CHAPER 4 FIREFIGHTING SYSTEM

4.1 INTRODUCTION

The design of any fire-protection system is an exact science that takes into account a building’s use, occupancy, footprint, and even its other installed systems.

Every well-designed system, whether it is being designed for a new building or being installed as part of a renovation or retrofit, must be developed with specific objectives in mind.

Planning for fire protection involves an integrated approach in which system designers need to analyze building components as a total package. In most cases, the analysis needs to go beyond basic code compliance and the owner’s minimum legal responsibilities for providing protection.

Design process should be a holistic one for both new construction and retrofits. Building ownership and management, architects, engineers, contractors, and consultants all need to be involved in the planning and design process, and fully understand the issues and concerns of all other parties.

4.1.1 Code Compliance

Code compliance is the first objective in any design. Codes are legal minimum requirements; you have to meet the minimum with any design.

The additional challenge is that fire codes can vary substantially across the country, even within a state or county.

Vietnamese CODE:

TCVN 5738 – 2001
QCVN 06 : 2010/BXD
Standard NFPA (National Fire Protection Association) of PCCC commitee

4.1.2 The Basics

In the design process, these typical fire-protection system goals are on the table for consideration:

Saving lives.

Saving property.

Preserving business continuity.

It all depends on how a building is used and occupied. A warehouse or storage facility, for example, will have different fire-protection requirements than a multi-tenant office building.

While no standard fire-protection design blueprint exists for any two buildings, the systems found in any building typically include these basic components:

Detection.

Alarms and notification.
Suppression.

All components of modern fire-protection systems need to work together to effectively detect, contain, control, and/or extinguish a fire in its early stages - and to survive during the fire. To achieve the most beneficial symbiosis between these components, it’s best to involve an experienced system designer, such as a fire-protection engineer, in the early stages of the planning and design process.

### 4.1.3 Detection Systems

Modern smoke-detection systems go beyond the small device that senses smoke and triggers the alarm system. Intelligent smoke detectors can differentiate between different alarm thresholds.

Heat detectors are another option. They can trigger alarms and notification systems before smoke even becomes a factor.

Specification and installation of detection systems can sometimes be selective. “You might not need it in some places,” Fraser notes. “It depends on if the building [is] occupied around the clock or if it goes unoccupied for periods.”

The main benefit of good detection (beyond triggering the alarm system) is that, in many cases, there is a chance to extinguish a small, early blaze with a fire extinguisher.

### 4.1.4 Alarms and Notification Systems

Alarm systems are a must in any facility - alarms that alert building occupants of a fire and alarms that alert emergency public responders (police and fire) through a central station link so they can initiate a response.

This can be achieved with AutoCAD floorplan integration. When an alarm goes off in a building and alerts the security or management team, an AutoCAD screen comes up on the computer, showing the floor where the alarm was activated and providing a computer print-out of that screen. Security can then hand the floorplan, which indicates the alarm zone, to first responders when they arrive.

Many modern systems now include speakers that provide alerts in place of (or in addition to) traditional bell-type alarms. These speakers also can be used in emergencies other than fires to instruct and inform occupants of the situation.

These voice-actuated systems can include pre-recorded or live messages that play in the event of fire or another emergency. Typical pre-recorded messages tell occupants that an
alarm has been sounded and that they should remain in their designated area for further instruction. Building management can then manually use the system to deliver additional information and prepare occupants for an evacuation, if necessary.

Alert systems can also close fire doors, recall elevators, and interface and monitor the installed suppression systems, such as sprinklers.

The systems can also connect with a building’s ventilation, smoke-management, and stairwell-pressurization systems - all of which are critical to life safety. Again, these features are dependent on the building in which the system is installed.

4.1.5 Suppression Systems

Sprinklers are the most widely specified suppression system in commercial facilities - particularly in occupied spaces.

According to the Quincy, MA-based National Fire Protection Association (NFPA), the presence of sprinklers cuts the chance of death and average property loss from a fire by one-half to two-thirds as compared to scenarios where sprinklers are not present.

Each independently operating sprinkler has a heat-sensitive element inside. These elements heat up to the sprinkler’s operating temperature and activate that sprinkler head. According to the AFSA, 90 percent of all fires are controlled by six or fewer sprinkler heads.

In situations where sprinklers aren’t feasible because of special considerations (e.g. water from sprinklers would damage sensitive equipment or inventory), designers might suggest an alternative fire-suppression system, such as gaseous/chemical suppression. Once more, experts note that the type of sprinkler used depends on the building’s function.

4.1.6 Maintaining Safety

Beyond the components that actually make up an integrated fire-protection system, there’s another important factor that affects design: maintenance.

An improperly maintained system lacks reliability and, therefore, true protection. If a system is not maintained properly, its reliability degrades rapidly. Don’t install a system that you can’t routinely maintain and test easily and effectively.
4.2 WATER SUPPLY FOR FIREFIGHTING:

According to data, the external maximum pressure head is 24.5 m, smaller comparing to firefighting supply water for 40 floor. Thus, we cannot use directed supply water from the external water net for firefighting.

Selecting 2 vertical pipe with 2 faucets for each floor. The flow rate of each faucets is 2.5 (l/s)

4.2.1 Vertical pipe:
Depending on faucet flow rate, the vertical pipe diameter is:

\[ D = 50 \text{ mm} ; \quad 1000i = 69.6 ; \quad v = 1.18 \text{ m/s} \]

The longest pipe length: \[ H = 124 - 15 = 109 \text{ (m)} \]

Pressure loss of vertical pipe
\[ h_1 = 109 \times 0.0696 = 7.59(m) \]

4.2.2 Horizontal pipe:
For both pipe working the same time, the flow rate is 5(l/s). Using table choosing pipe diameter:

D = 70(mm)

\[ 1000i = 75.2 \]

Length from the pump to the vertical pipe: \[ l = 7m \]

Pressure loss:
\[ h_2 = 7 \times 0.0752 = 0.5264(m) \]

Total pressure loss along the length:
\[ \sum H = h_1 + h_2 = 7.59 + 0.5264 = 8.12(m) \]

Pressure drop due to fittings:
\[ h_{cb} = 10% \times \sum H = 8.12 \times 0.1 = 0.81(m). \]

Working pressure:
\[ h_{ct} = h_1 + h_2 (m) \]

Where:
\[ h_v: \text{ pressure at the faucet to create a water column of 6m pressure depends on the diameter of faucets} \]

\[ h_o: \text{ Pressure loss} \]
Calculate \( h_o \):

\[ h_o = A \times l \times (q_{cc})^2 \ (m) \]

Where:

A: Resistance constant of rubber gasket

\( d = 50\text{mm} \Rightarrow A = 0,0075 \)

l: length of fabric pipe (m), according to standard \( l = 20\text{m} \)

qcc: firefighting flow rate (l/s)

\( h_o = 0,0075 \times 20 \times 2,52 = 0,9375 \text{ m} \)

Calculate \( h_v \)

\[ h_v = \frac{C_d}{(1 - \phi C_d)} \ (m) \]

Trong đó:

Cd : 6

A: \( Cd = 6 \Rightarrow \alpha = 1,19 \)

\[ \varphi = \frac{0,25}{d + (0,1d)^3} \] with \( d = 13\text{mm} \Rightarrow \varphi = 0,0165 \)

\[ h_v = \frac{6}{(1 - 0,0165.119,6)} = 6,8 \text{ m} \]

\( h^{cc} = 6,8 + 0,973 = 7,74 \text{m} \)

Working pressure:

\[ H^{cc} = H_d + \sum H + h_{vb} + h^{cc} = 109 + 8,12 + 0,81 + 7,74 = 125,67 \ (m) \]

4.2.3 firefighting water tank

\( W_{3h}^{cc} \): volume for 3h using, the total volume is:

\[ W_{3h}^{cc} = 3 \times 3600 \times 2,5 = 27000 \ (l) = 27 \ (m^3) \]

Choose brick with waterproof membrance water tank: 3x4,5x2 (m)