FIRE DEPARTMENT • CITY OF NEW YORK

STUDY MATERIAL FOR THE

CERTIFICATE OF FITNESS FOR:

INSPECTION, CLEANING & TESTING OF SMOKE DETECTORS

S-78 (CITYWIDE) / F-78 (PREMISES RELATED)

*****IMPORTANT INFORMATION:**
NEW TEST REQUIREMENTS FOR W-78/F-78 MAINTENANCE OF SMOKE DETECTORS. PRIOR TO RENEWAL, CURRENT HOLDERS OF W-26 AND F-57 MUST TAKE THE NEW EXAM. THE PREVIOUS CATEGORIES ARE VALID UNTIL THE EXPIRATION DATE. CURRENTLY ISSUED W-26 and F-57 C of Fs ARE VALID UNTIL THEIR EXPIRATION DATE.

ALSO INCLUDED IN THIS BOOKLET YOU WILL FIND THE FOLLOWING:

NOTICE OF EXAMINATION (NOE)

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NOTICE OF EXAMINATION

TITLE:
Examination for Certificate of Fitness for Cleaning and Testing of Smoke Detectors (**S-78/F-78**).

DATE OF TEST:
Written tests are conducted Monday to Friday (except legal holidays) 8:30 AM to 2:30 PM.

QUALIFICATION REQUIREMENTS

1. Applicants must be at least 18 years of age.
2. Applicants must have a reasonable understanding of the English language.
3. Applicant must provide two forms of identification, at least one identification must be government issued photo identification, such as a State-issued Drivers' License or Non Drivers License or a passport.
4. Applicants must present a letter of recommendation from his/her employer. The letter must be on official letterhead, and must state the applicant's full name, experience and the address where the applicant will work. If the applicants are self-employed or the principal of the company, they must submit a notarized letter attesting to their qualifications. The sample letters are available at the link below http://www.nyc.gov/html/fdny/html/c_of_f/cof_requirements.shtml or the Public Certification Unit, 1st floor, 9 Metrotech Center, Brooklyn.
5. Applicants not currently employed may take the test without the recommendation letter. If the applicants pass the test, FDNY will issue a temporary letter with picture for the job seeking purpose. The C of F card will not be issued unless the applicants are employed and provide the recommendation letter from his/her employer.
6. **Special Requirement for F-78 C of F:** The letter of the recommendation shall be from building owner which must state that the employee will have the necessary tools to perform the smoke detector inspection, testing and cleaning.
7. **Special Requirement for S-78 C of F:** Applicants must be an employee of a FDNY approved smoke detection company.

APPLICATION FEE

Application Fees: $25 for originals. Renewal fee for S-78/F-78 is $15. The fee may be paid by cash, money order, credit card, debit card or personal check made payable to the New York City Fire Department. The $25 fee must be paid by all applicants prior to taking the Certificate of Fitness test.

Application Forms: Application forms are available at the Public Certification Unit, 1st floor, 9 Metro Tech Center, Brooklyn, NY 11201.

On November 15, 2012, the FDNY will be implementing a new S-78/F-78 Certificate of Fitness examination which will **replace** the current W-26/F-57 test. Current holders must pass the S-78/F-78 test to renew their Certificates. For more detailed information about this change, and to obtain the NEW S-78/F-78 Study Guide, please visit **http://www.nyc.gov/html/fdny/html/c_of_f/cof_study_materials.shtml**

RENEWAL REQUIREMENTS FOR S-78/F-78

You will receive a courtesy notice of renewal 90 days before the expiration date. For renewal, send the renewal notification or a letter stating the C of F # with a fee of $15, money order or personal check payable to "Fire Department City of New York" to:

FDNY (Cashier's Unit)
9 MetroTech Center,
Brooklyn, NY 11201

Late renewals (90 days after the expiration date, up to 1 year) will incur a $ 25 penalty in addition to the renewal fee. Certificates expired over one year past expiration date will not be renewed. New tests will be required. FDNY also reserves the right to require the applicants to take a re-examination upon submission of renewal applications.

TEST INFORMATION

The test S-78/F-78 will consist of **25** multiple-choice questions, administered on a "touch screen" computer monitor. It is a time-limit test. A passing score of at least 70% is required in order to secure a Certificate of Fitness. Call (718) 999-1988 for additional information and forms.

WEBSITE

Please always check for the latest revised booklet at FDNY website before you take the test, the Certificate of Fitness Study Material link, below
http://www.nyc.gov/html/fdny/html/c_of_f/cof_study_materials.shtml

STUDY MATERIAL AND TEST DESCRIPTION

ABOUT THIS BOOKLET

The study material in this booklet will help you prepare for the examination for the **Certificate of Fitness for Testing and Cleaning of Smoke Detectors (S-78/F-78)**.
***NOTE: THIS STUDY MATERIAL WILL NOT BE PROVIDED TO YOU DURING THE TEST.**

The study material includes information taken from the New York City Fire Code (FC) Chapter 9, Fire Department Rules Chapter 9, and applicable NFPA Standard 72, (2002 Edition). It is important that you read **AND** understand this booklet in order to increase your chance of passing the computer exam. The study material **DOES NOT** contain all of the information you need to know in order to clean and test smoke detectors. It is **your responsibility** to become familiar with all applicable information needed to do your job, including rules and regulations of the City of New York, even if they are not covered in this material. Please check for the latest revised booklet at FDNY website, the Certificate of Fitness Study Material link, below
http://www.nyc.gov/html/fdny/html/c_of_f/cof_study_materials.shtml

About the Test

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 or mark more than one alternative your answer will be scored as incorrect. A score of **70%** correct is required on the examination in order to secure a Certificate of Fitness. Read each question carefully before marking your answer. There is no penalty for guessing.

Sample Questions

1. A smoke detector is a device that detects:
(A) visible particles of combustion only.
(B) invisible particles of combustion only.
(C) both visible and invisible particles of combustion.
(D) particles of combustion with high temperatures.
The correct answer is "**C**". You would press "**C**" on your touch screen computer monitor.

2. Smoke detectors:
(A) require regular cleaning and testing.
(B) are used where heat detectors cannot be installed.
(C) are usually cleaned with soap and fluids.
(D) all of the alternatives given are correct.
The correct answer is "**A**". You would press "**A**" on your touch screen computer monitor.

INTRODUCTION

A Fire Alarm System is any system arranged to monitor and alert the status of fire alarm or supervisory signal-initiating devices.

The **purpose** of fire alarm systems shall be primarily to: (NFPA 72, 4.2)

1. **Provide notification of fire alarm, supervisory, and trouble conditions;**
2. **Alert the occupants;**
3. **Summon aid;**
4. **Control fire safety functions.**

Smoke detectors are part of the fire alarm system. Fire alarm and fire alarm detection systems shall be operated, maintained, tested and cleaned in accordance with Fire Code, Section 901, the NYC Fire Rules and NFPA 72, 2002 edition (FC 907.20). Testing shall be performed in accordance with the schedules in NFPA 72 or more frequently where required by the commissioner (FC 907.20.2).

Any fire protection system or portion thereof not required by the NYC Fire Code, the Fire Rules or the construction codes, including the Building Code, may be installed to provide partial or complete protection of a building or structure, provided such system meets the requirements of the Fire Code, Fire Rules and the construction codes including the Building Code, as applicable. Where the design and installation of such fire protection system is governed by NYC Fire Code or the Fire Rules, the commissioner may modify such requirements. They may be modified as long as they are consistent with the interests of fire safety (FC 901.4.2). The standard provided by Underwriters Laboratory (UL) that addresses system smoke detectors is UL 268.

Whether a building is required to be provided with a fire alarm system or not, the type of fire alarm system required and the standard for such installations, are set forth in the Building Code. Where required by Section 901 of the NYC Fire Code, the required testing and inspection of fire alarm systems shall comply with NFPA standard 72 (as modified by appendix BC 106Q) and New York City Fire Rules.

The owner of any premises, or part thereof, monitored by a fire alarm system or sub-system thereof, shall be **responsible** for preventing **unnecessary** and **unwanted alarms** as set forth in the NY Fire Rules. Cleaning and testing of smoke detectors shall be performed and records maintained for smoke detectors installed in a defined fire alarm system as required by the Fire Rules.

DEFINITIONS

ACCESSIBILITY: As defined in NFPA admitting close approach: not guarded by locked doors, elevation, and other effective means.
ALARM NOTIFICATION APPLIANCE: A fire alarm system component, such as a bell, horn, speaker, light, text display or vibration device that issues an audible, tactile, and/or visual alert.
ALARM SIGNAL: A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.
APPROVED CENTRAL STATION COMPANY: A central station company that has been issued a valid certificate of operation from FDNY.
CENTRAL STATION: A facility that receives alarm signals from a protected premises and retransmits or otherwise reports such alarm signals to the Fire Department.
DEFINED FIRE ALARM SYSTEM: A fire alarm system or any sub-system thereof that automatically transmits signals to the department or a central station and that is installed in premises which are required to have a fire alarm system.
DESIGNATED REPRESENTATIVE: A person or entity designated by the subscriber who shall be responsible for receiving notifications from the central station company concerning the status of the protective signaling system at the protected premises and who is authorized to take action with respect to such system.
FIRE ALARM CONTROL UNIT (FACP, FCS): A system component that receives inputs from automatic and manual fire alarm devices and is capable of supplying power to detection devices and transponder(s) of off-premises transmitter(s). The control unit is capable of providing a transfer of power to the notification appliances and transfer of condition to relays of devices.
FIRE ALARM SIGNAL: A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, water-flow switch, or other device whose activation is indicative of the presence of a fire or fire signature.
FIRE ALARM SYSTEM: Any system, including any interconnected fire alarm sub-system, of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices.
FIRE PROTECTION SYSTEM: Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof, including fire extinguishing systems, fire alarm systems, sprinkler systems and standpipe systems.
IMPAIRMENT COORDINATOR: The person responsible as designated by the owner for ensuring that proper safety precautions are taken when a fire protection system is out of service.
INITIATING DEVICE: A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch.
SMOKE DETECTOR MAINTENANCE: Work, including, but not limited to, repair, replacement, and service, performed to ensure that equipment operates properly.
NUISANCE ALARM: Any alarm caused by mechanical failure, malfunction, improper installation, or lack of proper maintenance, or any alarm activated by a cause that cannot be determined.
PLENUM: The open space that carries air between the ceilings and floor above.
PROTECTED PREMISES: A building, occupancy or structure located in the city that is equipped with a fire alarm system that transmits an alarm signal to the department or a

central station that monitors such system for the purposes of reporting fire alarms to the department, whether or not the installation of such system on the premises is required by law.

SINGLE-STATION SMOKE ALARM: An assembly incorporating the detector, the control equipment, and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

SMOKE ALARM: A single- or multiple-station alarm responsive to smoke and not connected to a fire alarm system.

SMOKE DETECTOR: A listed device that senses visible or invisible particles of combustion that is connected to a fire alarm system.

SMOKE DETECTOR MAINTENANCE COMPANY CERTIFICATE: A certificate issued by the commissioner to a person engaged in the business of performing smoke detector cleaning and testing, which authorizes such person to engage in such business and supervise the performance of such cleaning and testing by certificate of fitness holders.

UNNECESSARY ALARM: An alarm signal transmitted by a fire alarm system which functioned as designed, but for which a department response proved unnecessary. An example of an unnecessary alarm is an alarm triggered by smoke from a lit cigarette in a non-smoking area, when the presence of such smoke does not implicate fire safety concerns.

UNWARRANTED ALARM: An alarm signal transmitted by a fire alarm system which failed to function as designed as a result of improper installation, improper maintenance, malfunction, or other factor. Examples of unwarranted alarms are alarms resulting from improper smoke detector placement, improper detector setting for installed location, lack of system maintenance, and control panel malfunction.

CERTIFICATE OF FITNESS

The smoke detector cleaning and testing required by this booklet shall be performed by a person holding a Certificate of Fitness (C of F) S-78/F-78, additionally S-97/T-97/S-98 holders can also perform duties described in this guide. (FR, 907-01, E2). Smoke detector cleaning and testing may be performed by an employee of the owner of the premises. That individual shall possess a proper Certificate of Fitness for smoke detector cleaning and testing. He/she should possess the tools, instruments or other equipment necessary to perform such services in accordance to the Fire Code and the Fire Rules (FC 901.6.3.4). S-78 C of F holders shall be a qualified person working for an FDNY approved company.

Individuals qualified to clean and test a smoke detector system may not be qualified to install or repair the system. When the approved company certificate expires, and if the company does not renew its certification, the person working for the company will no longer be able to perform the work.

The FDNY certifies individuals in different aspects of fire alarm systems. There are several Certificate of Fitness categories: S-78/F-78: (Cleaning and Testing of Smoke Detectors), S-95 (Supervision of Fire Alarm System), S-97/T-97/S-98 (Fire Alarm System Inspection, Testing and Service Technician) C of Fs.

The scope of each Certificate of Fitness title differs and it is critical that holders of each category know their limitations. Holders of the S-97/T-97 or S-98 may perform the responsibilities of holders of the S-78/F-78 C of F; however, S-78/F-78 holders cannot perform the functions of an S-97/T-97/S-98 holder (see chart below). Please keep in mind that if you are a technician who is interested in performing programming, testing, inspection and servicing of fire alarm systems in the City of New York for an approved fire alarm system company, you must take the S-98 Certificate of Fitness test.

	May be performed by		
Duties can be performed by C of F Holders	**S-78/ F-78**	**S-95**	**S-97 / T-97 / S-98**
Smoke detector visual inspection	**Yes**	**Yes**	**Yes**
Smoke detector inspection, testing and cleaning	**Yes**	**NO**	**Yes**
Smoke detector maintenance	**NO**	**NO**	**Yes**
Program, service, clean, test, repair and/or replace low voltage fire alarm system components	**NO**	**NO**	**Yes**

INITIATING DEVICES

As stated in the NYC Fire Code, the term initiating device covers not only fire detection devices such as heat detectors and smoke detectors, but also other devices that monitor conditions related to fire safety (NFPA 72, 5.4.1).

Initiating devices, such as a smoke detector, shall be installed in a manner that provides accessibility for periodic cleaning and testing (Fire Code, 907.13). Accessibility is defined in the NFPA as "admitting close approach: not guarded by locked doors, elevation, and other effective means." The installer, as well as certified personnel, shall apply this to all system components requiring maintenance and where security is not an issue. If special equipment, such as a man-lift is necessary to install or maintain any detection devices, the installer shall ensure that the building owner understands that this special equipment will be needed for future testing and cleaning of those devices.

SMOKE DETECTORS

Smoke detectors detect most fires much more rapidly than heat detectors. They automatically detect a fire by sensing smoke particles. The smoke particles may be visible or invisible to the human eye. Fires are measured by their heat release rate, in kW or Btu/sec. (NFPA 72, 5.7.11)

Smoke detectors are fragile devices. Where smoke detectors are subject to mechanical damage, they shall be protected. A mechanical guard used to protect a smoke detector shall be listed for use with that detector (example pictured on the right) (NFPA, 5.4.2).

Since smoke detectors rely on the ceiling jet to convey smoke and hot combustion to the detector, any object that slows down the flow. It affects the response of the detector. Smoke detectors can be of the photoelectric (pictured below), ionization, or other approved type. (NFPA 72, 5.14.6.4)

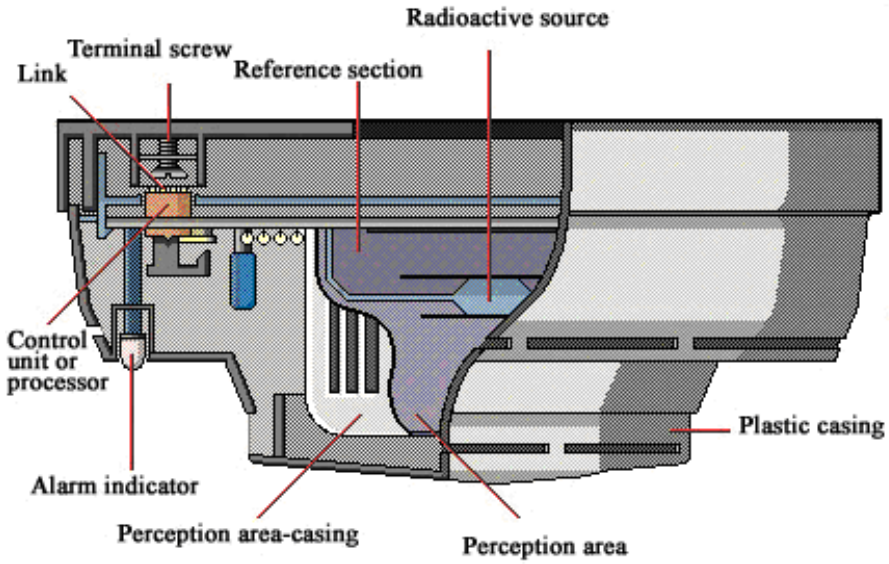
Detector **head** missing from its **base**.

Smoke detectors are helpful in **two very important ways**:

1. Smoke detectors can provide an early warning of a fire. They can warn of a fire at the earliest possible stage.

2. Occupants can evacuate the building immediately because of the early warning. (This reduces the need for later attempts to rescue occupants who have not evacuated the building.)

There are several kinds of smoke detectors. Most smoke detectors work either by optical detection (photoelectric) or by physical process (ionization) while multi-sensor detectors use both detection methods to increase sensitivity to smoke. Modern smoke detectors also may have a heat sensor built in.

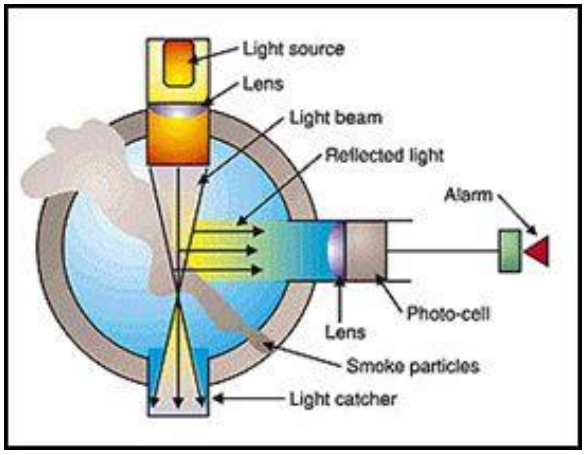


Anatomy of a typical Smoke Detector

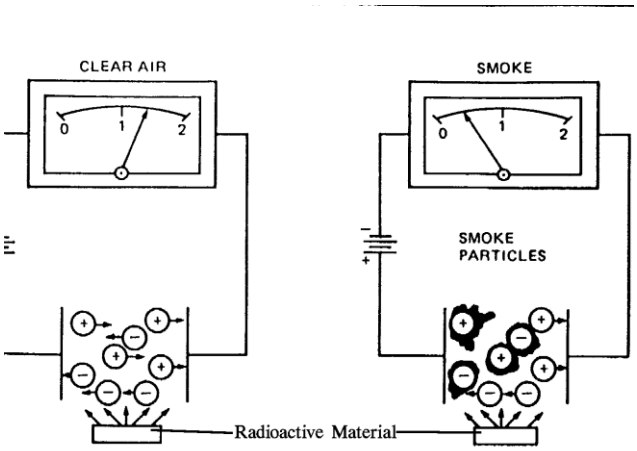
Ionization Detectors use an **ionization chamber** and a source of ionizing radiation to detect smoke. This type of smoke detector is better at detecting the smaller amounts of particles of combustion produced by flaming fires.

Ionization smoke detectors monitor '**ions,**' or electrically charged particles in the air. Air molecules in a sample chamber of ionization smoke detectors are 'ionized' by a radioactive source. This allows a small electrical current flow. Smoke particles entering the sensing chamber change the electrical balance of the air. The greater the amount of smoke, the higher the electrical imbalance. When combustion particles enter the smoke detector, they obstruct the flow of the current. When the current gets too low, the system actives the alarm.

Photoelectric detectors are better at sensing smoky fires, such as a smoldering mattress. Light from the light source in a photoelectric detector may be reflected off the walls of the sensing chamber, and be seen by the photosensitive device when no smoke is present. Insects, dirt, drywall dust, and other forms of contamination can accumulate in the sensing chamber and reflect light from the light source onto the photosensitive device; as a result detectors may cause nuisance alarms.



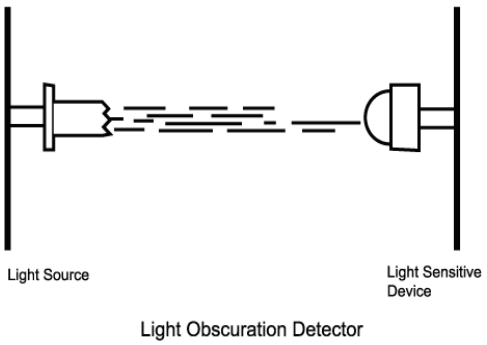
Photoelectric Detector Principle



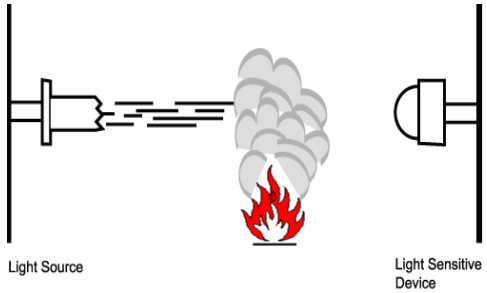
Ionization Detector Principle

<u>Projected beam-type detectors</u> shall be kept clear of opaque obstacles at all times (NFPA 72, 5.7.3.4.8). The beam length shall not exceed the maximum permitted by the equipment listing (NFPA 72, 5.7.3.4.3). The maximum beam length is determined by the maximum distance at which the detector can maintain its design stability even when some normal light obscuration is present (NFPA, 5.7.3.4.3). The beam shall be designed so that small angular movements of the light source or receiver do not prevent operation because of smoke and do not cause **nuisance alarms** (NFPA, 5.7.3.4.7). If mirrors are used with projected beams, the mirrors shall be installed in accordance with the manufacturer's documented instructions (NFPA 72, 5.7.3.4.4).

<u>Photoelectric Light-Obscuration Smoke Detectors</u> are area or projected beam-type smoke detectors and use the principle of a light source and a photosensitive sensor. When smoke particles enter the light path, some of the light is scattered and some is absorbed, thereby reducing the light reaching the receiving sensor. The light reduction signal is processed and used to convey an alarm condition when it meets preset criteria (please see images below) (NFPA 72, 3.3.180.3).



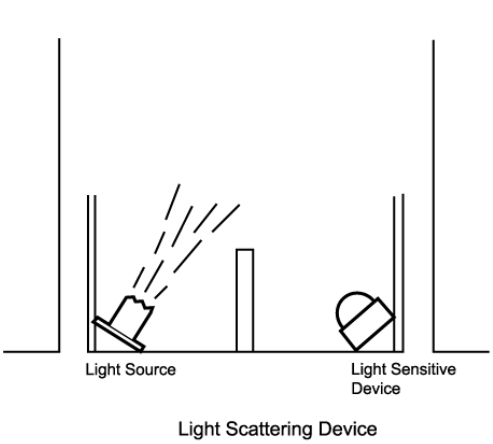
Light Obscuration Detector

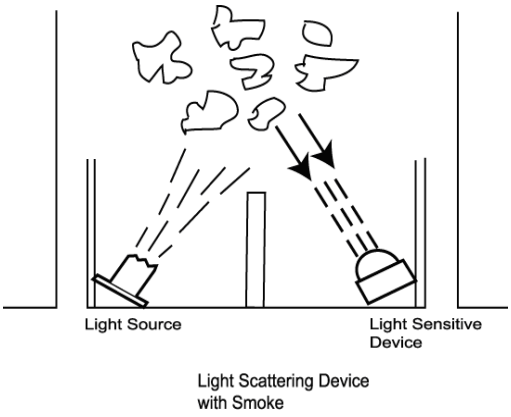


Light Obscuration Detector with Smoke

<u>Photoelectric Light-Scattering Smoke Detectors</u> are projected beam type detectors that use a light source and photosensitive light source. A photosensitive sensor is arranged so that the rays from the light source do not normally fall onto the photosensitive sensor (see images below). When smoke particles enter the light path, some of the light is scattered by reflection and refraction onto the sensor. The light

signal is processed and used to convey an alarm condition when it meets preset criteria (NFPA 72, 3.3.180.4).





Combination Sensing Technology Smoke Detectors

Multi-Criteria Detector a initiating device that contains multiple sensors that separately respond to physical stimulus such as heat, smoke, or fire gases, or employs more than one sensor to sense the same stimulus. This sensor is capable of generating only one alarm signal from the sensors employed in the design either independently or in combination. The sensor output signal is mathematically evaluated to determine when an alarm signal is warranted. The evaluation can be performed either at the detector or at the control unit. This detector has a single listing that establishes the primary function of the detector. (2010 NFPA 72, 3.3.59.12)

Multi-Sensor Detector a device that contains multiple sensors that separately respond to physical stimulus such as heat, smoke, or fire gases, or employs more than one sensor to sense the same stimulus. A device capable of generating multiple alarm signals from any one of the sensors employed in the design, independently or in combination. The sensor output signals are mathematically evaluated to determine when an alarm signal is necessary. The evaluation can be performed either at the detector or at the control unit. This device has listings for each sensing method employed. (2010 NFPA 72, 3.3.59.12)

Combination Detector a device that either responds to more than one of the fire conditions or employs more than one operating principle to sense one of these conditions. Typical examples are a combination of a heat detector with a smoke detector or a combination rate-of-rise and fixed-temperature heat detector.
Normally, a "Combination Detector" provides a single response from either sensing method, each of which operates independent of the other. This device has listings for each sensing method employed.

Smoke detector features that increase their ability to provide fire protection.

1. Addressable System Smoke Detectors: provide an alarm indication to a control unit. In addition, they also signal the location of the alarm.

2. Intelligent System Smoke Detectors: these types of smoke detector systems send information about smoke conditions to the control unit. The detector indicates the location of the alarm and provides environmental change information to the panel.

3. Smoke detectors with control output functions: when smoke detectors are installed on an initiating device circuit and are used for controlling operations (e.g., fan shutdown or elevator recall) with other devices installed on the same circuit, the control function must perform correctly, even with all other devices on the circuit in an alarm condition. See paragraph 6.15.3.4 of the Fire Code and NFPA 72 chapter 10 for more detailed information. The maximum allowable time for fire alarm output functions to operate once a smoke detector has been activated is 10 seconds.

Alarm Verification is used to reduce the number of unwarranted alarms. The automatic detector must report an alarm condition for a minimum period of time. Other systems require the alarm condition to be confirmed after the detector has been automatically reset (NFPA, A6.8.5.4.1). If a smoke detector is programmed for alarm verification. The alarm verification time **cannot delay the alarm longer than 60 seconds** (NFPA 72, A6.8.1.2).

Installation: Placement and Spacing

The selection and placement of smoke detectors shall take into account both the performance characteristics of the detector, and the areas into which the detectors are to be installed. The purpose is to prevent nuisance alarms or improper operation after the installation (NFPA 72, 5.7.1.8). Smoke detector placement should comply with the NFPA 72 as modified by Appendix Q106. Dead air spaces should be avoided. Dead air spaces occur at the top edge of a room where the ceiling and wall meet.

Unless specifically designed and listed for the expected conditions, smoke detectors shall not be located if the following conditions exist: (NFPA 72, 5.7.1.8)

(1) Temperature below 0°C (32°F)
(2) Temperature above 38°C (100°F)
(3) Relative humidity above 93 percent
(4) Air velocity greater than 1.5 m/sec (300 ft/min)

Smoke detectors can be affected by electrical and mechanical influences and by aerosols and other matter found in protected spaces. Most smoke detectors are installed in open areas, such as rooms or hallways. Smoke detectors may also be installed in plenums or in ducts of the heating, ventilating, and air conditioning systems.

Smoke detectors shall be supported independently of their attachment to the circuit conductors. (NFPA 72, 5.4.3) Dust and dirt can accumulate on the radioactive source of an ionization detector and cause it to become more sensitive. Projected beam-type or air sampling-type detectors should be considered for use where spot-type detectors are not readily accessible for periodic maintenance and testing in areas with high-ceilings (ex. Atriums).

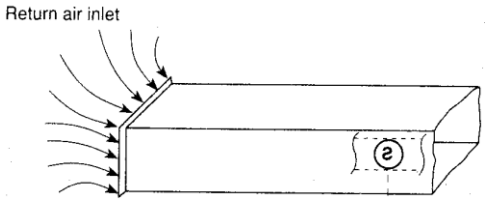
Spot Type smoke detector shall be located on the ceiling not less than **4 in.** from a sidewall to the near edge or, if on a sidewall, between **4 in. and 12 in.** down from the ceiling to the top of the detector. (NFPA 72, 5.7.3.2.1) Spot-Type placement is best when there is no airflow.

Projected Beam-Type smoke detectors shall be considered equivalent to a row of spot-type smoke detectors for level and sloping ceiling applications (NFPA 72, 5.7.3.4.5). Projected beam-type smoke detectors and mirrors shall be mounted on stable surfaces to prevent false or erratic operation because of movement (NFPA 72, 5.7.3.4.6). They shall be located in accordance with the manufacturer's documented instructions (NFPA 72, 5.7.3.4.1).

Some installations employ detectors being installed on cross-zone circuits because of some detectors issues with sensitivity. Cross-zoned placements purpose is identifying a legitimate fire/smoke signature in order to set the system into alarm or activate an output relay. Where utilizing two detectors/sensors where one would usually be enough. Circuits are used especially where the detectors initiate the discharge of a fire extinguishing agent. Adjacent detectors are located on a separate zone circuits. A detector must be in alarm condition in each zone before the fire extinguishing agent is discharged.

Air Duct and Heating, Ventilating, and Air Conditioning (HVAC)

Detectors placed in environmental air ducts or plenums shall not be used as a substitute for open area detectors (NFPA 72, 5.7.4). Air duct smoke detectors work by detecting smoke and control air movement by air conditioning and ventilating systems (pictured on the right). These detectors should be tested or inspected to ensure that the device samples the airstream (NFPA 72, 10.4.2.2).



Air duct smoke detectors may use photoelectric or cloud chamber principle of operation. Smoke might not be drawn into ducts or plenums when the building ventilation system is shut down. When the ventilation system is operating, the duct detector(s) can be less responsive to a fire condition in the room of fire origin because of dilution by clean air. The location of all detectors in air duct systems shall be permanently and clearly identified and recorded. Detectors mounted outside of a duct that employs sampling tubes for transporting smoke from inside the duct to the detector are designed and placed to allow verification of airflow from the duct to the detector (NFPA 72, 5.14.5.3-5.14.5.5).

Air Sampling Type smoke detectors that are placed in ducts use a sampling tube to draw a sample of air from the hazard area to the detector where the presence of visible smoke or invisible combustion products is determined. Each sampling port of an air sampling-type detector shall be treated as spot-type detector for the purpose of location and spacing (NFPA 72, 5.7.3.3.1). The maximum air sample transport time from the farthest sampling point shall not exceed **120 seconds** (NFPA 72, 5.7.3.3.2). Air-sampling detectors shall give a **trouble** signal if the airflow is outside the manufacturer's specified range. The sampling ports and in-line filter, if used, shall be kept clear in accordance with the manufacturer's documentation instructions (NFPA 72, 5.7.3.3.5 - 5.7.3.3.7).

Maintenance of Smoke Detector Systems

Smoke detectors require periodic testing and cleaning. The owner is **legally responsible** for satisfying the requirements of testing, cleaning and maintenance of the fire alarm system which automatically transmits signals to the central station. He/she shall be responsible for preventing unnecessary and unwarranted alarms as set forth in FDNY Fire Rules. (FR, 907-01, C1)

Testing and cleaning of smoke detectors shall be done by an S-78/F-78, S-97/T-97, or S-98 Certificate of Fitness holder. If there were system alterations, owner should be able to provide relevant certificates and information about changes to the individual performing testing and cleaning of smoke detectors (upon request) (NFPA 72, 10.2.4).

Smoke detectors are designed to be as maintenance free as possible; however, dirt and other foreign matter can accumulate inside the detector's sensing elements. This will change the sensitivity of the detector, which may cause unwarranted alarms. For example if dirt gets in it may block the sensor which will reduce the amount of warning time given in case of a fire. **Coverings placed on or over fire protection devices** (example pictured on right**) to protect them from damage during construction operations shall be removed immediately upon the completion of each work shift** (FC, 107.4.1).

Whenever a smoke detector is found to be defective, the Impairment Coordinator, who is designated by the owner of the property, must be notified immediately. Typically, the Fire Safety Director (F-25, F-58) or SUPERVISOR OF FIRE ALARM SYSTEMS AND OTHER RELATED SYSTEMS (S-95) performs this function. (See sample of the "**RECOMMENDED FDNY OUT OF SERVICE PROTOCOL**" at the end of the booklet).

Two log books that shall be completed:

1. **Smoke detector Maintenance Log Book** – completed by FSD or S-78/F-78 C of F holder.
2. **Alarm Log Book** – completed by FSD and buildings not requiring FSD someone who has proper C of F.

All smoke detector cleaning and testing shall be performed by a person possessing the requisite qualifications and experience, and S-78/F-78 or S-97/T-97/S-98 C of F.

The smoke detector cleaning and testing may be done at a specific building if the owner wants to hire their own employee but the person must be certified by the FDNY and possess a COF with the category of S-78/F-78. The certified individual must possess the tools, instruments or other equipment necessary to perform smoke detector cleaning and testing required (FR, 907.01, E1).

Visual inspections are performed to help ensure that there are no changes which affect the equipment performance (NFPA, 10.3.2). If a Certificate of Fitness holder observes something which is prohibited, such as a painted smoke detector, he/she shall make a log book entry and notify the building owner/managing agent to replace the smoke detector.

According to Fire Rules of NYC, before proceeding with any testing, all persons and facilities (ex. central station) receiving alarm, supervisory, or trouble signals and all building occupants shall be notified prior to testing to prevent unnecessary response. (NFPA 72, 10.2.3.1) At the conclusion of testing, those previously notified (and others, as necessary), shall be notified that testing has been concluded (NFPA 72, 10.2.3.2). The owner or the owner's designated representative and service personnel shall coordinate system testing to prevent interruption of critical building systems or equipment (NFPA 72, 10.2.3.3).

Inspection, Testing and Cleaning Guidelines

(A) All smoke detectors connected to a defined fire alarm system shall be visually inspected at least once every 6 months or as specified in the smoke detector manual.

(B) All smoke detectors connected to a defined fire alarm system shall be cleaned and tested in compliance with the procedures set forth in the manufacturer's recommended cleaning/specifications and in NFPA 72.

(C) All smoke detectors connected to a defined fire alarm system shall be:

- **Cleaned not less than once every six (6) months**, except for analog (intelligent) smoke detectors, **which shall be cleaned no later than one (1) week** from receipt of an indication of the need for cleaning. (FR 907.0, 4(1))
- **Tested for smoke entry not less than once a year.** (FR 907-01, 4E, 2)
- **Tested for sensitivity not less than once a year,** except for analog (intelligent) smoke detectors, which shall be tested for sensitivity no later than **one (1) week** from receipt of an indication of the need for such testing (Fire Rule, 907-01, E4).

***Special Conditions:** Devices or equipment that are inaccessible for maintenance shall be tested during scheduled shutdowns where approved by commissioner, but not less than every 18 months. A smoke detector in elevator shaft is an example of an inaccessible device.

Report of Inspection/Test

Address: 123 Main Street New York, NY 10314

Owner : ABC Company Inc. (212) 555-1000

Cert. of Fitness Numbers: _____
_____

DETECTOR #	DATE	TEST CLEANING	TEST SENSITIVITY	PERSON PERFORMING TEST	LOCTATION DESCRIPTION	MANUFACTURER MODEL NUMBER	RESULTS OF MAINTENACE
1	11/18	X	X	K Kim / O Stanton	First Floor Elevator Lobby	Fire Corp. Photo # 2627	Passed
2	11/18	X	X	K Kim / O Stanton	First Floor Electric Room	Fire Corp. Photo # 2627	Passed
3	11/18	X	X	K Kim / O Stanton	First Floor Mechanical Room	Fire Corp. Photo # 2627	Passed
4	11/18	X	X	K Kim / O Stanton	First Floor Above Fire Panel	Fire Corp. Photo # 2627	Passed
5	11/18	X	X	K Kim / O Stanton	First Floor Telephone Room	Fire Corp. Photo # 2627	Passed
6	11/18	X	X	K Kim / O Stanton	Second Floor Elevator Lobby	Fire Corp. Photo # 2627	Passed
7	11/18	X	X	K Kim / O Stanton	Second Floor Electric Room	Fire Corp. Photo # 2627	Passed
8	11/18	X	X	K Kim / O Stanton	Second Mechanical Room	Fire Corp. Photo # 2627	Passed
9	11/18	X	X	K Kim / O Stanton	Second Floor Duct Det AC # 1 Supply	Fire Corp. Photo # 2627	Passed
10	11/18	X	X	K Kim / O Stanton	Second Floor Duct Det AC # 1Return	Fire Corp. Photo # 2627	Passed
11	11/18	X	X	K Kim / O Stanton	Third Floor Elevator Lobby	Fire Corp. Photo # 2627	Passed
12	11/18	X	X	K Kim / O Stanton	Third Floor Electric Room	Fire Corp. Photo # 2627	Passed
13	11/18	X	X	K Kim / O Stanton	Third Mechanical Room	Fire Corp. Photo # 2627	Passed
14	11/18	X	X	K Kim / O Stanton	Third Floor Duct Det AC # 1 Supply	Fire Corp. Photo # 2627	Passed
15	11/18	X	X	K Kim / O Stanton	Third Floor Duct Det AC # 1Return	Fire Corp. Photo # 2627	Passed
16	11/18	X	X	K Kim / O Stanton	Third Floor Top of Stairs A	Fire Corp. Photo # 2627	Passed
17	11/18	X	X	K Kim / O Stanton	Third Floor Top of Stairs B	Fire Corp. Photo # 2627	Passed

Example of Inspection Report / Test Log (above)

Cleaning

Most smoke detectors are designed so that smoke can reach the sensing chamber from all directions. A screen is usually provided to keep out insects, which could cause an unwarranted alarm. Excessive dust accumulations must be removed so that smoke can reach the sensitive elements of the detector.

- The person doing the cleaning or maintenance should notify the building's Fire Safety Director or the owner's designated representative prior to starting the cleaning job.
- FSD or owner's designated representative will then notify Central Station to which the system is connected to. This will help prevent any unwarranted and unnecessary alarms from being reported to the Fire Department.
- The Fire Safety Director or the representative will then notify the building occupants.

The detector may be disconnected from its base while it is being cleaned. **Nearly all detectors are cleaned by vacuuming or using a soft brush.** This will remove accumulated dust from the entrance areas of the detector. **Please note that the exact cleaning procedure will vary according to the manufacturer's specifications.** One detector might be cleaned completely differently from another, which means that recommended procedure cleaning one detector may damage another type/brand of detector. However **the cleaning is done, it must always be strictly according to the manufacturer's specifications and NFPA 72** (FR 907-01, 4C). Not using the manufacturer's recommended method could damage the detector and cause it not to respond in an emergency.

- A copy of the manufacturer's recommended maintenance and cleaning procedures must be kept with the smoke detector maintenance log book

*** Special conditions:** areas with lots of dust may require the detectors to be cleaned more often.

Testing

The detectors shall be tested in place to ensure smoke entry into the sensing chamber and an alarm response. Testing with smoke or listed aerosol approved by the manufacturer shall be permitted as acceptable test methods (example pictured on the left). Other methods approved by the manufacturer that ensure smoke entry into the sensing chamber shall be permitted. After the smoke test, a dust air filter must be sprayed to get all the smoke particles removed from the detector (example pictured on the right).

Any smoke detector not performing in conformance with the manufacturer's specifications or the standards set forth in NFPA 72 shall be re-calibrated, repaired or replaced, as required, in accordance with the manufacturer's recommendations and the requirements of said standard. (FR, 907-01, 4C)

	Conventional Smoke Detector	Analog (Intelligent) Smoke Detector
Tested	**Smoke Entry: Annually**	**Smoke Entry: Annually**
	Sensitivity: Annually	**Within one year after they have been installed.**
Cleaned	**Semi-Annually**	**Within 1 week of indication for cleaning.**

Sensitivity

Smoke detector sensitivity is referred to in terms of the percent obscuration required to alarm or produce a signal (NFPA 72, 5.7.2.1). Smoke detectors that have provision for field adjustment of sensitivity shall have an adjustment range of **not less than 0.6 percent per foot obscuration** (NFPA 72, 5.7.2.2). If the means of adjustment of sensitivity is on the detector, a method shall be provided to restore the detector to its factory calibration (NFPA 72, 5.7.2.3). Smoke detectors are tested using various smoke sources that have different characteristics (e.g., color, particle size, number of particles, particle shape). Unless otherwise specified in the NY Fire Code, in the manufacturer instructions and in the listing agencies, report the percent obscuration produced using a specific type of gray smoke. Actual detector response will vary when the characteristics of the smoke reaching the detector are different from the smoke used in testing and reporting detector sensitivity.

Construction activities produce airborne dust that inevitably finds its way into detectors, contaminating them and making them prone to false alarms (old guide). Most common elements that may change the sensitivity of a smoke detector are dust, dirt and other foreign material. Detectors that have been installed during construction and found to have sensitivity outside the listed and marked sensitivity range shall be cleaned or replaced.

Sensitivity Test

The smoke entrance method does not ensure that smoke detector is within its listed and marked sensitivity range (NFPA, 10.4.4). According to Fire Code 907.20.3 (pg. 175) detector sensitivity shall be checked in compliance with the manufacturer's instructions and NFPA 72.

Detectors found to have a sensitivity of **0.25% outside the listed and marked sensitivity range** shall be cleaner, recalibrated or replaced (NFPA 72, 10.4.3.2.5). After the **second required calibration test** (if the device has been recalibrated and not replaced), if sensitivity tests indicate that the device has remained within its listed and marked sensitivity range (or 4 percent obscuration light gray smoke, if not marked), the length of time between calibration tests shall be permitted to be **extended to a maximum of 5 years** (NFPA 72, 10.4.3.2.3). Recalibration has to be done by S-97/T-97, S-98 Certificate of Fitness holder.

Calibration tests shall be performed in zones or in areas where nuisance alarms show any increase over the previous year (NFPA 72, 10.4.3.2.3.2).

- Smoke entrance method does not ensure that smoke detector is within its listed and marked sensitivity range (NFPA 72, 10.4.3.2.4-10.4.3.2.6).

All smoke detectors must be **tested for sensitivity within one year after the have been installed**. Every smoke detector that has been installed must then be retested annually thereafter (NFPA 72, 10.4.3.2.1-10.4.3.2.2). The detector is tested to see if it is within its listed sensitivity range. The exact method used to test smoke detector sensitivity will vary according to the manufacturer's instructions. Some detectors have a sensitivity test switch that is built into the detector.

The acceptable methods to test sensitivity include: (NFPA, 10.4.2.2)

- **Calibrated test method**
- **Manufacturer's calibrated sensitivity test instrument**
- **Listed control equipment arranged for the purpose**
- **Smoke detector/control unit arrangement whereby the detector causes a signal at the control unit when its sensitivity is outside its listed sensitivity range**
- **Other calibrated sensitivity test method approved by Fire Department of NY**

(Both of these devices are examples of manufacturers testing instruments)

Adjustments of smoke detector sensitivity should be done very carefully, and always in strict accordance with the manufacturer's instructions. Recalibration of a detector should be done only by the manufacturer or by a person specifically trained and qualified to do so. The detector sensitivity shall not be tested or measured using any device that administers an unmeasured concentration of smoke or other aerosol into the detector or smoke alarm (NFPA 72, 10.4.3.2.6). The requirements in Chapter 10 of the Fire Code, including sensitivity testing, apply to these types of detectors.

Maintenance, Inspection, and Testing Records

The owner (including any lessee) of any premises monitored by a defined fire alarm system shall be responsible for the detection maintenance required by FC chapter 9 and the smoke detector cleaning and testing (FR 907-01, E1). Records of all system inspections, tests, servicing and other maintenance required by this code, the rules or the referenced standards shall be maintained on the premises for a minimum of 3 years and made available for inspection by any Fire Department representative (FC 901.6.2).

Alarm Log Book

The responsibility of maintaining the **Alarm Log Book** belongs to the **Fire Safety Director**. In buildings not requiring a Fire Safety Director, **a person designated by the owner** shall be responsible to make all log book entries (FR, 907-01, D2). An Alarm log book shall be maintained on the premises, at the building's main fire alarm control panel. In the absence of a secure location at the main fire alarm control panel, the alarm log book may be secured during non-business hours in another area provided it is made available for inspection by any Fire Department representatives responding to an alarm on the premises. Note below:

- The Alarm log book shall be a **bound book** (other than spiral bound) with **consecutively numbered** and **lined pages**.
- The cover of the log book shall bear, **"ALARM LOG BOOK"**, together with the **name** and **address of the building**.
- All entries shall be made in **ink and dated**.
- A **separate log book** shall be kept for each calendar year.
- Log books shall be **retained for a period of three (3) years** from the date of the last entry (FR, 907-01, D4).

Alarm log book entries shall be made in chronological order, recording the location and causes of all alarm signals transmitted by such fire alarm system.

The alarm log book shall be divided into three **(3)** separate sections as set forth below. Each section shall have a sufficient number of pages to allow for entries for at least one (1) year. The following log book entries are required and shall be made in each instance:

Daily entries. The name of the person who made the entry, the Certificate of Fitness number of the Fire Safety Director on duty, if applicable, and the time each tour of duty began and ended, shall be entered in the alarm log book on a daily basis.

These entries shall be set forth in columns in the log book as follows:

- Name
- Certificate of Fitness number
- Time started
- Time relieved

Fire Safety Director On Duty

This Entry Required Daily

Date	Name	C.O.F. Number	Time Shift Began	Time Shift Ended
1/5/2012	Jane Doe	89924922	8:00	16:00
1/5/2012	Joe Doe	89925921	16:00	24:00
1/6/2012	Chris Doe	89924723	24:00	8:00
1/6/2012	Jane Doe	89924922	8:00	16:00
1/6/2012	Joe Doe	89925921	16:00	24:00
1/7/2012	Chris Doe	89924723	24:00	8:00

System off-line entries. The date and time the alarm system was taken off-line, the reason for such action, the name and Certificate of Fitness number of the person notified at the central station (or other evidence of notification satisfactory to the Fire Department), and the date and time the system was restored to service, shall be entered in the alarm log book in each such circumstance.

These entries shall be set forth in columns in the log book as follows:

- Time off line
- Reason off line
- Central station name and telephone number
- Time restored

System-Off Line Entries

Information When Necessary

Date & Time	Name & Title	Reason	Central Station (Name & Operator # of Person Notified)	Time System Restored to Service	Tenants/ Occupants Notified
1.15.12 8:00	Jane Doe, FSD	Fire Alarm Test	John Smith Operator #20 D6A	9:30	Yes, E-Mail
2.05.12 13:00	Jane Doe, FSD	Fire Alarm Test	Joe Smith Operator #24 D6A	14:30	Yes, E-Mail

Activated alarm entries. The date and time the alarm activated, the type and location of the device (e.g., smoke detector, 27th floor, elevator lobby), the probable cause of the alarm, and the Department unit and officer responding shall be entered in the alarm log book in each such circumstance.

These entries shall be set forth in columns in the log book as follows:

- Date and time activated
- Location and detector type
- Probable cause
- Department unit and officer

Notification entries. The date and time of any notification to the occupants of the premises pursuant to FC Chapter 9 and R907-01(d), regarding a non-functioning or improperly functioning alarm system (FR, 907-01, D, 5D).

Activated Alarm Entries (Example)
Information Required When Alarm Activates

Date & Time Activated	Location and Detector Type	Probable Cause	FDNY Unit & Officer Responding
1/5/2012 14:00	Elevator Lobby Smoke Detector	False Alarm	
1/26/2012 11:00	7th Floor Waterflow Switch	Construction	

Maintenance Log Book (FR, pg. 294)

A. A smoke detector maintenance log book shall be maintained on the premises in the office of the fire safety director, or, in buildings not requiring a fire safety director, in the building superintendent's office.

Such log book shall state the:
1. **Total number of smoke detectors on the premises and**
2. **List each smoke detector by location.**

B. Entries shall be made in such log book, in chronological order, regarding the installation, repair, maintenance and testing of the smoke detectors, and any signals transmitted by such detectors.

Such entries shall include the:
1. Date and nature of any inspection, cleaning, testing or calibration, **and**
2. Name of the person and company performing such work (including C of F S-78/F-78/S-97/T-97/S-98 #) **and**
3. Any signal transmitted by analog (intelligent) smoke detectors communicating a need for cleaning and/or adjustment.

C. The Fire Safety Director, or in buildings not requiring a Fire Safety Director, a person designated by the owner and/or S-95 C of F holder, shall be responsible to make all smoke detector maintenance log book entries required by this section.

D. The smoke detector maintenance log book shall be a bound book (other than spiral bound) with consecutively numbered and lined pages. The cover of the log book shall

bear the inscription, "**SMOKE DETECTOR MAINTENANCE LOG BOOK**," together with the name and address of the building or occupancy. All entries shall be made in ink and dated. A separate log book shall be kept for each calendar year. Log books shall be retained for a period of **three (3) years** from the date of the last entry. A computer record that is designed to prevent or detect alteration of information and that is otherwise maintained in a manner acceptable to the Fire Department of City of New York may be maintained in lieu of a bound log book provided that such computerized record is available on the premises for inspection by any Department representative during business hours.

E. A copy of the smoke detector manufacturer's recommended maintenance procedures shall be kept with the smoke detector maintenance log book.

***Note: The lack of required entries in the smoke detector maintenance log book would constitute a failure to maintain the fire alarm system.**

Sample Maintenance Log Book Entries

(*Example for Repair or Replacement Record of Building Smoke Detectors)

Date/Time of Maintenance	Location of Detector	Type of Detector	Type of Maintenance Performed	Work Performed by (COF holder)	Activation Number	Expiration of COF License
1/5/2012 13:00	Elevator Lobby	Ionization Smoke Detector	Re-calibrated	88888888	134CE46	06/12/14
1/26/2012 12:00	7th Floor	Photo-electric Smoke Detector	Replaced	88888888	134CE46	06/12/14
2/16/2012 12:00	5th Floor	Photo-electric Smoke Detector	Replaced	88888888	134CE46	06/12/14
3/5/2012 13:00	Elevator Lobby	Ionization Smoke Detector	Re-calibrated	88888888	134CE46	06/12/14
5/26/2012 12:00	3th Floor	Photo-electric Smoke Detector	Replaced	88888888	134CE46	06/12/14
6/16/2012 12:00	3th Floor	Photo-electric Smoke Detector	Replaced	88888888	134CE46	06/12/14

Unwarranted and Unnecessary Alarms

Section below sets forth operating and maintenance requirements intended to minimize the number of unwarranted and unnecessary alarms transmitted by Fire

Alarm Detection systems. Such Fire Alarm Detection systems automatically transmit signals to the Fire Department or a central station.

Minimum smoke detector testing/maintenance and accurate maintenance records with follow-up allow for effective prevention and quick identification of nonfunctional devices that may transmit unnecessary or unwarranted alarm transmissions. Such alarms, that trigger an emergency response, are costly and endanger the public safety (Fire Rule, 290; Pursuant to FC 901.6). Any type of dust and other particles are the leading cause of unnecessary alarms by all smoke detectors. (FC 902.1) An example of unnecessary alarm is failure to take the system “off-line” prior to testing and inspecting a fire alarm system.

All owners shall comply with the requirements of Fire Rules of NY and prevent unwarranted alarms (FR, 290). According to the NYC Fire Code, an unnecessary alarm is considered to be an alarm signal transmitted by a fire alarm system which functioned as designed, but for which a department response proved unnecessary (FC 902-Definitions).

Other alarms may be transmitted to the Fire Department when fire alarm devices activate for the wrong reason. These are referred to as **unwarranted alarms**. Unwarranted alarms can occur for several reasons. These reasons are: lack of maintenance, improper detector placement, improper detector settings, etc. Unwarranted alarms are preventable by properly installing and maintaining the detection system.

Prevention of Unnecessary and Unwarranted Alarms

- In any premises having a fire alarm system or a smoke detector that automatically transmits signals to the Department or a central station, the owner (including lessee) of the premises shall be responsible for preventing the transmission of unnecessary or unwarranted alarms, and shall be liable for any violation of this section.

- It shall be unlawful to transmit two (2) or more unnecessary or unwarranted alarms in any (3) three-month period, and it shall be unlawful to transmit any additional unnecessary or unwarranted alarms as set forth in R907-01 (FR 907-01, C).

- The owner of any premises from which a second unnecessary or unwarranted alarm is transmitted in any three-month period will be subject to issuance of a notice of violation. Such notice of violation will afford the owner the opportunity to address the cause of the unnecessary of unwarranted alarm and to certify correction of the violation in accordance with R109-01 (c), without having to appear for an ECB (Environmental Control Board) hearing and without imposition of a penalty.

- An owner issued a notice of violation pursuant to R907-01(c)(3) shall be liable for violation of this section for any subsequent unnecessary or unwarranted alarm within six (6) months of the date of issuance of the notice of violation. Each such subsequent notice of violation shall constitute a repeat offense pursuant Administrative Code 15-229(a) and shall not be eligible for certification of correction without a hearing and penalty pursuant to R109-01(c). Each such subsequent notice of violation shall extend for an additional six (6) months the time the owner is liable for unnecessary or unwarranted alarms pursuant to this provision.

- An owner issued one (1) or more notices of violation pursuant to R907-01(c)(3) or (4) who does not transmit any unnecessary or unwarranted alarm within six (6) months of the date of issuance of the last-issued notice of violation shall be restored to compliant status and shall thereafter be subject to issuance of a notice of violation for only two (2) unnecessary of unwarranted alarms within a three-month period, as set forth in R109-01(c)(2). (FR, 907-01, C)