

**NEW YORK CITY FIRE DEPARTMENT**

**BUREAU OF FIRE PREVENTION**



**STUDY MATERIAL FOR THE  
CERTIFICATE OF FITNESS FOR:**

**GASEOUS FIRE EXTINGUISHING SYSTEMS INSPECTION, TESTING AND  
SERVICING **TECHNICIAN** (Citywide)**

**S-16**

**GASEOUS FIRE EXTINGUISHING SYSTEMS INSPECTION, TESTING AND  
SERVICING **PRINCIPAL** (Citywide)**

**S-61**

***All applicants are required to apply and pay for an exam online before arriving at the FDNY. It can take about 30 minutes to complete.***

Simplified instructions for online application and payment can be found here:

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/fdny-business-cof-individuals-short.pdf>

Create an Account and Log in to:

<http://fires.fdnyccloud.org/CitizenAccess>

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## EXAM SPECIFIC INFORMATION FOR S-16/S-61 CERTIFICATE OF FITNESS

### **Save time and submit application online!**

***All applicants are required to apply and pay for an exam online before arriving at the FDNY. It can take about 30 minutes to complete.***

Simplified instructions for online application and payment can be found here:

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/fdny-business-cof-individuals-short.pdf>

Create an Account and Log in to:

<http://fires.fdnyccloud.org/CitizenAccess>

### **REQUIREMENTS FOR CERTIFICATE OF FITNESS APPLICATION**

#### **General requirements:**

Review the General Notice of Exam:

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/general-notice-of-exam-cof.pdf>

#### **Special requirements for the S-16 Certificate of Fitness:**

- Applicant must be employed by an S-61 COF holder's company. The company list:

<http://www.nyc.gov/assets/fdny/downloads/pdf/business/approved-dry-chemical-systems-list.pdf>

- Applicant must provide a recommendation letter signed by an S-61 COF holder, and the letter must specify what types of training related to the installation and maintenance of gaseous fire extinguishing systems this applicant has received.

Sample recommendation letter:

<http://www.nyc.gov/assets/fdny/downloads/pdf/business/s16-sample-letter.pdf>

#### **Special requirements for the S-61 Certificate of Fitness:**

- **AIP only**, please refer to the "REQUIREMENTS FOR ALTERNATIVE ISSUANCE PROCEDURE".

**--S-16 Sample Recommendation Letter--**

**COMPANY NAME  
BUSINESS ADDRESS**

Date: \_\_\_\_\_

Fire Department  
Bureau of Fire Prevention  
9 Metro Tech Center  
Brooklyn, NY 11201-3857



To whom it may concern:

The purpose of this letter is to affirm that the applicant (full name of applicant) qualifications for a S-16 Certificate of Fitness. (Name of applicant) is currently employed by (name and address of employer). (Name of applicant) has been or will be trained and knowledgeable for all systems that he/she will install/inspect/maintain/test.

All trainings have been or will be followed the manufacturer's recommendations which covered the entire instruction manual, hands-on training as well as incorporated installation, inspection, maintenance, and testing procedures for the system. I also understand that his/her training records must be readily available upon the FDNY representatives' request. I will also be responsible to notify the FDNY COF unit if this applicant is no longer working in my company.

Applicant is of GOOD CHARACTER and is PHYSICALLY ABLE to perform the functions required by the holder of this Certificate of Fitness.

\_\_\_\_\_  
(Printed name of S-61 COF holder)

\_\_\_\_\_  
(S-61 COF number)

\_\_\_\_\_  
(Signature of S-61 COF holder)

*Filled by the applicant*

I affirm that I understand that I can only install/inspect/maintain/test the gaseous fire extinguishing systems that I have received proper training listed above.

\_\_\_\_\_  
(Printed name of Applicant)

\_\_\_\_\_  
(Signature of Applicant)

**Application fee (Cash is NO LONGER ACCEPTED):**

Pay the **\$25** application fee online or in person by one of the following methods:

- Credit card (*American Express, Discover, MasterCard, or Visa*)
- Debit card (*MasterCard or Visa*)
- In person: Personal or company check or money order (*made payable to the New York City Fire Department*)

A convenience fee of 2% will be applied to all credit card payments.

For fee waivers submit: *(Only government employees who will use their COF for their work- related responsibilities are eligible for fee waivers.)*

- A letter requesting fee waiver on the Agency's official letterhead stating applicant full name, exam type and address of premises; **AND**
- Copy of identification card issued by the agency

**REQUIREMENTS FOR ALTERNATIVE ISSUANCE PROCEDURE (AIP)**

**The S-61 Certificate of Fitness can only be obtained by the alternative issuance procedure.** Qualified applicants should review and complete the S-61 Certificate of Fitness Alternative Issuance Procedure Application Affirmation Form:

S-61 AIP form:

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/cof-s81-aip.pdf>

The AIP applicants must submit the application, required documents and payment on FDNY Business:

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/fdny-business-cof-individuals-short.pdf>

## **EXAM INFORMATION**

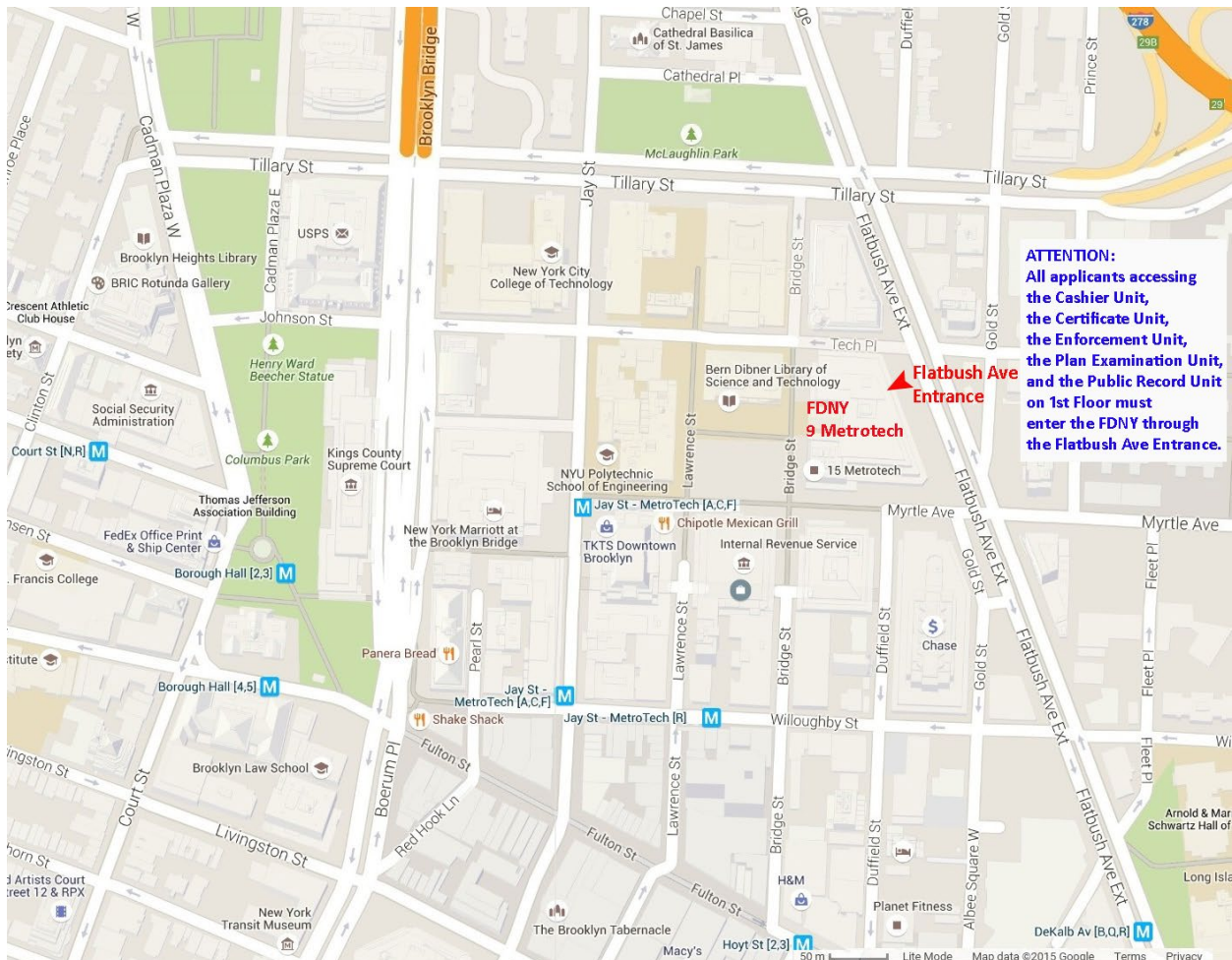
The **S-16** exam will consist of **40** multiple-choice questions, administered on a “touch screen” computer monitor. It is a time-limit exam. Based on the amount of the questions, you will have 60 minutes to complete the test. A passing score of at least 70% is required in order to secure a Certificate of Fitness.

Call (718) 999-1988 for additional information and forms.

Please always check for the latest revised booklet at FDNY website before you take the exam.

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/cof-S16-noe-study-materials.pdf>

**EXAM SITE:**            **FDNY Headquarters, 9 MetroTech Center, Brooklyn, NY. Enter through the Flatbush Avenue entrance (between Myrtle Avenue and Tech Place).**



## **RENEWAL REQUIREMENTS**

### **General renewal requirements:**

Review the General Notice of Exam:

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/general-notice-of-exam-cof.pdf>

### **Special renewal requirements for S-16 COF: None**

**The FDNY strongly recommends the S-16 COF holders to renew the COF on-line. To learn the simplified on-line renewal:**

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/cof-simplified-renewal-short.pdf>

### **Special renewal requirements for S-61 COF:**

**Need to upload the following documents:**

- S-61 Application Form  
<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/cof-s61-aip.pdf>
- The valid DOB Master Fire Suppression Contractor Licenses

Read the Quick Renewal Guide to learn the procedure:

<http://www1.nyc.gov/assets/fdny/downloads/pdf/business/cof-renewal-short.pdf>

## **FAQ for Alternative Fire Extinguishing Systems COFs**

**1. Why are these Certificates and changes occurring now?**

FC904 of the 2022 New York City Fire Code requiring a new Certificate of Fitness for all fire protection systems became effective on April 15, 2022. However, FC102.2.2 permits to operate without such a certificate for a period of 1 year from the effective date of the amendment to the code.

**2. What is a Certificate of Fitness?**

The FDNY issues Certificates of Fitness (COF) to responsible persons for the supervision of the operation or facilities. for various types of dangerous occupations. We provide tests and/or qualification review processes to individual applicants to ensure they are familiar with the Fire Code and regulations governing the operation or the regulated material and to ensure the proper and safe performance of the duties as a COF holder.

**3. What are the COF types for alternative agent Fire Extinguishing Systems?**

Wet Chemical Fire Extinguishing Systems: Principal: S-71 COF; Technicians: S-17 COF  
Dry Chemical Fire Extinguishing Systems: Principal: S-81 COF; Technicians: S-18 COF

**4. As a technician, can I change my company?**

You can change companies, but a new company letter must be submitted. The principal of the new company must hold a valid principal COF.

### **Principal's COF related issues**

**5. How can principals apply for a COF?**

All principals must be DOB Master Fire Suppression Contractor (MFSPC) Type A or C license holders.

(1) To apply for Gaseous Fire Extinguishing System principal COFs (S-71 and S-61):

In addition to the DOB Master Fire Suppression Contractor (MFSPC) (A or C) license, every principal must provide documents showing that at least one representative has received the manufacturer's training for each system maintained/installed by the company. Such manufacturer's training certificate must be issued for MFSPC company name.

The FDNY will use the manufacturers' training certificates submitted by each principal to create a list of companies with the names of specific manufacturers these companies are allowed to install and maintain.

(2) To apply for Gaseous Fire Extinguishing System principal COF (S-61):

Only DOB Master Fire Suppression Contractor (A or C) license is required since gaseous fire extinguishing systems are engineered systems.



**6. When can principals start to apply for a COF? Will the principals need to pass an exam to obtain the principal COF?**

02/13/24

On or after **02/13/24**, the S-71, S-81 and S-61 COFs will be available on FDNY Business online application. No exam is required. The principal COFs are issued based on the criteria listed above via the Alternate Issuance Procedure (AIP).

All application materials and payments will be required to be submitted online.

Please obtain the required AIP forms on the FDNY COF website.

**7. When will the company list be established and provided to the public?**

04/04/2023

After the FDNY receives and approves the S-71, S-81 and S-61 applications, the FDNY will establish three company lists for three types of alternate agent fire extinguishing systems and publish them on the FDNY website for the public on **04/04/2023**. The lists will be updated every month.

Wet Chemical Fire Extinguishing List (S-71):

<http://www.nyc.gov/assets/fdny/downloads/pdf/business/approved-dry-chemical-systems-list.pdf>

Pre-Engineered Gaseous Fire Extinguishing List (S-81):

<http://www.nyc.gov/assets/fdny/downloads/pdf/business/approved-dry-chemical-systems-list.pdf>

Gaseous Fire Extinguishing List (S-61)

<http://www.nyc.gov/assets/fdny/downloads/pdf/business/approved-gaseous-systems-list.pdf>

**8. When will the FDNY start to enforce all principals to have COFs?**

07/01/2024

The FDNY will start to enforce all companies' principals who install or maintain any alternate agent fire extinguishing systems must hold a valid COF. For gaseous and gaseous systems, the FDNY will only allow the companies to install or maintain the manufacturers that listed on the company lists.

**9. What happens if principals do not obtain their COFs by 07/01/2024?**

The FDNY personnel will use the FDNY-approved list to determine whether a company can file design and installation documents with the Fire Department and/or is authorized to install or service systems from a specific manufacturer. If a company is not listed as approved for the installation and service of the particular manufacturer, then appropriate enforcement actions will be taken.

## Gaseous technician's COF related issues

### **10. How can gaseous fire extinguishing systems technicians apply for a COF?**

The technicians must present a company letter and pass a COF exam.

(1) Company letter:

The letter must be on letterhead and signed by the principal holding principal COF.

The letter must state that effective 07/01/2024, the technician will be assigned jobs related to the installation or tests witnessed by the Fire Department only for systems for which the technician holds a **valid** training certificate from the manufacturer. Such manufacturer's training certificate has to be issued to the technician and under the MFSPC company name.

The letter must state that effective 07/01/2024, the technician will be assigned jobs related to the maintenance or service of systems for which the technician received proper training (manufacturer's training or company internal training).

Sample recommendation letter can be obtained via the link below:

<http://www.nyc.gov/assets/fdny/downloads/pdf/business/s16-sample-letter.pdf>

(2) COF exam:

Technicians for Gaseous Fire Extinguishing System need to pass the S-16 COF exam.

### **11. When can gaseous fire extinguishing systems technicians start to apply for a COF?**

02/13/2024

The S-16 exam will be available to the public on or after 02/13/2024.

### **12. When will the FDNY start to enforce all technicians performing installation and testing on gaseous fire extinguishing systems to have COFs?**

07/01/2024.

These technicians must also hold a **valid** training certificate from the manufacturer for the specific system(s) that will be installing or testing on or after 07/01/2024.

Effective 07/01/2024, the FDNY inspector will be verifying the presence of a valid manufacturer's training certification and COF before any tests.

#### **How will FDNY verify that the installation of the gaseous fire extinguishing systems on or after 07/01/2024 was conducted by a COF holder??**

For any gaseous fire extinguishing system which the initial Project Authorization issued on or after 07/01/2024, as a part of the public request for any tests witnessed by the FDNY, the contractor will be required to submit

- Copy of S-16 COF for the technician who will perform the installation/testing, AND
- Copy of the valid manufacturer's training certificate issued to the technician who will perform the installation/testing.

**13. When will the FDNY start to enforce all technicians performing maintenance on gaseous fire extinguishing systems to have COFs?**

07/01/2024.

Effective 07/01/2024, the service tag for a semi-annual inspection of a gaseous fire extinguishing system must also include the information related to the COF holder who conducted the inspection, as required by FC904.5.2(10). The FDNY Rangehood Unit inspectors will verify if the system's inspection and/or maintenance was conducted by a person holding valid COF and may request proof for proper training of such COF holders.

The FDNY may require all technicians to hold a valid manufacturer training certificate for each system serviced by 2025.

**What actions will be taken by the FDNY if determined that maintenance or service of a gaseous fire extinguishing system was conducted by a person without a valid COF on or after 07/01/2024?**

Appropriate enforcement actions will be taken for failure to comply with Section FC901.6.3(1).

**Other General Questions**

**14. Why are there different enforcement deadlines to enforce the COF requirements for the technicians who perform installation and the technician who perform maintenance?**

Installation and service of a pre-engineered gaseous fire extinguishing system must be conducted by an individual who attended a training program run by the manufacturer for each specific system.

The Fire Department recognizes that it may take time for all individuals responsible for installing, recharging, and maintaining the systems to undergo manufacturer training for each system that a company works with, while a large number of approved fire extinguishing systems needs to be properly maintained across New York City.

The installation of a system is more complicated than its maintenance. It involves many complex and interrelated tasks requiring an individual to have more profound knowledge and ability to navigate through the installation manual. Effective 07/01/2024, the installation and tests requiring an FDNY representative's presence will be conducted by a COF holder holding a valid training certificate from a manufacturer.

In contrast, the maintenance of a pre-engineered gaseous fire extinguishing system is typically simpler and involves tasks specific to each manufacturer; however, overall, similar across all manufacturers.

It's important to note that regular maintenance by a trained and knowledgeable person is essential to ensure that the fire suppression system is always ready to operate when needed.

**15. Why is the FDNY requiring manufacturer's training in addition to having a COF for pre-engineering fire extinguishing systems?**

The COF study materials and the exams will only focus on the general basic requirements of Fire Code and applicable NFPA.

The pre-engineering fire extinguishing systems made by different manufacturers are usually not identical in all characteristics and each manufacturer designs equipment for use with a specific chemical. Therefore, it is critical that the applicants are thoroughly trained and be familiar with the latest manufacturer's manual before they serve any pre-engineering fire extinguishing system.

**16. Can the technicians take the exams before he/she receives all required manufacturer's or company internal trainings?**

Yes. However, the company letter must be submitted stating that the technician will be assigned work for the installation and/or maintenance of the systems for which appropriate training was received.

**OTHER QUESTIONS?**

**FDNY Business Support Team:** For questions, call 311 and ask for the FDNY Customer Service Center or send an email to [FDNY.BusinessSupport@fdny.nyc.gov](mailto:FDNY.BusinessSupport@fdny.nyc.gov)

# CHAPTER 1. INTRODUCTION

## 1.1. Pre-Engineered Systems vs. Engineered Systems

Pre-engineered systems are systems that have predetermined flow rates, nozzle pressures, quantities of extinguishing agent, specific pipe size, maximum and minimum pipe lengths, flexible-hose specifications, number of fittings, and number and types of nozzles. Pre-engineered systems can only be installed to protect hazards within the limitations of the manufacturer's listing. Pipe sizes and nozzles are selected according to the manufacturer's listed installation and maintenance manual. Only the system components referenced in the manufacturer's manual that are listed for use with a specific extinguishing system are permitted to be installed.

Pre-engineered systems are commonly used for commercial cooking wet chemical fire extinguishing systems, gaseous fire suppression systems for vehicle paint spray booths, gas stations, elevator machine rooms, flammable liquid storage rooms and cabinets, and dip tanks.

Engineered systems are systems that require individual calculation and design to determine the flow rates, nozzle pressures, pipe sizes, area or volume protected by each nozzle, quantity of suppression agent, number and types of nozzles and their placement in a specific system. For engineered systems, pipe sizes and nozzles are selected, on the basis of calculations, to deliver the required flow rate to each nozzle.

**COF S-16 and S-61 will cover both pre-engineered and engineered fire extinguishing systems. Both S-61 and S-16 certificates are vital to protecting life and property. Essentially, they are responsible for mechanical and inspectional responsibilities. Electrical installations are performed by Licensed electricians or individuals with a S-98, S-61 and S-16 holders should verify that the electrical systems have been installed.**

## 1.2. Illegal Gaseous Extinguishing Systems

### Existing Carbon Dioxide Systems.

The 2022 New York City Fire Code Section FC 904.1.4.1 states that it is unlawful to install or continue to maintain total flooding carbon dioxide fire extinguishing systems within normally occupied areas, including commercial kitchens.

Total flooding carbon dioxide systems installed in normally occupied areas prior to July 1, 2008 were required by the NYC Fire Code to be removed by July 1, 2013. Existing total flooding carbon dioxide fire extinguishing systems in such areas must be removed and a replacement fire extinguishing system should be installed, where required, in accordance with the Building Code, NYC Fire Code or other applicable laws, rules and regulations.

### Existing Halon Systems.

It is unlawful to install a halon system in any building or occupancy. Lawfully existing halon fire extinguishing systems must be maintained in accordance with FC Section 904.5. If a lawfully existing system cannot be maintained under the laws, rules, regulations, standards and design and installation approvals under which it was installed, such system must be removed and replaced with a type of fire extinguishing system complying with this code.

### Clean Agent Systems.

It is unlawful to install clean agent systems that are not total flooding systems. Lawfully existing clean agent fire extinguishing systems that are not total flooding systems must be maintained in accordance with FC Section 904.5. If a lawfully existing system cannot be maintained under the laws, rules, regulations, standards and design and installation approvals under which it was installed, such system must be removed and replaced with a type of fire extinguishing system complying with this code.

### **1.3. COF Requirement**

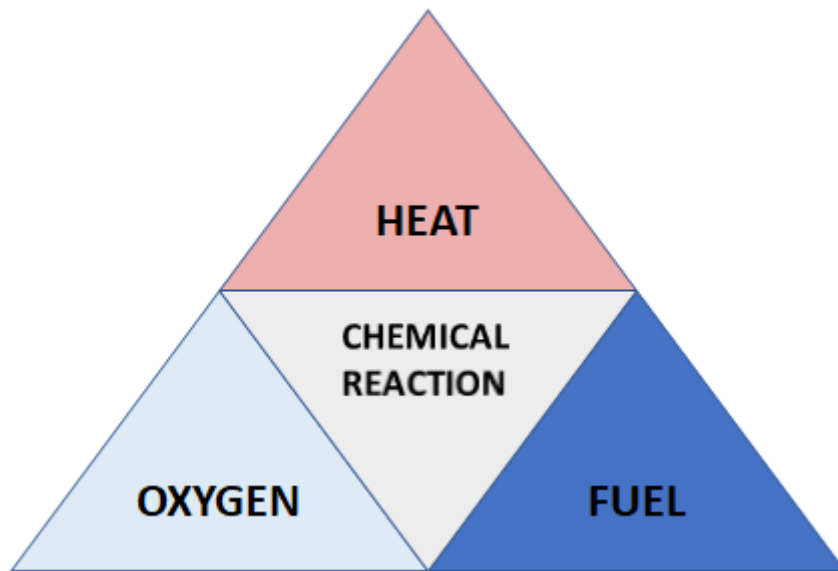
The installation, inspection, testing, servicing, and other maintenance of gaseous fire extinguishing systems must be personally conducted by an S-16/S-61 COF holder. The S-16 COF holder must be under the direction of an S-61 COF holder.

### **1.4. Gaseous Fire Extinguishing Systems**

Clean agent fire extinguishing systems are designed in accordance with NFPA 2001 (2015).  
Aerosol fire extinguishing systems are designed in accordance with NFPA 2010 (2015).  
Carbon Dioxide fire extinguishing systems are designed in accordance with NFPA 12 (2011).

### **How do gaseous suppression agents work?**

Gaseous fire suppression agents fundamentally work the same way as other fire suppression systems. This is done by removing one or more of the components of the fire tetrahedron as shown below.



Most gaseous fire suppression systems generally work by reducing the oxygen available for combustion and then with an added benefit of cooling and inhibiting the chemical chain reaction. Some of the gaseous agents are the opposite with the primary being heat absorption and the secondary being reduction of the oxygen concentration and inhibiting the chemical chain reaction.

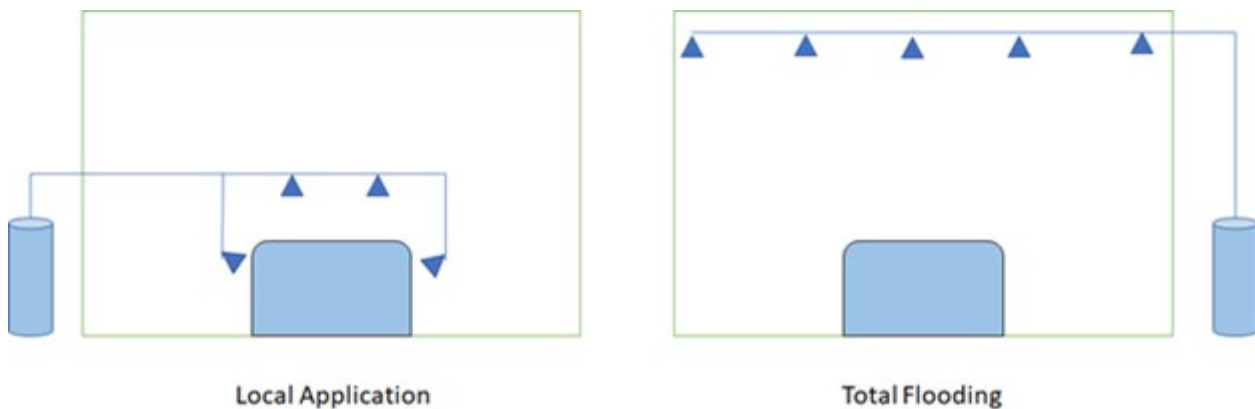
Gaseous fire protection systems usually are supplied by pressurized gas or liquid cylinders. When the pressurized gas is released, it goes through a process known as adiabatic cooling, which is the reduction of heat through a change in air pressure caused by the pressurized gas expanding in volume expansion. This is the primary mechanism by which heat is removed.

These systems can provide protection through either a “total flooding” or a “local application” approach.

### **Total flooding**

Total flooding systems discharge extinguishing agent throughout the entire volume of space to suppress the fire. This is done by the gaseous agent being introduced into the space and mixing with the air to reach a designated concentration. The concentration needed is based on the type of extinguishing agent used and the hazard being protected.

An important part of total flooding systems is reaching and holding the concentration level until the oxygen available for combustion is below the threshold for where it could occur. It needs to remain until the items have cooled below their auto-ignition temperatures. If the concentration were to diminish prior to the items cooling enough the fire could reignite.



### **Local application**

Whereas total flooding systems discharge into the entire space, local application systems discharge the extinguishing agent locally onto a designated hazard. This can be used when an enclosure is not suitable for a total flooding system. Since the object being protected is not enclosed it will require more agent to be discharged as the discharge nozzles and rate of application must be capable of enveloping the object. The agent supply and nozzle design are critical to maintain the agent flow for the required amount of time to extinguish the fire.

Local applications present a high level of risk for personnel life safety. Extreme caution must be given to ensure that the extinguishing agent cannot migrate, settle and accumulate in places creating a concentration level above the allowable **Lowest Observed Adverse Effect Level (LOAEL)**.

Gaseous fire extinguishing systems made by different manufacturers are usually not identical in all characteristics and each manufacturer designs equipment for use with a specific gas. Therefore, it is

critical that the S-61/S-16 COF holders are thoroughly trained and knowledgeable with the latest manufacturer's requirements before they service any gaseous fire extinguishing system.

This study material and the exam will focus on the general basic requirements of the Fire Code and applicable NFPA standards as modified by the Fire Code Appendix B. The S-61/S-16 COF holders must additionally receive separate training to install, inspect, maintain, or test any gaseous fire extinguishing systems.

The list of approved manufacturers by each company:

<https://www.nyc.gov/assets/fdny/downloads/pdf/business/approved-gaseous-systems-list.pdf>

## 1.5 Types

### A. Carbon Dioxide, NFPA 12

Carbon Dioxide (CO<sub>2</sub>), although not classified through NFPA as one, can be considered one of the first clean agent systems. It works by both removing oxygen and simultaneously cooling the fire. The biggest limitation when using this fire suppressant is that for it to be effective in extinguishing a fire it needs to displace oxygen at a level that is fatal for humans. Because of this issue, new CO<sub>2</sub> systems are limited in their application and typically are not permitted to be installed in normally occupied enclosures.

### B. Clean Agents, NFPA 2001

NFPA 2001 defines clean agents as electrically non-conductive, volatile, or gaseous fire extinguishing agents that do not leave a residue upon evaporation. Clean agent fire suppression systems help extinguish fires when they have just started.

All clean agents are stored as either a gas or a liquid, and when the system activates, it is released as a gas to suppress the fire. Upon discharge, the clean agent works by removing one of the four elements needed to sustain a fire- heat, oxygen, fuel source, or the chemical reaction. Most clean agent fire suppression systems reach extinguishing concentration levels in 10 seconds or less. There is no clean-up required of clean agents as they evaporate quickly leaving minimal residue. The most common clean agent systems used are FM-200 (HFC-227ea) and NOVEC 1230.

There are different types of fire extinguishing systems within clean agent systems. These include Inergen, halocarbons, and inert gases.

Examples of where clean agent systems are used include laboratories, spaces that house critical building infrastructure, flammable liquid storage areas, museums, libraries, telecommunication centers, and server rooms.

#### a. Inergen

INERGEN clean agent systems use a combination of nitrogen, argon, and carbon dioxide to suppress fires. Out of the three main types of clean agent fire suppression systems, INERGEN is the only system that has less global warming potential. These systems are safe to use in occupied spaces and are often found in historical archives, museums, and art galleries.



### **b. Halocarbon Agents,**

Halocarbon agents are agents that contain as primary components one or more organic compounds containing one or more of the elements fluorine, chlorine, bromine, or iodine. Examples are hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs), perfluorocarbons (PFCs or FCs), fluoroiodocarbons (FICs), and fluoroketones (FKs).

Halocarbons extinguish fires through a combination of chemical and physical mechanisms. They primarily work by interrupting the chemical chain reaction of a fire. Halocarbons also extract heat from the fire, reducing the flame temperature until it is below what is needed to maintain combustion. Oxygen depletion also plays a vital role in reducing flame temperature.

Halocarbon agents were developed to be a more environmentally friendly alternative to halon and have been referred to as halon replacement agents. Halon was an effective fire suppressant which is no longer produced since it was identified as a stratospheric ozone-depleting substance and is one of the most potent ozone-depleting substances.

### **c. Inert Gases, NFPA 2001**

An inert gas agent contains one or more of the following gases as components: helium, neon, argon, or nitrogen, and can also contain carbon dioxide as a minor component. Inert gases suppress fires primarily by reducing the oxygen concentration and reducing the flame temperature below what is required for combustion.

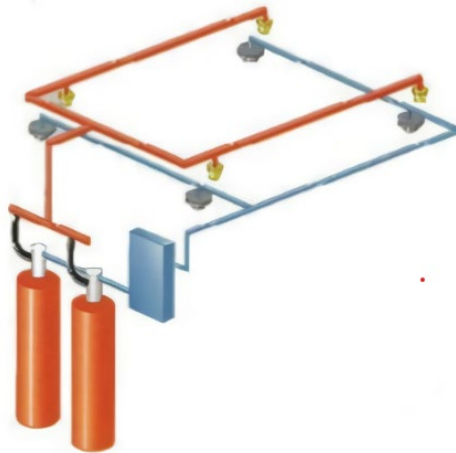
### **d. Aerosol, NFPA 2010**

Aerosol fire suppression systems use a combination of microparticles and gaseous matter to flood a protected area and suppress a fire. The particles are in a vapor state until discharged from the device and then once released, a chain reaction produces solid particles and gaseous matter. The released particles surround the flame and on contact cool the flame and absorb heat to suppress the fire.

Aerosol fire suppression systems can also work by disrupting a chain reaction by having aerosol particles containing potassium nitrate that can act as oxidizers. These particles bind with the free radicals that sustain the fire's combustion to produce by-product molecules, such as potassium hydroxide and water disrupting the combustion process until the fire is out.

Aerosol fire suppression systems can be effective in suppressing Class A, B, and C fires. However, effectiveness depends on the concentration of particulates near the flame, location of other flammable materials, and type of fuel involved.

Examples of where aerosol systems are used include data centers, server rooms, electrical cabinets, and elevator machine rooms,



## **Initiation & Activation**

### **Clean Agent System**

In the event of a fire, clean agent systems are activated by a control panel which detects the fire using automatic detection. Once a fire has been detected a releasing sequence starts often with a delay to allow occupants to evacuate. Notification devices in the protected area sound for a pre-determined time before the system is activated. The gas is released from the cylinders by the releasing panel via an electronic signal to a solenoid valve on the agent tanks. The gas then flows through the piping and out the open nozzles to either protect a local area or flood the protected enclosure.

A manual option of activation is also often required where the releasing panel receives the signal from a manual station.

Should the activation be a false alarm, abort switches should be provided, which can delay the agent release during the pre-discharge phase.

### **Aerosol System**

Aerosol systems do not require a separate vessel for the agent itself and the interconnected piping to deliver the agent. Once a fire is detected through a smoke or heat detector or through a manual pull station the releasing sequence starts. Then the actuator on the top of the aerosol container energizes a compound, which creates the aerosol agent. The agent is a mixture of micro-particles and nitrogen exit the cannister and fill the space to extinguish the fire.

## CHAPTER 2. DEFINITIONS

**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.** Acceptable to the FDNY commissioner.

**AUTOMATIC.** As applied to fire protection devices, any device, equipment or system that initiates emergency system function as a result of a predetermined temperature rise, rate of temperature rise, or combustion products, without the necessity for human intervention.

**AUXILIARY EQUIPMENT.** Listed equipment used in conjunction with the gaseous systems, for example, to shut down power, fuel, or ventilation to the hazard being protected or to initiate signaling devices.

**BUILDING CODE.** The New York City Building Code in effect on and after July 1, 2008, and as amended thereafter.

**CENTRAL STATION.** A facility that receives alarm signals from a protected premises and retransmits or otherwise reports such alarm signals to the department.

**CERTIFICATE OF APPROVAL.** A written statement issued by the commissioner, certifying that an article, device or equipment, or type, class or kind thereof, has been examined, tested and approved for a specific purpose or use in conformity with the requirements of the construction codes, this code or the rules.

**CONSTRUCTION CODES.** The New York City construction codes, consisting of the New York City Building, Fuel Gas, Mechanical and Plumbing Codes, and General Administrative Provisions, in effect on and after July 1, 2008, and as amended thereafter.

**CONTAINER.** For solid and liquid hazardous materials, a vessel of 60 gallons (227 L) or less in capacity used for storage or transportation. For compressed gases, a cylinder, pressure vessel or tank designed for pressures greater than one atmosphere at 68°F (20°C). Pipes, piping systems, engines and engine fuel tanks associated with solid or liquid hazardous materials or compressed gases, must not be deemed to be containers if in active use.

**DESIGN AND INSTALLATION DOCUMENTS.** Plans and specifications, or other written, graphic and pictorial documents or submissions, setting forth the location, design, arrangement and physical characteristics of the device, equipment, system, operation or facility for which approval by the commissioner is sought.

**DISCHARGE NOZZLE.** Device from which the extinguishing agent is discharged to provide for suppression of a fire in the designated hazard.

**DOTn.** United States Department of Transportation.

**GASEOUS AGENT.** Normally a sodium bicarbonate and mono-ammonium phosphate. Sodium bicarbonate can handle all Class B fires and some Class C fires, while mono-ammonium phosphate is an all-purpose solution used for fires in Classes A, B, and C.

**GASEOUS SYSTEM.** A means of applying gaseous that can be automatically or manually activated to discharge through a distribution system onto or into the protected hazard. The system includes auxiliary equipment.

**DUCT.**

*Branch Duct.* The duct work that contains the exhaust air from a single hood or hazard area.

*Common Duct.* The duct work containing the exhaust air from two or more branch ducts.

**ELECTRICAL CODE.** The New York City Electrical Code in effect on July 1, 2008, and as amended thereafter.

**EMISSION CONTROL DEVICES.** Also known as Air Pollution Control Unit. When required by the Air Pollution Code, commercial cooking systems must be equipped with a precipitator or other emission control device of a type for which a certificate of approval has been issued.

**ENGINEERED SYSTEMS.** Engineered systems as those systems requiring individual calculation and design to determine the flow rates, nozzle pressures, pipe size, area, or volume protected by each nozzle, quantity of suppression agent, number and types of nozzles and their placement in a specific system.

**EXPELLANT GAS.** The medium used to discharge extinguishing agent from its container.

**FIRE.** A rapid, persistent chemical reaction that releases heat and light, especially the burning of a combustible substance in the presence of oxygen. For purposes of this code, a flame used in any lawful, properly operating device, equipment or system or other controlled setting must not be considered a fire.

**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 DETECTOR, AUTOMATIC.** A device designed to detect the presence of a fire signature and to initiate action.

**FIRE EXTINGUISHING SYSTEM.** An approved system of devices and equipment that discharges an approved fire extinguishing agent onto or in the area of a fire. The term includes (water-based) sprinkler systems and (water and non-water-based) alternative fire extinguishing systems, as those terms are used in the Building Code. An automatic fire extinguishing system incorporates a device that detects a fire and activates the system. A manual fire extinguishing system does not detect a fire and requires manual activation to discharge the fire extinguishing agent.

**GENERAL SUPERVISION.** Except as otherwise provided in this code, supervision by the holder of any department certificate who is responsible for performing the duties set forth in FC113.2 but need not be personally present on the premises at all times.

**HOOD.** An air-intake device used to capture by entrapment, impingement, adhesion or similar means, grease and similar contaminants before they enter a duct system.

*Type I.* A kitchen hood for collecting and removing grease vapors and smoke.

**INDICATOR.** A mechanical or electrical device that shows when an extinguishing system or critical component of it is ready to operate or if it has already operated.

**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.

**LABELED.** A material, device, equipment or system to which has been attached a label, symbol or other identifying mark of a nationally recognized testing laboratory or other approved organization, and whose labeling indicates compliance with nationally recognized standards and designates suitable usage.

**LISTED.** A material, device, equipment or system included on a list published by a nationally recognized testing laboratory or other approved organization performing product evaluations that maintains periodic inspection of production of such listed material, device, equipment or system, and whose listing indicates compliance with nationally recognized standards and designates suitable usage.

**LOCAL APPLICATION SYSTEM.** A supply of gaseous permanently connected to fixed piping with nozzles arranged to discharge directly onto the fire.

**MASTER FIRE SUPPRESSION PIPING CONTRACTOR.** A licensed master fire suppression piping contractor, as that term is defined by the Building Code.

**MEANS OF EGRESS.** A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building, structure or premises to a public way. A means of egress consists of three separate and distinct parts: the exit access, the exit and the exit discharge.

**MECHANICAL CODE.** The New York City Mechanical Code in effect on July 1, 2008, and as amended thereafter.

**OPERATING DEVICES.** Mechanical, electrical, or pneumatic devices involved in the operation of a system.

**OPERATION.**

*Automatic Operation.* Operation without human intervention. This operation includes, but is not limited to, heat, rate of heat rise, smoke, or pressure change.

*Manual Operation.* Operation of a system or its components through human action.

**PIPE.** Pipe for conveying the extinguishing agent to the discharge nozzle(s).

**PORTABLE COOKING EQUIPMENT.** Commercial cooking equipment, provided with or installed with wheels.

**PRE-ENGINEERED SYSTEMS.** Those systems having predetermined flow rates, nozzle pressures, and quantities of extinguishing agent and having specific pipe size, maximum and minimum pipe lengths, flexible-hose specifications, number of fittings, and number and types of nozzles.

**PREMISES.** Any real property, including buildings and structures thereon, or any part thereof.

**RECHARGE.** The replacement of the extinguishing agent and expellant gas.

**SERVICING.** Performing maintenance, recharging, or hydrostatic testing.

**SHUTOFF DEVICES.** Devices that operate simultaneously with the extinguishing system to shut off fuel and power to appliances protected by the system and other appliances required to be shut off upon operation of the system.

**SIGNAL.** A status indication communicated by electrical or other means.

**SPRAY BOOTH.** A spray booth or spray room is a mechanically-ventilated and heated structure used to enclose or accommodate a spraying operation and curing cycle to harden paint.

**SUPERVISORY SIGNAL.** A signal indicating the need for action in connection with the supervision of guard tours, fire extinguishing systems or equipment, fire alarm systems or the maintenance features of related systems.

**SYSTEM.** An assembly of devices, equipment, containers, appurtenances, pumps, compressors and connecting piping that is designed to perform a complex and/or complete function.

**TOTAL FLOODING SYSTEM.** A supply of gaseous permanently connected to fixed piping and nozzles that are arranged to discharge gaseous into an enclosure surrounding the hazard.

**TRAINED.** A person who has undergone the instructions necessary to safely design, install, and reliably perform the maintenance and recharge service in accordance with the manufacturer's design, installation, and maintenance manual.

**TROUBLE SIGNAL.** A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component.

**U.S. DEPARTMENT OF TRANSPORTATION (DOT).** The department that has jurisdiction over the design and transportation of compressed gas cylinders and cartridges in the United States.

## CHAPTER 3. INSTALLATION AND THE REQUIRED INSTALLATION INSPECTION AND TESTING



### 3.1 Hazard Analysis

Before design and installation documents are prepared and submitted for Fire Department review and approval, design professionals are required to conduct a hazard analysis of all the hazards requiring protection. Such assessment will help to determine the type of system required to be installed, the total required nozzle flows, quantity and size of agent tanks and cartridges, if applicable. It also determines whether the manufacturer's Technical Support needs to be contacted for further assistance. COF S-16/COF S-61 holders should verify hazard analysis at the time of installation. The hazard analysis must include but not be limited to the following:

- Location, dimensions, and hazard areas that require protection
- Engineered or Pre-Engineered System
- Local or Total Flooding Application
- Occupied or Non-Occupied Enclosure
- Class of Hazard
- Minimum Design Concentration
- Maximum concentration allowed.
- System Discharge time
- Enclosure volume
- Temperature of enclosed space
- Cylinder Location Relative to the area or hazard being protected.
- Number and size of cylinders required to protect the space.
- Presence of equipment requiring special application protection
- Presence of equipment requiring a non-UL listed application and/or Department of Buildings approval.
- Presence of existing fire extinguishing systems that need to be interconnected to operate simultaneously

- All points of egress from the hazard area
- Presence and interconnect of a building fire alarm system or central station
- Proper Signage

### **3.2 Installation**

#### Electrical equipment

Electrical equipment and wiring systems must be installed in accordance with the New York City Electrical Code and the terms of their listing.

#### Activation

Unless otherwise provided by this code or the rules, fire extinguishing systems must be designed and installed to activate automatically. Automatically activating fire extinguishing systems must additionally be provided with a manual means of activation.

The manual devices must be readily accessible and accurately identified.

#### System interlocking

Automatic equipment interlocks with fuel and/or power shutoffs, ventilation controls, and other features necessary for proper operation of the fire extinguishing system must be provided as required by the New York City Construction Code, Fire Code, or other design and installation standard utilized for the hazard.

#### Alarms and warning signs

Where alarms are required to indicate the operation of fire extinguishing systems, distinctive audible, visible alarms and warning signs must be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal must be provided to alert occupants once agent discharge has begun. Carbon dioxide fire extinguishing systems, where allowed, must comply with the signage requirements of NFPA 12

Where a building fire alarm system is installed, all such gaseous fire extinguishing systems must be monitored by fire alarm system. All gaseous fire extinguishing systems must be monitored by an approved central station.



## Additional Safety Measures

### **Carbon Dioxide Systems**

Egress: All areas where the atmosphere will be made hazardous by the discharge of carbon dioxide must be provided with:

- Exit and exit routes that are kept clear at all times.
- Lighting and exit directional signs in accordance with the construction codes, including the Building Code
- Only outward swinging, self-closing doors at exits, and panic hardware on any such doors that are secured with a locking or latching device.

Ventilation: A carbon dioxide system must be provided with a fixed emergency forced ventilation system able to clear the area with sufficient capacity to accomplish at least 6 air changes per hour, and such other safety equipment as may be prescribed by the commissioner.

Detection, activation, alarm, and control: Detection, predischage alarms and discharge alarms must be provided within and outside the protected area and such other areas that are made hazardous by a carbon dioxide discharge. Such alarms must be audible and visible.

Manual Operation: A manual pull station must be provided which, upon activation, transmits an alarm to an approved central station, overrides any delay other than the predischage delay, and causes the carbon dioxide to discharge. Activation of a carbon dioxide fire extinguishing system by means of a manual pull station must result in a complete predischage delay sequence prior to system discharge.

Abort Systems: Abort systems may be installed but must be limited to systems activated by smoke detectors. Abort controls must be located in the protected area near the means of egress for the area and must be designed to cause the discharge of carbon dioxide after a time delay expires unless the abort control is reactivated for another cycle of delay. Abort controls must not interfere with transmission of local alarms or central station alarms.

Pressure Relief venting: The protected area enclosure must be provided with suitable pressure relief venting which vents outdoors.

### **Clean Agent Systems**

System alarm and activation: Audible and visible alarms must be installed both inside and outside the protected area to signal the activation of an automatic detection device and the operation of the fire extinguishing system. Such signals must continue until the atmosphere has been returned to normal. Activation of a single automatic detection device must sound a local alarm and transmit an alarm to an approved central station. Unless the alarm is cancelled by an abort system as set forth in FC 904.3.7.2.3, activation of a second automatic detection device must, within 30 seconds, initiate the discharge of clean agent. Power supply to the alarm system must be in accordance with the Electrical Code, the construction codes, including the Building Code, and NFPA 2001, as modified by FC Appendix B.

Warning and instruction signs: Warning and instruction signs must be posted at entrances to and within the protected area subject to flooding.

Abort systems: Abort systems may be installed only on systems activated by smoke detectors. Abort controls must be manually operated, must be located in the protected area, and must cause the discharge of the clean agent after a 2- minute delay unless the abort control is reactivated for another cycle of delay. A manual pull station must be provided which, upon activation, must transmit an alarm to an approved central station, override the delay and cause the clean agent to discharge immediately. Abort controls must not interfere with transmission of local alarms or central station alarms.

Means of egress: Where the protected area is normally occupied, provision must be made for adequate clear routes of exit with doors opening in direction of travel. Emergency lighting must be provided for such exits. Exit directional signs must clearly indicate the path of egress and exits must be clearly marked.

Fixed emergency forced ventilation: When the protected area is normally occupied, a fixed emergency forced ventilation system sufficient to accomplish at least six air changes per hour of the flooded protected area must be provided unless all of the following apply:

Pressure relief venting: Clean agent fire extinguishing systems using inert gas agents must be provided with suitable pressure relief venting for the flooded protected area that discharges outdoors.

**Exception**: Such venting must not be required when a registered design professional certifies that the walls, ceilings, and floors comprising the protected space have sufficient porosity and leakage to prevent damage to the integrity of such space upon discharge of the extinguishing agent, and that the inert gas agent leakage into other non-flooded rooms and spaces will not reach dangerous concentrations.

### **3.3 Pretest and Inspection**

Fire extinguishing systems must be inspected and tested upon completion of the installation **prior** to the installation acceptance testing.

**The fire extinguishing system must be inspected for the following conditions:**

- Hazard specification for consistency with design hazard.
- Type, location and spacing of automatic- and manual- initiating devices.
- Size, placement and position of nozzles or discharge orifices.
- Location and identification of audible and visible alarm devices, if applicable.
- Identification of devices with proper designations.
- Proper sequence of operations.

- Operating instructions, to ensure that the system is correctly operated during the acceptance testing.

Alarm testing: Notification appliances, connections to fire alarm systems, and connections to an approved central station must be tested to verify proper operation, including the following conditions:

1. The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, must be verified.
2. Central station connections must be tested to verify proper identification and retransmission of alarms.

### **3.4 System Inspection Pre-Test**

System Inspection Pre-Test must be performed based on the manufacturer's requirements and NYC approved plans. This test must include functional tests of the automatic detection system, the manual release devices, equipment shutoff, the shutoff of makeup air supplied internally to the protected area, and the electrical power shutdown.

### **3.5 Releasing Control Unit**

Where a releasing control unit is provided, the COF holder must verify that the panel is connected to a dedicated circuit and labeled properly. The unit must be readily accessible and restricted from unauthorized personnel.

### **3.6 Installation Acceptance Testing**

All fire extinguishing systems must be subject to acceptance test conducted at the owner's risk by authorized company with a S-61 COF before a representative of the FDNY. The authorized company must furnish all necessary equipment and sufficient qualified staff required to conduct the test. A puff test is required during the initial installation acceptance test as set forth in the applicable installation standard.

Carbon dioxide systems will require a full discharge concentration test.

It must be verified that the hazard areas are properly protected with nozzles and positioned in accordance with the manufacturer's design, installation, and maintenance manual and approved plans.

### Mechanical Components and Appliances

The COF holder must verify that nozzle sizes and types and pipe sizes are in accordance with the manufacturer's design parameters and approved plans.

### Piping Integrity Test

Piping must be physically checked for tightness and must not be hydrostatically tested. A test using nitrogen or dry air must be performed on the piping network at a pressure not to exceed the normal operating pressure of the extinguishing system. The quantity of the nitrogen or dry air must be

sufficient to verify that the piping and each nozzle are unobstructed, and the air must be discharged out of each nozzle.

According to NFPA 2001 for clean agent systems the pressure should be held to 40 psi for 10 minutes and cannot drop more than 8 psi.

### Room Integrity Fan Test

It is important to ensure the minimum concentration of agent will be maintained within the space for the required amount of time to suppress the fire. The room integrity fan test is a procedure to measure the leakage of the enclosure and is determined by measuring the enclosure leakage under both positive and negative pressure and averaging the absolute values of the readings. This test should be performed at acceptance and any time the room is altered such as added wall, ceiling, or floor penetrations to the enclosure or any structural or HVAC changes.

### Labeling

The labeling of devices with proper designation and instruction must be verified.

### **3.7 Return of System to Operational Condition**

Once the installation, and satisfactory FDNY acceptance test is performed, the COF holder must ensure that each extinguishing agent storage container (cylinder) is reconnected, and the system is restored back to proper working order.

If the gaseous fire extinguishing systems are monitored by a central station company, the central station company must be notified that the fire extinguishing system is in full-service operational condition.

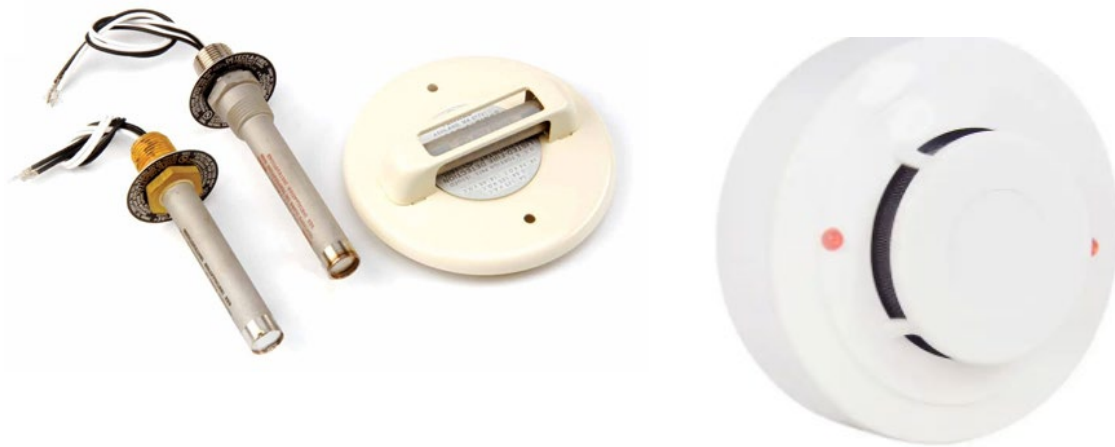
The COF holder must provide the building manager or the owner of the system the owner's manual.

## CHAPTER 4. GASEOUS EXTINGUISHING SYSTEM COMPONENTS

### 4.1 Detectors

Heat detectors are one form of detection. They can be re-settable, normally-open contacts which close when a pre-determined temperature is reached. If the temperature rise is great enough, the detector contacts will close at a temperature somewhat below the set point. Heat detectors are available at different set points and are not the best for early warning detection.

Smoke detectors are another form and are devices that sense smoke as a primary source of fire and send a signal to the control panel.



Heat detectors and smoke detectors should be cleaned and tested in accordance with the manufacturer's specifications. They must be installed per manufacturer's design criteria and recommendations.

Examples of other types of detection devices include ionization smoke detectors, photoelectric smoke detectors, and air sampling systems.

## 4.2 Discharge Nozzles



The discharge nozzles are used to protect the hazard area by distributing agent to the designated area. Different types of nozzles will provide different types of flow and/or pattern.

All discharge nozzles must be located to minimize damage or misalignment and be listed for the intended use. Listing criteria should include flow characteristics, height limits, and minimum pressures.

Discharge orifices and discharge orifice plates and inserts must be of a material that is corrosion resistant to the agent used and the atmosphere in the intended application.

- Special corrosion resistant materials or coatings must be required in severely corrosive atmospheres;
- Discharge nozzles must be permanently marked to identify the manufacturer as well as the type and size of the orifice.

Nozzles must be installed so that they are free of obstruction that could interfere with the proper distribution of the discharged agent in accordance with manufacturer's installation and maintenance manual.



## Aerosol Generator

Condensed aerosol agent generators are devices that generate the particles upon activation. The device is sealed until activated. Then the actuator on the top of the aerosol container energizes a compound, which creates the aerosol agent by exothermic oxidation. The agent mixture of micro-particles and nitrogen exit the cannister and fill the space to extinguish the fire.



## **4.3 Control Equipment**



The operating equipment consists of the UL or FM approved agent releasing devices or valves, discharge controls, and shutdown equipment. The control panel received signals from the detectors and then sends out signals to the notifications devices and activates the releasing device to release the agent from the cylinder.

The system operates either automatically if activated by a detector or manually if activated by a manual activation device. The fire extinguishing systems are automatically tripped when they detect heat over a certain accepted temperature or smoke from a smoke detector. While automatic actuation is necessary, it's also required to provide a manual activation option.

Removal of an electric actuator from an agent storage container discharge valve that it controls must result in an audible

#### 4.4 Mechanical Manual Activation Device

A manual activation device enables an operator to immediately activate the system, extinguishing the flames. The automatic and manual activation devices must be separate and independent of each other, so that a failure of one will not impair the operation of the other.

##### The requirements of the manual activation device:

1. Manual activation device must be activated with reasonable force which must not exceed 40 lb.
2. Manual activation device must not require a movement of more than 14 in. to secure operation. When these actuators are used for related protection, the device must be installed not more than 4 ft above the floor.



3. A manual pull station must be located inside the protected enclosure, along path of egress.
4. At least one manual activation device must be provided for each system.

#### 4.5 Abort Switch

Abort Switches are buttons located inside of the protected enclosure that when pressed will delay the system activation and give personnel time to evacuate before agent is dispersed. When button is no longer pressed the system will continue the process of activating the system.



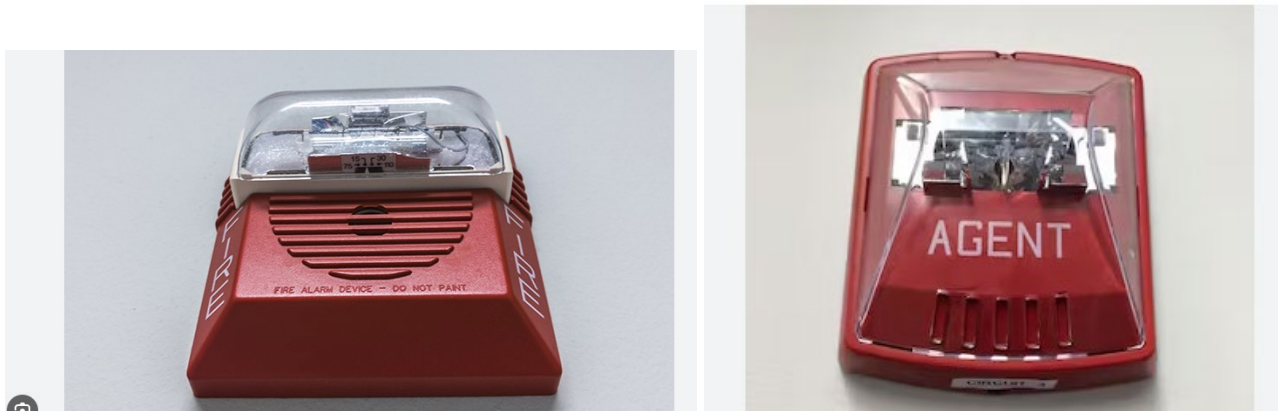


#### 4.6 Maintenance Disconnect



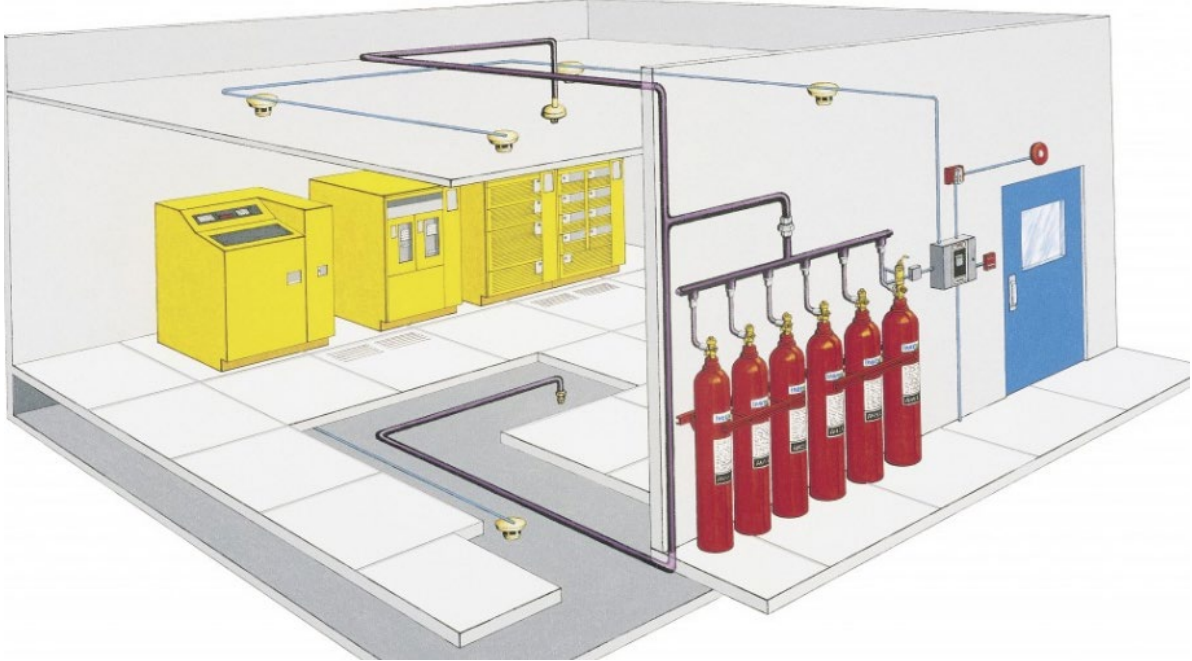
Maintenance Disconnect Switch disables automatic activation of the system during maintenance or inspections. Manual activation is still operable.

#### 4.7 Notification Devices



After the detection devices are tripped the control panel will activate the notification devices. Notification devices are used to warn those around or in the protected area that the fire suppression system is preparing to activate and release the agent. Notification devices consist of horns, strobes, and alarm bells.

### Acceptable layout of the manual activation device:



### Instructions for fire extinguishing system manual activation

The manual operating devices must identify the hazards they protect. You must provide the user the operating instructions. These instructions must be permitted to include the use of pictographs and must have lettering at least 1/4 in. in height.

A 3" x 5" sign or marking that clearly identifies what is being protected must be posted on or adjacent to the manual activation device. The manual activation device must be always kept unobstructed.



### 4.8 Pipe and Fittings, Tubing, Hose.

The pipes and fittings must be non-combustible material that is compatible with the gaseous agent (e.g., black iron, chrome plated, galvanized or stainless steel). The pressure rating of the pipe fittings and connection joints must withstand the maximum expected pressure in the piping system. Special corrosion-resistant materials or coatings must be required in severely corrosive atmospheres. All piping must conform with manufacturer's requirements.

Piping for pre-engineered systems must be designed in accordance with the limitations of the manufacturer's listed installation manual.

## **4.9 Assembly**

During assembly, the piping system must be examined internally to detect and remove contaminants or other foreign materials. Contaminants and foreign materials can affect the extinguishing agent distribution due to a reduction in the effective nozzle orifice area.

The COF holder must ensure that all extinguishing agent storage containers (cylinders) are fastened securely to their mounting brackets and structure.

## **CHAPTER 5. GASEOUS EXTINGUISHING SYSTEM REQUIREMENTS**

### **5.1 Location of Gaseous Containers (Cylinders) and Expellant Gas Assemblies**

#### **5.1.1 In the correct temperature range**

Clean agent containers (cylinders) and expellant gas assemblies must be installed in an area where the temperature will not go below or exceed the temperature range specified in the manufacturer's design, installation, and maintenance manual. If the temperatures may be outside the range, the approved method must be provided to ensure the temperature can be maintain within the listed range.

#### **5.1.2 Away from possible damage**

Gaseous containers (cylinders) and expellant gas assemblies must be installed away from ignition source, fire, mechanical, chemical, or other damage. If they are subjected to any potential damage, protective devices such as enclosures or guards acceptable to the FDNY must be provided.

#### **5.1.3 Access**

Gaseous containers (cylinders) and expellant gas assemblies must be installed and maintained to be accessible for inspection, maintenance, and recharge.

### **5.2 Ignition Sources**

Ignition sources or a secondary filtration, whether or not it includes an ignition source, must be protected by the same extinguishing system or a separate extinguishing system arranged for simultaneous automatic operation.

## **CHAPTER 6. PERIODICAL INSPECTION, TESTING AND RECORD**

### **6.1 Maintenance of Gaseous Fire Extinguishing System**

Gaseous fire extinguishing systems must always be maintained in good working order. These systems must be periodically inspected, tested, and otherwise maintained in accordance with the NYC Fire Code, applicable NFPA standards as modified by FC Appendix B, and the system manufacturer's design, installation, and maintenance manual.

Any gaseous system that is not in good working order must be repaired or replaced as necessary to restore such system to good working order, or, where authorized by the Building Code, removed from the premises. The corrective action must be conducted by an S-61/S-16 Certificate of Fitness holder. If is a major issue and/or beyond repair, contact your supervisor for further instructions. When starting the maintenance of a gaseous system it is best to consider the system installation has some kind of impairment, until it can be confirmed otherwise.

The semiannual inspection, testing, servicing, and other maintenance of gaseous fire extinguishing systems must be personally conducted by an S-61/S-16 certificate of fitness holder.

### **6.2 Monthly Visual Inspection**

As a Certificate of Fitness holder, you must advise the owner of the system to have at least one employee trained for performing the monthly inspection. The on-site personnel are not required to have a Certificate of Fitness. The on-site personnel should be trained by an S-16/S-61 COF holder and be knowledgeable to confirm that the system is in good working order, including the following conditions:

- i. The fire extinguishing system is in its proper location. It is intact and undamaged, including the extinguishing agent container (cylinders), system piping, nozzles, and protective nozzle caps.
- ii. Any system components and fire detection devices are not damaged and appear in operating condition.
- iii. Access to each manual activation device, if required, for the fire extinguishing system is not obstructed and any tamper indicator is intact.
- iv. Check the pressure gauge, control panel or control unit, as applicable, to determine whether the fire extinguishing system is operational and whether there are any supervisory or trouble signals.
- v. The maintenance tag for the fire extinguishing system is in place and has not expired.

As a COF holder, you should provide the following monthly inspection check list or the check list provided by the manufacturer to the owner. Checklist should be readily available for FDNY inspectors.

## S-16 Monthly Owner Visual Inspection Check list

Location: \_\_\_\_\_

Inspection Date: \_\_\_\_\_

Name (Print): \_\_\_\_\_

Inspection Items	Check Mark	Description of The Issue (if check "No")
Hazard area has not changed. Ex. Is the room now being used as a storage area for boxes or other products.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
Extinguishing agent cylinder(s) is/are intact.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
Control panel is in a normal status.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
Detectors are in place, not damaged, and clean.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
System piping is intact and secured.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
The nozzles are in place and not obstructed. Make sure nozzles are not covered in dirt, grease, or paint or otherwise obstructed	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
No obvious physical damage or condition exists on any component that might prevent operation.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
All alarm devices are clean and free of other damage.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
Access to each manual activation device for the fire extinguishing system is not obstructed.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
The tank pressure gauge(s) has been inspected to ensure it is in the proper operable range.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
The enclosure is free of visible penetrations.	<input type="checkbox"/> Yes; <input type="checkbox"/> No	
The maintenance tag for the fire extinguishing system is in place and current, which includes COF holder name, number, and approved company	<input type="checkbox"/> Yes; <input type="checkbox"/> No	

I here certify that I have visually inspected the item listed above based on the training I received, and I have immediately notified the owner or the owner's representative to contact the responsible S-16 or S-61 COF holder to fix any issue listed above. All items present a major hazard and must be addressed and recorded.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

### 6.3 Semiannual Inspection

An S-16/S-61 COF holder must inspect, test, service and otherwise maintain the gaseous fire extinguishing system in accordance with the following requirements and the manufacturer's specifications and servicing manuals at least on a semiannual basis.

Such semiannual inspection, testing and servicing must include all procedures necessary to determine that the system is in good working order, including the following actions:

1. Verification that the hazard has not changed.
2. Verification that the fire extinguishing system has not been altered.
3. Examination of all detection systems, expellant gas containers, alarms, manual stations, extinguishing agent containers (cylinders), releasing devices, piping, hose assemblies, nozzles, and all ancillary equipment.
4. Verification that the extinguishing agent has not been discharged.

Each system has its own method to indicate if the extinguishing agent has been discharged. You should follow the manufacturer's specifications and servicing manuals to verify.

Cylinders should be weighed semi-annually or utilize the manufacturer's liquid level indicator and thermal tables.

Only reading the pressure gauge is not a means of verifying the quantity of extinguishing agent available.

5. Verification that the agent distribution piping is not obstructed.
6. Verification that the extinguishing agent container (cylinder) and/or ancillary pressure containers (cylinders) have been, as applicable, inspected, retested and marked in conformance with the requirements of the United States Department of Transportation.
7. Preparation and submission to the owner of a written inspection report. If there is any non-compliance issue that cannot be fixed immediately, the owner must be notified.
- 7 Upon satisfactory completion of the semiannual inspection and correction of all defects, providing the owner with an inspection, testing and service compliance tag. Such tag must indicate:
  - the year and month issued;
  - the name, S-61 COF number, and DOB license number of the licensed Master Fire Suppression Piping Contractor issuing the tag;
  - the name and S-16 COF number of the COF holder conducting the inspection
  - Cylinder serial number

### Gaseous containers (cylinders)

If any agent containers (cylinders) reveal conditions such as, but not limited to corrosion or pitting more than the manufacturer's limits; structural damage; fire damage; or repairs by soldering, welding, or brazing, the affected container (cylinder) must be replaced in accordance with the manufacturer's specifications and servicing manual and the Fire Code.



← The gaseous cylinder must not be repaired by welding.

### Other system components

If any gaseous system components reveal conditions such as, but not limited to, corrosion or pitting in excess of the manufacturer's limits, structural damage, or fire damage, the affected part(s) must be replaced.

### Impairment

If the COF holder notices that there is any defective part that **could cause an impairment or failure of proper operation of the system(s)**, the affected parts must be replaced or repaired in accordance with the manufacturer's specifications and servicing manuals.

Until the impairment issue is resolved, the system must be tagged as impaired with a non-compliance tag (the FDNY recommends using red color), and the COF holder must notify the owner to discontinue all system use covered by the impaired system. The FDNY also needs to be notified by emailing [FDNY.BusinessSupport@fdny.nyc.gov](mailto:FDNY.BusinessSupport@fdny.nyc.gov) and [rangehood\\_unit@fdny.nyc.gov](mailto:rangehood_unit@fdny.nyc.gov) including address, name of the business, description of the non-compliance issues within 24 hours.

The FDNY notification should be made for the following major impairments:

- Defective control panel
- Defective control head
- Alteration of the protected space
- Alteration of room use and hazard classification
- Loss of pressure in gaseous containers (cylinders) or damaged gaseous containers (cylinders)



- The fire suppression shut off valve is inoperable
- Completely clogged nozzles
- Defective agent hose or high-pressure actuation hose
- Incorrect gaseous agent, not following the specification by the manufacturer in non-stored pressure containers.
- Damaged or removed distribution piping or components.

After proper repairs, when the system can be restored to full operating conditions, the owner and the FDNY must be notified, and the impairment tag must be removed and operation can resume.

### Recharging



You must follow the manufacturer’s design, installation, and maintenance manual to confirm if the recharging is required. For stored pressure systems, you will need to check the pressure gauge on the agent container (cylinder) to verify if the cylinder is fully charged. All verification procedures must follow the manufacturer’s manual.

If the recharging is found to be necessary after an inspection or maintenance procedure, the following procedures must be conducted in accordance with the manufacturer’s design, installation, and maintenance manual:

- (1) The system must be recharged in accordance with the manufacturer’s design, installation and maintenance manual.
- (2) The system must be placed in the normal operating condition.

It is very critical to use the agent provided by the manufacturer of the system.

Recharging supplies of gaseous must be stored in the original closed shipping container supplied by the manufacturer and maintained within the manufacturer’s specified storage temperature range. The containers must not be opened until the system is recharged.

Halocarbons must be recycled in full compliance with federal regulations CFR 49 180. Inert gases can be released into the atmosphere or follow manufacturer requirements.

## 6.3 Additional Maintenance Requirement

### Carbon Dioxide Systems.

High-pressure containers. High-pressure containers must be weighed, and the date of the last hydrostatic test must be verified at 6-month intervals. Where a container shows a loss in original content of more than 10 percent, the container must be refilled or replaced.

Low-pressure containers. The liquid-level gauges of low-pressure containers must be observed at one-week intervals. Where a container shows a content loss of more than 10 percent, the container must be refilled to maintain the minimum gas requirements.

System hoses. System hoses must be examined at 12-month intervals for damage. Damaged hoses must be replaced or tested. At five-year intervals, all hoses must be tested or replaced with new.

Test procedure. Hoses must be tested at not less than 2,500 pounds per square inch (psi) (17 238 kPa) for high-pressure systems and at not less than 900 psi (6206 kPa) for low-pressure systems

### Clean Agent Systems

Containers. The extinguishing agent quantity and pressure of the containers must be checked at 6-month intervals. Where a container shows a loss in original weight of more than 5 percent or a loss in original pressure, adjusted for temperature, of more than 10 percent, the container must be refilled or replaced. The weight and pressure of the container must be recorded on a tag attached to the container

System hoses. System hoses must be examined at 12-month intervals for damage. Damaged hoses must be replaced or tested. All hoses must be tested at 5-year intervals or replaced with new.

### Halon Systems

Containers. The extinguishing agent quantity and pressure of containers must be checked at least on a semiannual basis. Where a container shows a loss in original weight of more than 5 percent or a loss in original pressure (adjusted for temperature) of more than 10 percent, the container must be refilled or replaced. The weight and pressure of the container must be recorded on a tag attached to the container.

System hoses. System hoses must be examined at 12-month intervals for damage. Damaged hoses must be replaced or tested. At 5-year intervals, all hoses must be tested.

Test procedure. For Halon 1301 systems, hoses must be tested at not less than 1,500 psi (10 343 kPa) for 600 psi (4137 kPa) charging pressure systems and not less than 900 psi (6206 kPa) for 360 psi (2482 kPa) charging pressure systems. For Halon 1211 hand-hose line systems, hoses must be tested at 2,500 psi (17 238 kPa) for high-pressure systems and 900 psi (6206 kPa) for low-pressure systems.

## Aerosol Systems

Aerosol generators are never required to be weighed. Replacement is based on manufacturer and UL listing.

### **6.4 5 Year Test**

All fire extinguishing systems must be retested once every five years from the date of acceptance of the system. The test must be conducted and reported to the department by a licensed master fire suppression contractor holding a certificate of fitness, properly trained and having knowledge of the installation, operation and maintenance of the specific fire extinguishing system, or a person holding a certificate of fitness under the direction and control of such license holder.

Perform a 5 year hazard analysis to confirm the hazard has not changed from the original approved installation.

### **6.5 Hydrostatic Test**

The hydrostatic test must ensure:

- Gaseous agent cylinders, auxiliary pressure cylinders, and hose assemblies must be subjected to a hydrostatic test pressure equal to the marked factory test pressure or the test pressure specified in the manufacturer's design, installation, and maintenance manual.
- No leakage, rupture, or movement of hose couplings.
- The pressure in a hydrostatic test of a cylinder must be maintained for a minimum of 30 seconds, but for no less time than is required for complete expansion of the cylinder and to complete the visual examination of the cylinder.
- Gaseous agent removed from the cylinders prior to hydrostatic testing must be discarded or recycled.

Hydrostatic testing must comply with NFPA, DOT, and manufacturer's requirements.

It must be done by a DOT certified testing facility in compliance of Code of Federal Regulations (CFR) 49 Section 180 from 2015.

Prior to being refilled in accordance with DOT requirements, containers (cylinders) bearing DOT markings must be retested or replaced in accordance with the appropriate DOT requirements.

When transporting cylinders follow manufacturer's instructions including always install shipping plate and anti-recoil plate when transporting a pressurized agent cylinder and follow federal, state, and local DOT requirements.

### **6.6 Tag and Recordkeeping**

Records of all system inspections, tests, servicing, and other maintenance required by the Fire Code or the referenced standards must be maintained.

### Tag

Gaseous system cylinders must have a tag securely attached.

Such tag must indicate the information required in section 7.3, item 8 of this booklet.

Only the current tag must remain in place.

### Recordkeeping

The monthly inspection record must include the date the inspection is performed, Certificate of Fitness holder's COF number, and the initials of the person performing the inspection.

The COF holder must provide the semiannual inspection reports, including any recommendations, to the owner or the owner's representative.

The owner or the owner's representative must keep all inspection, maintenance or repair record at the premises at least 3 years.

## **CHAPTER 7. COMMON MISTAKES THAT RESULT IN SYSTEMS FAILURE OR FDNY SUMMONS/ VIOLATIONS**

### **7.1 Incorrectly Installed and Modified Systems**

It is critical that the system is installed for each unique hazard and is correctly maintained by well-trained COF holders. The system must be installed in accordance with the procedures detailed in the manufacturer's design, installation, and maintenance manual.

The fire extinguishing system will also fail during a fire condition if the layout of the hazard is expanded or changed without properly modified protection. The approval must be obtained from the FDNY.

### **7.2 Poor Maintenance or Inspection**

The COF holder must ensure any required inspection or maintenance is properly conducted to minimize fire threats.

The monthly visual inspection also matters. Examples of which include cardboard boxes being moved into a server room or a self-closing door being kept open. Most poor maintenance problems have been observed to have been caused by the end user.

### **7.3 Common Installation/Maintenance Mistakes**

#### **(1) During the acceptance test:**

- Failure to install the fire extinguishing system in accordance with the manufacturer's installation manual.
- Failure to properly interconnect automatic equipment interlocks with the fire extinguishing system.
- Pneumatic test failure. Unable to hold 40 psi
- Room integrity fan testing compromised due to modification of the space prior to FDNY acceptance test
  - Example drilling a hole in the wall
- Failure to meet the design sequence of operations of the control panel.

#### **(2) During the maintenance:**

- Failure to report and document any discrepancies.
- Failure to replace all high-pressure actuation hoses
- Not activating pull station.

**Please read this before taking your test.  
Your test may include a few questions from this material.**

**Lithium-ion safety**

Lithium-ion batteries are rechargeable batteries found in electric bikes, scooters, cars, laptops, tablets, phones, and many other common household devices.


Lithium-ion battery fires have caused deaths, serious injuries, and devastating damage to property around the city. It's important to follow rules for safe storage, charging, and disposal for these types of batteries.

If you own a lithium-ion powered device or plan to buy one, the FDNY has important safety tips that you should follow. These tips apply to all devices powered by lithium-ion batteries, including phones, tablets, laptops, e-cigarettes, toys, high-tech luggage, and even robotic vacuum cleaners.

**Immediately stop** using or charging battery and call 911 if you notice:

- Fire or Smoke
- Overheating
- Change in color or shape
- Odd noises
- Leaking
- Strange smell

**ALWAYS:**

- purchase and use devices certified by a Nationally Recognized Testing Laboratory (NRTL). 
- follow the manufacturer's instructions for:
  - charging and storage.
  - correct battery, cord, and power adapter
- **keep exit path clear at all times.**
- plug directly into a wall electrical outlet for charging.
- keep batteries and devices at room temperature.
- store and/or charge batteries away from anything flammable.
- keep away from heat sources.
- bring batteries to a **NYC Battery Recycling Center**. Visit [nyc.gov/batteries](http://nyc.gov/batteries) for more information.

**NEVER:**

- use aftermarket batteries or chargers.
- use damaged or altered batteries
- plug into a power strip or overload an outlet.
- overcharge or leave battery charging overnight.
- charge a battery or device under your pillow, on your bed, or near a couch.
- leave e-bikes or e-scooters unattended while charging.
- block your primary way in or out of a room/space with e-bikes, e-scooters, wheelchairs, etc.
- place batteries in Trash or Recycling bin. **It is ILLEGAL.** Visit [nyc.gov/batteries](http://nyc.gov/batteries) for disposal locations and information.

**In the event of a Fire,  
Leave and CLOSE the door.  
Call 911 once you are in a safe location.**



## Charging Lithium Ion

Lithium-ion batteries do not have to be fully charged; partial charge is the most suitable.

When **charging more than five (5)** personal mobility devices or their removable batteries, it must be in a **dedicated room with ventilation** and a self-closing door.

For a total battery capacity of 20 kilowatt-hours (kWh), a 2-foot separation between charging batteries is required. For a total battery capacity up to 50 kWh, a 3-foot separation is needed.

Chargers must only be used with a compatible battery pack. The original equipment manufacturer (OEM) charger interplays with the battery pack using the battery management system (BMS). The wrong battery/charger combination may not work safely. For example, the 100% cutoff to prevent overcharging, which damages batteries, may not work which can easily create hazardous conditions such as fires, explosions and/or injuries.

Always check with the manufacturer or retailer of the personal mobility device, an authorized repair shop or a testing laboratory such as Underwrites Laboratories (UL) to see if replacement is recommended or listed and safe for use with that device. Using unauthorized parts, including batteries and/or chargers, may cause damage, fire, and possibly void your warranty.

## Extinguishing Lithium-ion

Water may not prevent a battery from burning and spreading. Battery cells are known to explode and quickly spread to another battery. It can spread to another devices.



**Fire Extinguishers**  
**do not work**  
on lithium-ion batteries fires.

## **Unexpected Re-ignition.**

Reignition is common. Lithium-Ion Batteries are known to unexpectedly re-ignite (without warning) minutes, hours and even days after all visible fire has been put out.

Lithium-ion batteries can enter an uncontrollable, self-heating state. This can result in the release of gas, cause fire and possible explosion.

These batteries may continue to generate heat even when there is no visible sign of fire. Once heat reaches a certain level fire may reignite on the battery and surrounding area.

