CHAPTER 15

FIRE SYSTEM

15.1 GENERAL

The project is a new large-scale construction work, which is mainly used for offices, restaurants and bars where many people live and work. Especially, this is a multi-storey building, so the fight against fire has certain difficulties. Because of the importance of this, investment in fire protection equipment is a very important and practical objective.

Implementing the idea, we chose the design of the fire protection system for the project. Based on the requirements of the project management board, we have studied and surveyed the characteristics of the project and the Vietnamese standards on fire safety to design fire prevention and fighting systems for the project. These include:

- Fire alarm system.
- Wall fire protection system.

15.1.1 APPLICABLE STANDARDS

  TCVN 3254: 1989 Fire safety - General requirements.
  TCVN 2622: 1995 Fire protection for houses and structures - Design requirements.
  TCVN 5738: 2000 - Fire alarm system - Technical requirements
  TCVN 4513: 1988 Internal Water Supply - Design Standards

Refer to the NFPA (National Fire Protection Association) standards for the following:

15.1.2 REQUIREMENTS FOR FIRE PROTECTION SYSTEMS FOR WORKS

Based on the fire and explosion hazards of fire prevention system projects, the following requirements must be satisfied:

a. Fire protection requirements

Fire prevention measures must be applied to minimize the possibility of fire. In the event of a fire, the fire must be detected quickly and promptly to prevent the fire from spreading to other areas causing great fire and causing serious consequences.
Fire prevention measures must ensure that when people are in the fire, people and property in the building easily evacuated to the safety area as quickly as possible.

Under any conditions, when fire occurs in areas prone to fire such as technical areas, the hall in the school must be detected immediately in the place of fire to organize timely treatment.

**b. Fire fighting requirements**

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

- Fire-fighting equipment must be ready for use in the fire-fighting mode.

- Firefighting equipment must be suitable and effective fire fighting for fires occurring in the works.

- Fire-fighting equipment equipped for the project must be easy to use, suitable to the works and conditions in our country.

- Fire-fighting equipment must be fire fighting without damage to other tools and equipment in secondary fire-fighting areas.

- Equipped fire protection equipment must ensure minimum investment conditions but maximum efficiency.

**15.2 DESIGN OF AUTOMATIC FIRE ALARM SYSTEM**

**15.2.1 GENERAL DESCRIPTION**

The design plan includes:

- Design and installation of fire alarm system for the entire project.

- Design and installation bell system, fire alarm button for the whole project.

- Design and install the emergency exit lamp (Exit) lamp incident when the incident occurred.

**15.2.2 AUTOMATIC FIRE ALARM SYSTEM**

The fire alarm system includes the following basic parts:

- The detector detects fire.

- Fire alarm button.

- Analysis modules, signal processing.

- The control center handles the information from the sensor and the hand-held press button.

- Fire alarm: horn, bell.

- Conduit system: including signal wiring and power supply wiring.

- Electricity supply.
Peripheral control devices such as fire alarm data recorders, control panel cabinets on computers, fire alarm control cabinets, elevator systems, as well as on-off devices. wind, escape door.

**15.2.3 DESIGN OPTIONS**

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

The fire bell push button on the floor is arranged in the position of many people like the area near the elevator and stairs to facilitate the observation of troubleshooting in the event of a fire. The fire button on each floor is the fire alarm button usually associated with the address module and is mounted on a single address for each floor.

The alarm is selected as the fire alarm. Fire alarms are installed in the fire alarm knob. The bell is mounted on the same power line and sends the addressing module to the fire alarm to control the operation of all the bells on the same floor.

The signal conductor for the address fire detector is a dedicated anti-interference cable with a cross section of 1.2 mm².

**15.3 FIRST FIRE PROTECTION & FIRE FIGHTING SYSTEM**

**15.3.1 OVERVIEW**

**a. Design grounds**

- Applicable Standards, Standards and References in Part II - Applicable Standards.
- Architectural drawings of the building.

**b. General description of the system**

After studying the architectural characteristics, scale, importance, nature and extent of danger of the project, the solutions for the design of the fire-fighting system for water shall include the following basic parts:

- Fire hydrant.
- Main fire pump system, spare pump, pressure compensation pump.
- Fire pump control cabinet.
- Pressure vessels, pressure gauges, pressure switches.
- Alarm valve system and flow switch.
- Stop valves, one-way valve, filter suction filter.
- Plumbing system.
- Water vents fire walls.
- Fire extinguishers outside the house.
- First-aid measures: Use ABC 9kg portable fire extinguisher (MFZL 4), 5 kg CO2 (MT3) for electrical engineering rooms.

15.3.2 FIRE FIGHTING SYSTEM WITH WATER

Fire extinguishers are supplied to the fire hydrant, using a pipe network of diameter D65-D150. D150 main pipe runs from pump station to technical box. The main shaft goes in the technical box using a D150 coated steel tube running alongside the technical box and is connected to the roof water tank. At each floor there is a main shaft D100 and will reduce to D50 when entering the cabinet

The water supply and pressure for fire mains are used between the sprinkler system and the wall fire hydrant by means of a horizontal fire pump.

At the design stage, the sprinklers are equipped with pressure gauges to check the pressure of the piping network.

Pump start-up and shutdown can be fully automatic or manual. The fire control cabinet receives the signal from the pressure switch, the flow switch to give the fire control signal to the pump fire pump cabinet. Depending on the state that the fire control cabinet decides to give the control signal to start the main fire pump, standby fire pump or pressure compensation pump. In addition, the fire alarm control panel also provides a fire alarm, a fire alarm as well as an automatic fire alarm.

When the pressure in the system drops to 90% of the preset pressure, the pressure switch will start the Jockey pump. A minimal run-time control Zole is attached to the control system to prevent the pump from being restarted continuously.

If the system pressure drops to 80% of the installed level, the pump will be stoped and the main pump will be started (one permanent pump is selected).

The power supply to the pump is taken from the priority source and is supplied by the building's generator power supply.

The whole fire-fighting system is used in conjunction with the living water tank located at the ground floor. The amount of water used for fire fighting is ensured by water level monitoring and pumping equipment.

15.3.3 FIRE FIGHTING SYSTEMS

- This is a semi-automatic fire extinguishing system. The project is used for D50 - L = 20 m, with a diameter of 13 mm with an injection flow of 2.5 l / s. a fire occurs at the same time 2 so the required flow is 5L / s. Pipes to the throats are branched from the spindle at diameters of D150 mm, or D100 mm.

- The coil must be approved and must be equivalent to the hose reel approved by the local Fire Department. The working pressure of the coil under normal conditions must be 10 bars.

- Unless indicated otherwise, the center of the throat is located at a height of 1.25 m from the ground. All the water in the fire box is placed in the wall, where the fire box is located in the glass wall, concrete walls, pipes and boxes floating outside and the tube is painted red. (layout, installation, view design drawing)
Diameter diameter of D50mm. Working pressure 16 bars. The right-angle valves meet fire safety standards on couplings, fire valves

- The instruction manual is located at the immediate vicinity of the reel in a prominent position.

<table>
<thead>
<tr>
<th>Type of fire</th>
<th>Unit</th>
<th>Flow (l/s)</th>
<th>Time (min)</th>
<th>Total traffic (l/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire inside the 50 mm hose reel</td>
<td>2</td>
<td>2.5</td>
<td>180</td>
<td>50</td>
</tr>
</tbody>
</table>

The total amount of water for fire extinguishers is \( Q = 50 \) (l/s)

- Out-of-home water supply system, because the building is located in the city, so we use fire fighting water of the city, so we do not calculate the reserve for outside the house.

### 15.3.4 SELECTION OF THE FIRE EXTINGUISHING PUMP

Working pressure of the pump

Apply the formula

\[
H_{cc} = H + H_{TT} + H_{L} \quad (1)
\]

Inside:

- \( H_{cc} \): The required pressure head of the fire pump
- \( H \): The geometric height of the throats compared to the fire pump.
- \( H_{TT} \): Pressure losses on piping.
- \( H_{L} \): Height of the water column when the head of the tombstone (equal to the height of the highest part of the building but not less than 6m + with the loss of head and the coil D50 loss of 12 mcn.

According to Vietnamese standard TCVN 4513-1998 we have

\[
H_{TT} = H_D + H_{CB} \quad (2)
\]

Inside:

- \( H_D \): Loss of pressure column length
- \( H_{CB} \): local loss head. \( H_{CB} = 10\% \ H_D \).

And

\[
H_D = L \times Q^2 \times A \quad (3)
\]

Inside:

- \( L \): The length of the pipe from the pumping station to the calculated position.
- \( Q \): Water flow in the pipeline.
- \( A \): pipe resistance factor.

From (2) and (3) we have the formula:

\[
H - TT = L \times Q^2 \times A \times 1.1
\]
• The calculation parameters for the main and wall systems are as follows:

D100 pipe segment = 50 m, coefficient A = 0.000267, loss = 36.7 m

o D50 pipe section = 4 m, coefficient A = 0.001108, loss = 12.2 m

• The pipe losses for the walls are: m

o Natural pressure losses (pipeline D150): 37 m

o Loss of hose reel: 2 m

o Leakage losses and condensation: 18 m

• plus the loss of the head of the pump is>= 105 m

Pump Specifications

So from the calculation of technical parameters of pumps on the technical parameters of the pump to use as follows:

o Electric motor fire pump has: H ≥ 105 mcn; Q = 50 l / s

o Standby pump for fire fighting: H ≥ 105 m; Q = 50 l / s

o We choose 2 pumps to fill the head: pump ETARNORM 80-250, n = 2900rpm

* (If the project has a reserve generator of sufficient capacity for the fire pump to operate, then the backup pump can be used as an electric motor pump.) In case the project does not have a separate power station, Diesel engine backup pump)

Use of common water tank with living tank.

Basic configuration of fire fighting systems for high rise buildings
15.4. REFRESHER

- It is a direct monitoring device, detecting smoke signals to transfer smoke signals to the treatment center. The time the smoke detectors receive and transmit information to the fire alarm no more than 30 seconds. Environmental density ranges from 15% to 20%. If the concentration of smoke in the environment exceeds the permitted level (10% -20%), the equipment will send an alarm signal to the center for processing.

Smoke detectors are usually located in the study rooms, halls, warehouses, areas with densely populated areas and pre-existing fumes.

- Smoke detector is divided into two main categories as follows:

15.4.1 SPECIFIC ROUND TILES

Installed in areas where the scope of supervision is small, low ceilings (offices, apartments ...).

a. Ion Smoke Detector: The device generates positive and negative ions that move in the presence of smoke and smoke, which interferes with the movement of positive and negative ions. mind processing.

b. Photo smoke detector (photovoltaic): The equipment consists of a pair of detectors (one transmitter, one receiver) arranged opposite, when there is smoke between the two alarm, smoke will obstruct the transmission. the signal between the two alarms, from which the alarm will send a fire signal to the central processing.

15.4.2 BEAM TYPE REQUIREMENTS

- Include a pair of equipment installed at both ends of the area to be monitored. The projection device emits an infrared beam through the area of the surveillance area and then to a receiving device containing a photosensitive cell that monitors the signal balance of the light beam. This detector operates on the principle of blurring the light as opposed to the principle of scattering light (smoke in the head).

- Beam smoke detectors have a very wide range (15m x 100m), suitable for use in areas where photoelectric smoke detectors are unsuitable, such as in places where smoke is present. Will there be black smoke?

In addition, the Beam head can withstand extreme temperatures, dust, excessive humidity, impurities, etc. Due to the Beam head can be placed behind the glass window., it is easy to clean, preserve.

- Beam detectors are usually installed in areas with large monitoring range, too high ceiling can not install point detectors (factories ...)

15.5 HEAT TUBE

- The heat detector is used to detect the temperature of the environment within the protection range, when the temperature of the environment does not meet the requirements of the manufacturer's prescribed heaters, it will signal. An alarm sent to the processing center.

- Heat detectors are installed in places where smoke detectors can not be installed (where appliances, garages, kitchens, factories, kitchens, etc. are installed).
15.5.1 FIXED FIXED HEATER

This type of alarm is triggered and the alarm signal generated when the temperature in the air around the alarm head increases to the manufacturer's specified level (57°C, 70°C, 100°C ...).

15.5.2 INCREASED HEAT TUBE

This type of alarm is triggered and emits an alarm signal when the ambient air temperature sensor is suddenly increased by approximately 9 °C / min.

15.6 FIRE ALARMS

It is a device that senses ultraviolet light emanating from the flame, receives a signal, and sends an alarm signal to the processing center when it detects fire.

Used mainly in places where there is a high risk of fire, where the light of the fire is a sign of fire (eg, flammable liquid storage).

- The fire detector is very sensitive to ultraviolet light and has been investigated to avoid false alarms. The probe only sends an alarm signal to the fire control center when there are two ultraviolet induction pulses after two intervals, each period of 5 seconds.

15.7 EMERGENCIES

Installed in the visible areas of the corridor for use when needed. This device allows the user to actively transmit fire alarms by pressing or pulling on emergency switches, emergency alarms for anyone present in the area known to have fire-fighting measures and Move out of danger area by emergency exit.

The following types of emergency switches are included:
- Urgent, round
- Urgent broken
- Urgent

15.8 FIRE ALARM

Installed in a security room, rooms with concierge staff, corridors, stairs, or crowds of traffic are available to inform those around you who may be experiencing the problem. timely evacuation.

In the event of a fire incident, the alarm will sound an alarm that will allow the security guard to identify and by means of a fire alarm monitor (the secondary display panel), which area will be exposed to the fire, from time to timely notify the staff responsible for fire prevention and fighting to overcome the problem or take appropriate measures.

15.9 FIRE REPLACEMENT

It has the same features and installation location as the fire alarm, but the whistle is used when the distance between the place of notification and the place where the alarm message is received is too far away.

15.10 LAMP

There are alarming signals, each type of lamp has different functions and is installed in the appropriate position to maximize the features of this device. Composed of lamps:

15.11 LIGHTING LENS

Placed near the stairs of each floor, indicating the exit in the event of a fire. Automatic illumination in case of AC power loss.
15.12 LIGHT FIRE

Placed above the emergency switch of each floor. The fire alarm will light up when the emergency works, and this is also an emergency light for those present in the building. This is important because, during the confusion caused by the fire, the user needs to clearly distinguish the emergency work that has triggered the fire pump.