers where there is a risk for fast spread of the fire, due to higher partial oxygen pressure in the chamber atmosphere and other associated risks to

patients its recommended to utilize a spray fog system.

- The system allows for effective firefighting control with a low water consumption and workability at a higher pressure of the chamber. The size of the water tank should be ideally selected by the chamber supplier corresponding to the chamber size. The room should be served by standard sprinklers.

11 Vertical Transportation System

General

Healthcare facilities are greatly depended on lifts to provide a reliable and efficient vertical transport system for the movement of patients, staff, visitors, medical equipment, and associated support services. They are also dependent on lifts to provide firefighting and evacuation facilities.

All lifts shall meet the statutory regulations from Municipality and Civil Defense authorities.

Lift Categories

The lifts in healthcare buildings shall be categorized and provisioned based on the function as below:

- General Passenger Lifts

These lifts supporting general passenger traffic including wheelchair users. The clear internal dimension of a general passenger lift serving clinical areas should not be less than 2000mm wide by 1700mm deep with a minimum loading capacity of 1250kg with a minimum clear door opening width of 1100mm and clear height of 2100mm. This is to enable proper circulation space for patients on wheelchair and accompanying persons. The lifts intended for housekeeping services may be part of a group of general passenger lifts. However, housekeeping activities should be scheduled not to coincide with general peak passenger demands. As far as practically possible, care should be taken so that public passenger lifts are separated from the Bed, Service and Goods lifts with access to separate lifts lobbies.

- Bed Lifts

These lifts are intended for the carrying of a patient on patient beds or stretchers together with the necessary staff and support equipment. The bed lifts should have a minimum rated load capacity of 2500 kg, with a minimum clear car dimension of 1800mm wide by 2700 mm deep. Clear door-opening width must be no less than 1400mm and 2200mm high. Lift car internal height should not be less than 2500mm.

- Service/Goods Lift/s

These lifts are intended for the movement of items such as furniture, equipment, building materials, equipment maintenance supplies, waste etc. The service/goods lifts should have a minimum rated load capacity of 2500 kg, with a minimum clear car dimension of 1600mm wide by 2200 mm deep. Clear door-opening width must be not be less than 1200mm and 2200mm high. Lift car internal height should not be less than 2500 mm. For smaller healthcare facilities (less than 50 beds) smaller sized goods lifts may be considered based on proper due diligence. However, in facilities where heavier equipment is anticipated to be transported, larger goods/service lift with wider door opening size to be provided.

Design Considerations

Below is key recommendations and requirements to be adhered with while designing vertical transportation solution for healthcare facilities.

- Selecting the appropriate lift operational speed and drive system is important in order to optimize the operation, comfort, and efficiency of the system.
- Lifts to be located away from sensitive areas in consideration of vibration and acoustics, and with respect to magnetic distortion for MRIs.
- Depending upon the nature of the facility firefighting lift/s to be provided where called for as per Civil Defense requirements.
- In large facilities with numerous lifts, Passenger Lifts may be categorized based on different