

**STUDY MATERIAL FOR THE  
CONSOLIDATED CERTIFICATE OF FITNESS EXAMINATION  
FOR MAINTENANCE AND SUPERVISION OF INTERIOR AND MARINAS FIRE  
ALARM SYSTEMS**

**F-90**

**(Revised 021100)**

This study material will help you prepare for the examination for the Certificate of Fitness for Fire Alarm Systems. The study material includes information taken from the Fire Prevention Code and the Fire Prevention Directives of the Bureau of Fire Prevention, NYFD. The study material does not contain all of the information you need to know to perform your job. It is your responsibility to learn anything else that is needed to work with fire alarm systems. It is also your responsibility to become familiar with all applicable rules and regulations of the City of New York, even if they are not covered in this material.

All questions on the Certificate of Fitness examination are multiple choice, with four alternative answers to each question. Only one answer is correct for each question. If you do not answer a question your answer will be scored as incorrect. A score of 70% correct is required on the examination in order to qualify for the Certificate of Fitness. Read each question carefully before marking your answer. There is no penalty for guessing.

### Sample Questions

**1. Who was the first President of the United States?**

- (A) George Jefferson.
- (B) George Washington.
- (C) Bill Clinton.
- (D) Jesse Jackson.

The correct answer is **"B"**. You would press **"B"** on your computer terminal.

**2. The city in the United States referred to as The Big Apple is:**

- (A) Los Angeles.
- (B) Buffalo.
- (C) Florida.
- (D) New York.

The correct answer is **"D"**. You would press **"D"** on your computer terminal.

## FIRE ALARM SYSTEMS

Fire alarm systems are required in many premises as part of a fire protection system. For example, alarm systems are required in hotels, motels, shelters, hospitals, office buildings and marinas. If a fire emergency occurs the alarm system warns the occupants of the premises. Loud sirens, gongs or bells are used to signal when there is a fire. Some fire alarm systems also use flashing lights. The sirens, gongs, bells and flashing lights are commonly called the signaling devices. A signal indicating that there is a fire may be sent directly to the Fire Department or may also be sent to an approved central station company.

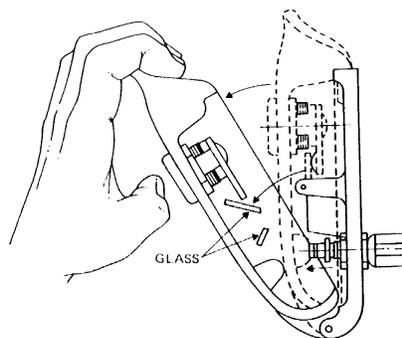
### DESCRIPTION OF THE FIRE ALARM SYSTEM

#### Manually activated fire alarms

Some fire alarms are activated automatically. Special sensors detect heat or smoke and sound an alarm. Other fire alarms must be activated manually. A person who notices a fire emergency must activate the alarm by hand. Fire alarms that are manually activated use fire alarm stations. Fire alarm stations are usually located near the natural exits from a building. There must be at least one manual fire alarm station on each floor of a building.

There are two types of manual fire alarm stations. They are called **single action** and **double action** stations.

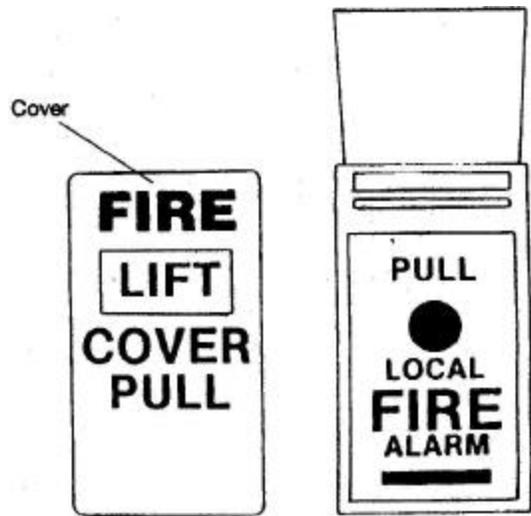
**Single action stations.** Single action stations require only one step to activate the alarm. For example, the alarm might be activated by pulling down on a lever. An example of a single action station is shown below. This kind of alarm station is often found indoors, e.g., in office buildings. The cover on these alarm stations serves as a lever. When the cover is pulled down, it allows a switch inside to close. This sends the alarm signal. Another kind of single action breakglass station requires someone to break a small pane of glass with a small metal mallet.



#### Single Action Station

**Double action stations.** Double action stations require two steps in order to activate the alarm. The user must first break a glass, open a door or lift a cover. The user can then gain access to a switch or lever which must then be operated to initiate an alarm. To activate this type of alarm

station the cover must be lifted before the lever is pulled. This kind of double action station is often found indoors.



**Double Action Stations**

The alarm stations used to activate the fire alarm system are called initiating devices. The Certificate of Fitness holder must know how to manually operate each alarm station on the premises. Once activated, the fire alarm system can not be shut off at the fire alarm station. The alarm must be shut off at a main control panel using a special key. This key must be located near the control panel at all times. The alarm may be turned off only by a Certificate of Fitness holder or by a Fire Department representative.

A silencing switch may be installed in the fire alarm system. Under special circumstances the silencing switch may be used to turn off part of the system. For example, the silencing switch may be used to turn off the sirens and bells after the building has been evacuated. However, the silencing switch does not prevent a signal from being transmitted to a central station company.

All fire alarm stations installed or relocated after April first, nineteen hundred eighty-four should be installed so that the handle is approximately four feet from the floor.

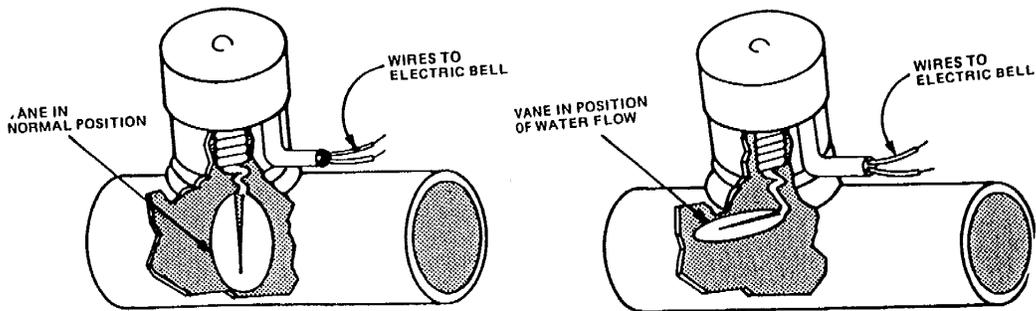
### **Automatically activated fire alarms**

Automatic fire alarm systems sound a signal when a fire detection device indicates that there is a fire. Special sensors detect heat, smoke or the flow of water. These sensors are the initiating devices in automatic fire alarm systems. A few of the more common initiating devices are described below.

**Waterflow indicators** are designed to signal when water flows through the fire protection system. For example, a waterflow indicator signals when water flows through the piping in a sprinkler

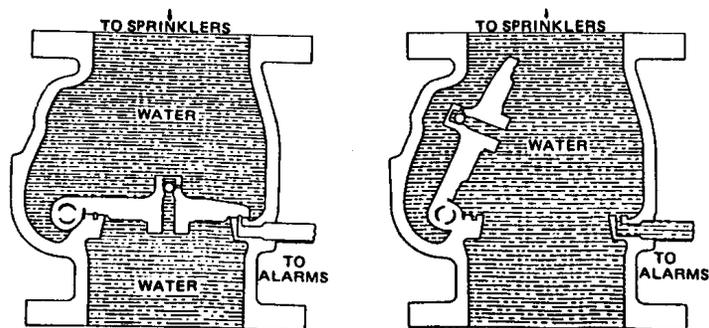
system. Waterflow in the sprinkler system may be detected using one of two methods. These methods use vane type waterflow indicators or special check valves.

**Vane type indicators** are installed inside the piping of the fire protection system. When the water flows through the piping it moves the vane. The movement of the vane causes a signal to be transmitted to the alarms. When the signal is transmitted the alarm is sounded. A signal may also be transmitted to a central station company. An example of a vane type indicator is shown below. The figure on the left shows the vane position when water is not flowing through the piping. The figure on the right shows the position of the vane when water flows in the piping. When the vane moves it closes a switch and a signal is sent.



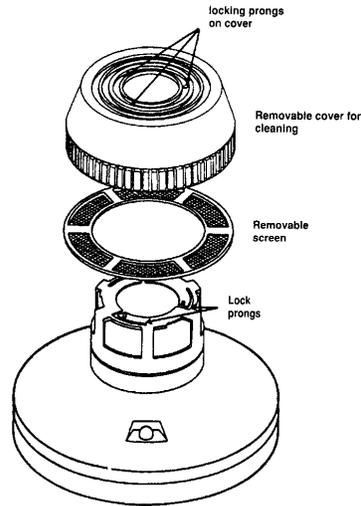
**Vane Type Waterflow Indicator**

**Check valves** are designed to detect when water flows into the fire protection system's piping. The check valve indicators are usually installed close to the main control valve, or at the location where the water supply enters the fire protection system. A clapper mechanism is located inside the check valve. Under normal conditions the clapper is in the closed position. When in the closed position the clapper prevents water from flowing into the piping. The clapper mechanism opens when there is a demand for water in the fire protection system. For example, the clapper will open when a sprinkler head opens to discharge water. When the clapper opens it allows water into the system's piping. It also allows water to flow into a chamber that leads to the waterflow gong. When the water flows into this chamber it causes the gong to sound. An illustration of a check valve is shown below.



**Check Valve with a Connection to the Waterflow Gong**

**Smoke detectors** sound an alarm when smoke is detected in the building. Smoke detectors have been shown to be very effective in reducing fire damage. An example of a smoke detector is shown below.

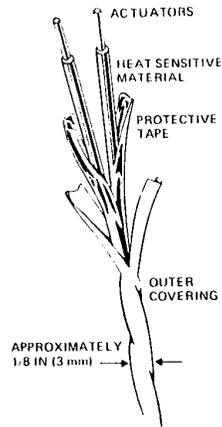


**Smoke Detector**

Smoke detectors may be installed on walls or ceilings. When installed on the wall they must be located between 4 and 12 inches from the ceiling. When installed on the ceiling they must be located at least 4 inches from the wall. The smoke detectors must also be located at least 3 feet from any heating vents. This prevents the air coming from the vents from blowing the smoke away from the detectors. The smoke detectors should never be installed in the corner of a room. In multistory buildings smoke detectors must be installed on every landing in the stairwell.

**Heat Detectors** are sensors that detect high temperature levels. There are two types of heat detectors, fixed-temperature and rate-of-rise detectors. The fixed-temperature heat detectors are most commonly used. The detectors consist of two electrical contacts housed in a protective unit. The contacts are separated by a fusible element. The element melts when the temperature in the room reaches a preset level. This allows the contacts to touch. When the contacts meet the detector activates the fire alarm. The fixed-temperature heat detectors must be replaced after they have sounded an alarm.

An example of a fixed-temperature heat detector is shown in the illustration on the following page. This kind of detector is called a line type heat detector. This detector uses a pair of wires in a small cable. The wires are held apart by heat sensitive insulation. When the temperature limit is reached, the insulation melts. When this happens the wires touch and an alarm is initiated. After an alarm the fused section of the cable must be replaced to restore the system.



### Line Type Heat Detector

**The rate-of-rise heat detectors** activate the alarm when the room temperature increases at a certain rate. This kind of detector is more sensitive than the fixed temperature detector. The rate-of-rise heat detector does not have to be replaced after it has activated the fire alarm.

Regardless of what kind of detector is installed, heat detectors require special attention. All heat detectors must be carefully installed according to the manufacturer's instructions.

### Supervisory Devices

Supervisory devices are commonly installed as part of some protection systems. The supervisory devices monitor important parts of the system. An alarm such as a bell will be sounded when there is a problem or trouble with part of the system. For example, a signal will be sounded when a control valve is damaged or when it is in the wrong position. This kind of signal is commonly called a trouble signal or trouble bell. The trouble signal is always transmitted to the main control panel. When a trouble bell starts to ring the Certificate of Fitness holder should check the system in order to identify the part of the system that caused the trouble signal. Then that part of the system should be repaired immediately. The trouble signal may be transmitted to a central station company as well.

Some control panels indicate the exact location of the trouble. Other panels only display a general trouble signal. For example, a lighted panel might indicate only that there is a problem somewhere in the fire protection system. Each supervised device must then be inspected to determine which part is causing the trouble signal. When a trouble signal is detected the Certificate of Fitness holder must make sure that the problem is corrected. Some parts of the fire protection system that are commonly supervised are:

- (a) Water control valves
- (b) Water temperature in gravity and pressure tanks
- (c) The water level in the gravity and pressure tanks
- (d) The pressure level in the tanks
- (e) The power supply for the fire pump

## Power Supply

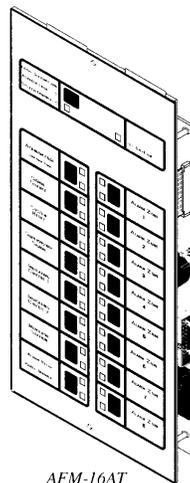
The main power supply for a fire alarm system may be provided by the local utility or by an engine driven generator. Connection to a local utility should be on a dedicated branch circuit. The primary power supply should be supervised and its failure indicated by a distinctive trouble signal. The fire alarm system should also have a reliable secondary (standby) power supply. The secondary supply should provide power to the alarm system within 30 seconds of failure by the primary power supply. Storage batteries or engine driven generators can provide standby power for the system.

## Transmission of Alarm Signals

There are three methods used to notify the occupants of a building in case of a fire. The first method is the general alarm method. This method activates all signaling devices throughout the building when a fire is discovered. The second method is the selective method. The selective method activates the signaling devices only in areas close to the fire. The third method is the pre-signal system. The pre-signal method sends a signal to a control panel or a manned station. When the signal is detected the Certificate of Fitness holder must investigate the cause of the alarm. When a fire is discovered the Certificate of Fitness holder must manually activate the general fire alarm. The alarm is activated by inserting a key into the manual fire alarm station.

After the fire alarm system has been activated it must be reset manually. The Certificate of Fitness holder must reset the alarm. The fire alarm system must be reset at the control panel. The fire alarm must remain in operating condition at all times unless the building is vacated for more than one week.

**Annunciator panels** are sometimes installed in large buildings. The annunciator panel is used to monitor the fire alarm devices in a designated fire zone. There may be several fire zones in a building. Each fire zone is marked clearly on the panel. When a fire occurs an indicator light flashes on the panel. The indicator light identifies the location of fire. For example, the light on the panel might indicate that a fire has occurred in Fire Zone 2. This information allows the Fire Department to quickly locate the fire. An example of a typical annunciator panel is shown below.



AFM-16AT  
**Annunciator Panel**

## Communication System

A dependable communication system is required as part of the fire alarm system. A two-way communication system is required in some fire alarm systems. Usually a type of telephone system is installed. Telephones must be placed at several locations in the building. The telephones are usually located in elevators and next to the stairways in the building. A telephone must also be installed in a command center. The command center is used to issue instructions during a fire emergency. Portable two-way radios may also be used as a means of communication.

Some buildings also have a public address system installed. The public address system may be used to warn and instruct building occupants in case of a fire emergency. All communication systems may be used to issue evacuation instructions in case of an emergency.

### REQUIREMENTS AND DUTIES

The Certificate of Fitness holder must know the telephone numbers of the local Fire Department and the Fire Department Borough Communication Office. The borough phone numbers are listed below.

<b>Manhattan</b>	<b>(212) 999-2222</b>
<b>Queens</b>	<b>(718) 999-5555</b>
<b>Bronx</b>	<b>(718) 999-3333</b>
<b>Staten Island</b>	<b>(718) 999-6666</b>
<b>Brooklyn</b>	<b>(718) 999-4444</b>

These phone numbers must be posted near the phones most likely to be used in case of an emergency.

### Testing and Inspections

A Certificate of Fitness holder must supervise the operation and testing of the fire alarm system. **Each fire alarm system must be tested every morning immediately after the hours of starting work.** The fire alarm system may also be used when conducting fire drills. **The Certificate of Fitness holder must make sure that all signaling devices are working correctly.** Special permission must be obtained to use fire alarm system to signal the end of the workday. This permission may be granted by the Fire Commissioner. However, the fire alarm may not be used for any other purpose.

**Initiating devices must be tested by a Certificate of Fitness holder at least once a month.**

These devices are tested by activating them in their normal manner. For example, the exterior fire alarm must be activated by pulling down on the lever. It is not necessary to test all devices individually. Instead, one initiating device of each type must be tested each month. A record must be kept to make sure that a different device is tested each time.

**Two-way communication systems must be tested at least once every three months.** The Certificate of Fitness holder must make sure that all communication units are working correctly. If

a telephone system is used a signal should sound at the command center as soon as the receiver is lifted from the cradle.

**Smoke detectors must be tested at least once every six months.** When testing smoke detectors follow the directions of the maker of the smoke detector carefully. All smoke detectors must be reset at least once a year. This procedure makes sure that the detector is kept in good working condition.

**Heat detectors must also be tested.** Rate-of-rise detectors may be tested using a hair dryer or a heat lamp. The rate at which the temperature increases will be detected. The fire alarm will be activated when the rate of increase is higher than acceptable levels. When a defective detector is discovered it must be replaced immediately.

**Fixed temperature heat detectors *may not* be tested using heat.** Using a heat source would melt whatever is used to separate the electrical contacts. Then the detector would have to be replaced. Instead special testing methods are used. For example, heat detectors housed in a protective unit are tested by using insulated wire alligator clips. First the detector is removed from the protective box. Then a clip is connected to each of the electrical contacts inside the detector. The fire alarm will sound if the detector is working correctly. If the detector is satisfactory the detector is replaced in the protective box. **Fixed rate detectors must be tested every 15 years.**

**Supervisory devices must be tested at least once a year.** They are tested by disconnecting the appropriate wires from the control panel. A trouble signal should light up at the control panel when the wires are disconnected. When the trouble signal sounds the supervisory device is working correctly. The Certificate of Fitness holder must then reconnect the wires.

**The entire fire alarm system must be visually inspected at least once a month.** This inspection must be conducted by the Certificate of Fitness holder. Defective equipment must be replaced immediately.

**The lights on the control and annunciator panels must be inspected monthly.** The Certificate of Fitness holder must manually activate each of the lights on the panel. If any defective bulbs are discovered they must be replaced immediately. When a emergency power generator is installed the generator must be checked monthly.

**A silent test may also be conducted on some fire alarm systems.** This method determines if the entire system is functioning properly. If a defect is discovered a signal will sound. It also sends a signal to the Fire Department and the central monitoring station. The Fire Department and the central station must be notified before making the silent test. Then the Certificate of Fitness holder must make sure that the signal was received. A special key on the control panel is used to conduct the silent test.

A record of all tests, inspections, fire drills and other operations of the fire alarm system must be noted in a testing log. The Certificate of Fitness holder is responsible for this log. The Certificate of Fitness holder must keep the log in a safe location inside the building. The log must be made available to any representative of the Fire Department.

If any defects are discovered the Certificate of Fitness holder must have the defects repaired immediately. When the fire alarm system is shutdown during repairs a sign must be posted. This sign must indicate that the fire alarm system is not in operation. These signs must be posted at the fire alarm stations inside the building. The Certificate of Fitness holder must notify all occupants in the building that the system is shutdown. The Fire Department must also be notified. This will allow the Fire Department to modify the fire protection strategy for the building. The Fire Department may conduct inspections of the fire alarm system. Summonses may be issued if any violations are discovered.

## **Maintenance**

The Certificate of Fitness holder must make sure that all parts of the fire alarm system are kept in good working order. When defects are discovered the Certificate of Fitness holder must have the defects repaired immediately. All repairs must be performed only by a licensed contractor.

When break glass fire alarms are installed the Certificate of Fitness holder must make sure that an extra supply of glass plates is kept available. At least one extra glass plate is required for each fire alarm station. These extra glass plates must be stored on the premises.

Smoke detectors must be cleaned regularly. Care must be taken when cleaning the smoke detectors. The detectors are extremely sensitive and easily damaged.

The fire alarm stations and related equipment must never be painted. The paint may prevent the equipment from working properly. For example, a smoke detector may not be able to detect smoke after it has been painted.

Whenever a building is remodeled the fire alarm system must be checked to make sure that it is working correctly. For example, the system must be checked whenever partitions or walls are erected or taken down. When the fire alarm system has been damaged it must be repaired immediately. **The Fire Department must be notified when any changes are made to the fire protection system.**