CHAPTER 14

FIRE SYSTEM

14.1. GENERAL

The work is a large-scale new construction, this is the building for the purpose of using mostly office work, restaurants, bars and more people live and work. In particular this is the multi-tier architecture so the combat fighting certain difficulties. Due to the degree of importance on investment in fire prevention and fighting equipment for the project is a very important and practical goals.

Implementation of our ideas on choosing the design fire prevention and fighting systems for the project. Pursuant to the requirements of project management, we have studied the characteristics of the survey work, the Vietnamese standard of fire prevention and fighting safety design of fire prevention and fighting systems for projects include the following items:

- Automatic fire alarm system.
- Sprinkler inerting system.
- Water fire-fighting system throat wall.

14.1.1. Apply standards:

- Building code of Vietnam, 1996.
- Vietnam Construction Standards

TCVN 3254:1989 Fire Safety - Generic Requirement
TCVN 5738:2000 Automatic fire alarm system - Technical requirement
TCVN 7336:2003 Extinction, Fire protection system – Automatic Sprinkler Systems

Reference Standards of NFPA (National Fire Protection Association):
NFPA 13 Design Standards, installation Sprinkler inerting system;
14.1.2. Fire protection systems requirement for buildings.

Based on the dangerous nature of fire works fire prevention and fighting system for the project must meet the following requirements:

14.1.3. Fire protection requirement:

To adopt fire prevention solutions ensure minimize the possibility of fire. In case of fire, to detect fires fast to heal in time for the fire spread to other areas generate large fire difficult to cure serious consequences.

Fire prevention measures to ensure that when there is a fire, people and property in the building easily evacuated to safe areas as quickly as possible.

In any conditions when the fire occurs in the fire-prone position as the technical area, the lobby of the building to discover right in a fire and to organize timely rescue.

14.1.4. Extinction requirement.

Fire-fighting equipment of the building must meet the following requirements:

- Fire-fighting equipment must be available in the permanent regime, when the fire must be used immediately.
- Fire fighting equipment must be suitable and efficient fire for fire occurred in the building.
- Equipment for fire-fighting must be equipment easy to use, compliant with building and the conditions for our country.
- Fire-fighting equipment must be equipment not damaging the instruments and other equipment at the secondary damage fire zone.
- Equipment fire protection system is equipped to ensure minimum investment conditions but maximum efficiency.

14.2. Automatic fire alarm system design:

Alternative design includes

- Design installation of fire alarm systems to address the whole project.
- Design and installation bell system, fire alarm buttons for the whole project.
- Design and installation exit light (Exit) warning light when the problem occurred.

14.2.2. **Addressable auto fire alarm system:**

Automatic fire alarm systems include the basic parts as:

- The early fire detection sensor.
- Fire alarm button hand.
- Module analysis, signal processing.
- Control Center handled the information from the sensors and fire alarm buttons manually taken.
- Fire alarm parts including: whistles, bells.
- Wire network: including signal wiring and power supply cord.
- Power.

Control peripheral devices such as printers alarm data, cabinet control interface on the computer system, cabinets paired control signal fire systems, elevator systems, as well as opening and closing ventilating device, escape door.

14.2.3. **Alternate design:**

The design fire alarm system for the building was selected as intelligent addressable fire alarm system.

The basement is the first installation of the temperature increase (type detector normal) to the parking area. The detectors are connected to a central fire alarm cabinet by creating modules address. By center management can be an area for parking and high economic efficiency, still meets the technical requirements. The technical room or warehouse to be installed first in order to detect the location address fire correctly and quickly.

The office area and hallway floors are installation smoke detector addressable. These detectors allow accurate detection of fire and the location is very convenient to the division office later.

Combination of bells, fire alarm buttons on the upper floors are arranged in the position many people travel to the area near the elevator and stairs to facilitate
troubleshooting observed when fires occur. The fire alarm buttons on each floor are
fire alarm button is usually combined with the module address and is mounted on one
address for each floor.

Selected alarm equipment is fire alarm. On the floor of the fire alarm installed
in combination with the fire alarm button. The bell was installed on the same
first line power cord and put the address of the module for the fire alarm to
control the operation of all of the bells on the same floor.

Wiring fire alarm signal to the address specialized shielded cables and cross-
section 1.2 mm²

14.3. INITIAL EXTINCTION FACILITIES & WATER EXTINGUISHING
SYSTEM :

14.3.1. General.

14.3.1.1. Base design:

- The applicable standards, criteria and references in Part II – Standards apply
- Architectural drawings of the building.

14.3.1.2 General diagram system.

After studying architecture characteristics, size, importance and nature of use and the
risk level of the project, design solutions for fire-fighting system with water for building
consists of the following basic parts:

- Fire-fighting water tank.
- Main fire pumps system, pump backup, pump compensated pressure.
- Fire-fighting pump control cabinet.
- Pressure vessels, pressure gauge, pressure switch.
- Alarm valve system and flow switch.
- Cutoff valve system, check valve, suction filter valve.
- Plumbing system.
- Sprinkler nozzles.
- Wall fire dydzant.
- External fire dydzant.
- Means the initial fire using the fire extinguisher portable ABC (MFZL 4), CO2 air tank (MT3) for electrical engineering and MFZT air tank.

14.3.2. Water extinguishing system:

Water extinguishing system supplied to nozzles and Sprinker and wall fire hydrant, pipe network with a diameter from D25-D150. D150 main pipe running from the pump station to the technical box. Spindle vertical pipe goes in the box technique using zinc coated steel pipes D150 and D100 along the technical box and is connected to the water tank in the roof. At each floor there are two main pipelines.

The water supply pipeline network and to create pressure for fire fighting system used in common Sprinkler and hydrant wall of fire pumps horizontal axis.

In the Sprinkler design layout floor pressure gauges to check the pressure of the pipeline network.

The startup and shutdown of pumps can be fully automatic or manually. Fire control panel receives the signal from the pressure switch, flow switch to provide control signals to fire cabinets fire pump start. Depending on the status of the fire control cabinet decisions taken control signals start the main fire pumps, fire pumps or pressure compensated pump backup. The fire control panel also offer fire alarm bell, fire indicator light as well as fire alarm center.

When the pressure in the system dropped to 90% compared with a preset pressure switch will boot pump offset pressure (Jockey pump). A Zole minimum runtime control is attached to the control system to prevent the compensating pump case continuous boot.

If the system pressure dropped to 80% compared to pre-install the pressure compensated pump will stop and the main fire pumps will be started (one permanent pumps were selected).

The power source for the pump from the priority, at the same time be issued by the building's power generators.

Water tank for fire-fighting system is used in conjunction with submersible water tank is located in the basement 3. The amount of water used for fire fighting is secured by the equipment to check the water level and life activity pump control.

14.3.3. Sprinkler extinguishing system.

Fire fighting system use the Sprinkler facing the up (upright) was installed in the basement (garage), use Sprinkler go down (pendent) arranged for floor false ceiling
layout. The distance between the nozzle is 2.6m to 4m, distance to wall 1.2m to 2.0m (see drawings).

Basic technical parameters to calculate, system design “Theo TCVN 7336:2003” follow:

- Maximum protection area for a nozzle: 9-12m²
- Threat level: normal
- Pressure at the nozzle: 1at (10 m.c.n)
- Intensity spray: 14,4lit/min m²
- Injection period: 60 min
- Protected area: 120 m²

Water sources will be sufficient to supply the sprinkler system and hydrant in simultaneous operation.

**Unit components in system:**

The Sprinkler nozzles

Installation location: view layout drawing fire fighting system.

- Clusters dedicated valve of the Sprinkler system

Clusters control valve located at the top of the pipeline in the pump. Cluster valve including equipment in complete sets following:

Alarms valve.

Master valve and branch valve

Pressure switch.

Cluster valve selection for system diameter is D150.

- Flow switch

Flow switches are installed for each floor as shown in the design drawings.

Switch and the base is made of cast aluminum. Rubber cushion between the seat base and lid liner. Exposure foil can be aligned to match the size in the device incorporating a time delay can be adjusted from 0 to 60 seconds in order to prevent false alarms due to the sudden increase in pressure may occur. Signal from the flow switch will be connected to the fire alarm system.
- Pressure gauges.

14.3.3.2. Calculate the parameters required for Sprinkler systems.

* Computing base:

- Required flow from the basic water supply for the system to work

\[ q = I_b F \quad \text{(l/s)} \]

Where:

- \( I_b \): Standard spray intensity 14.4 l/\text{m}^2.\text{min.}.
- \( F \): Protected area at a time when the system is working 240m².

\[ q = 14.4 \times 120 = 3456 \text{ l/phút} = 28.8 \text{ (l/s)} \]

14.3.4. Water fire-fighting system throat wall.

- Water fire-fighting system throat wall is designed with the Sprinkler system pipe network. This is a semi-automatic fire-fighting system, the building used hose reel D50 - L = 30 m, wheel diameter \( d = 13 \) mm mouth spray with spray flow is \( 2.5 \text{ l/s} \), the number of nozzles for a fire occurred at the same time is 2 so the necessary flow of \( 5\text{L/s} \). The pipe to throat branching from the main axis in the diameter floor is D150, or D100 mm.

- Hose reel must be approved and must be equivalent to the hose reel has been approved by the local fire fighting agencies. Working pressure of the hose reel in normal conditions to must achieve 10 bar.

- Unless otherwise indicated, the center of throat water placed at a height of 1.25 m floor. Entire throat water in the fire box sunk in the wall, where the fire box located at the glass walls, concrete walls, pipes and tube outside the box well and is painted red. (detailed layout and installation design drawings).

- Valve angle D50mm diameter. Working pressure of 16 bars. The valve angle must meet fire protection safety standards for couplings, valves fighting.

- Guidelines used to in the position adjacent to the hose reel in a prominent position frontally.

14.3.5. Selection fire pump.

14.3.5.1 Working pressure of the pump:
Hct = Hhh + Htd + ΣH

- Hhh: the height of the lowest water level in the tank to fire hose high and far. 47 m.
- Htd: pressure freedom necessary for nozzle system is 10m.
- ΣH: total loss of pressure from the pump intake to fire hydrant high and farthest (including losses to length and pressure loss how through the local device: valve, tee, ...) 5 m

Hct = 47 + 10 + 5 = 62 m.

14.3.5.2. Capacity of pump:

Qct = 28.8L/s + 5L/s = 33.8L/s = 121.68 m3/h

14.3.5.3. Choose pump

From the above parameters, the following pump selection:

Q = 121.68 m³/h, H = 62 m (includes 1 main and 1 backup pump)
14.4. SMOKE DETECTOR

- Is direct monitoring devices, detect signs of smoke to move the smoke signal processing center. The first time the smoke detector to receive and transmit information to the fire no more than 30 seconds. Environmental density from 15% to 20%. If the concentration of smoke in the environment in the region over the threshold (10% -20%), the device will signal the alarm center to handle.
- The smoke detector is usually located in the office, meeting hall, the warehouse, the area enclosed space density smoke and previous created flammable substances.
- Smoke detector is divided into two main categories as follows:

14.4.1. Smoke detector point.

Installed in areas where the scope of monitoring small, low ceiling (office, apartment ...)
a. Smoke detector Ion: The equipment creates flow of positive ions and negative ions motion, when there is smoke, smoke would impede the movement of positive ions and negative ions, from which the device will send alarm signals to the central processor.

b. Optical smoke detector (photo): The device includes a pair of detectors (a first signal, a signal receiver) layout for each other, alternating between the two smoke detectors, smoke will interfere with transmission between the two signals, from which the fire alarm signal will be sent for processing center.

14.4.2. Beam smoke detector.

- Consists of a pair of devices installed at both ends of the monitored area. Equipment projector shines an infrared beam through the area under surveillance and to a receiver containing a photosensitive cell is responsible for monitoring the balance of the light beam signal. This detector operates on the principle of light blurs opposition to the principle of light scattering (smoke sensors at the detector).

- Type Beam smoke detector has a very wide operating range (15m x 100m), using appropriate in areas where the photoelectric type smoke detector proved to be inappropriate, such as in areas where smoke anticipate there will be black smoke.

- Moreover Beam detector can cope with extreme conditions of temperature, dust, excessive moisture, impurities, ... Due to the Beam form can be placed behind the glass in the window, which makes it very easy to clean, preserve.

- Beam types are usually located in areas with large monitoring range, the ceiling is too high to mount the detector points (factories, etc.)

14.4.3. Protected area of one smoke detector:

- Protected area of one smoke detector and the maximum distance between the smoke detector, between the smoke and the walls must be determined according to the table below.
Because high smoke detector installed at 2.6 m high, so I choose the protected area of less than 80 m² smoke detector and the distance between two smoke detector is 10 m. And the distance between the smoke and the walls are 5 m.

### 14.6. FLAME DETECTOR.

- As sensor ultraviolet rays emitted from the flame, the received signal, and then send the alarm signal to the center handled the discovery of fire.

- Used primarily in the areas deemed high risk, where the light of the flame is the symbol of the fire (e.g., storage of flammable liquids).

- Flame detector is very sensitive to ultraviolet rays and has been investigated in order to avoid false report. Probe only signal on the fire alarm when there is 2 sensor ultraviolet rays after the two period, each period is 5 seconds.

### 14.7 EMERGENCY SWITCH:

Be installed at conspicuous places of the hallway stairs to use as needed. This device allows the user to actively transmit alarm information by clicking or dragging on the emergency switch, emergency alert to all people present in the area are known to have measures for handling fire and move out of the danger area by the exit.

Include the following types of emergency switches:

- Emergency round, square
- Emergency glass
- Emergency hitch

14.8. FIRE BELL:

Installed in the watch room, the room staff on duty, corridors, stairs or crowded places back and forth to inform those around them know the problem is going to plan to deal reasonable, timely evacuation.

When incidents of fire, the alarm will signal the alarm to help employees recognize and protection through fire incident tracking device (display on the side) will know which area fire occurred fire, from which timely notice to the employee is responsible for fire protection troubleshoot or take appropriate remedial measures.

14.9. HORN WARNING FIRE:

Features and the installation location as the fire alarm, but the horn is used when the distance between the place of arrival to receive notification alarm too far.

14.10. LAMP:

Used for alarms, all kinds of different functions and lights are installed at appropriate locations to maximize the features of this device. Including the type of light:

14.11. EXIT LIGHT:

Placed near the stairs of each floor, to escape in case of fire. Automatic lighting in the event of AC power loss.

14.12. CORRIDOR LAMP

Be placed on the emergency switch of each floor. The fire lamp will light up when the emergency operation switch, and this is also the emergency lights for those present in the building is known. This is important, because in the confusion caused by fires, the user should clearly distinguish the work of any emergency in effect is activated fire pumps.