

FIRE DEPARTMENT • CITY OF NEW YORK



**STUDY MATERIAL FOR THE
CERTIFICATE OF FITNESS EXAMINATION FOR
TORCH USE OF FLAMMABLE GASES**

G-60

(old G-95, G-33, G-38)

**Note: This G-60 Certificate of Fitness DOES NOT include the TORCH USE
IN MANUFACTURE OF JEWELRY. For TORCH USE IN MANUFACTURE OF
JEWELRY, please ask for G-61 Certificate of Fitness.**

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NOTICE OF EXAMINATION

Title: **Examination for Certificate of Fitness for Torch Use of Flammable Gases (G-60).**

Date of Test: Written tests are conducted Monday through Friday (except legal holidays) 8:00 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. 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, character, physical conditions, experience, and address of premises where applicant will be employed.
4. Applicants must present two (2) forms of satisfactory identification i.e., driver's license, passport, vehicle registration, library card, or equivalent.

APPLICATION INFORMATION

Application Fees: \$25.00 for originals and \$15.00 for renewals. The fee may be paid by credit card (no debit), in cash, money order, or personal check payable to New York City Fire Department. The \$25.00 fee must be payable by all applicants prior to taking the Certificate of Fitness test. Application forms are available at the Public Certification Unit, 1st floor, 9 Metro Tech Center, Brooklyn, NY 11201.

TEST INFORMATION

Test: The test will be of the written, multiple choice type. A passing score of at least 70% is required in order to secure a Certificate of Fitness. Call 718-999-1988, or 2504 for additional information and forms.

STUDY MATERIAL AND TEST DESCRIPTION

About the Study Material

This study material will help you prepare for the examination for the Certificate of Fitness for torch use of flammable gases. The study material includes information taken from the Fire Prevention Code of the Bureau of Fire Prevention. This study material consists of 4 parts. The exam covers the entire booklet and any tables. **It will not be provided to you during the test. It is critical that you read and understand this booklet to help increase your chance of passing this exam.** The study material does not contain all of the information you need to know to work with a torch. It is your responsibility to become familiar with all applicable rules and regulations of the City of New York, even if they are not covered in this study material. You need to be familiar with the National Fire Protection Association (NFPA) 51B, and Fire Code Chapter 26, Chapter 35, and Chapter 38 which regulate the torch use of flammable gases in order to adequately prepare for the exam.

About the Test

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

Sample Questions

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

- (A) George Jefferson.
- (B) George Washington
- (C) Bill Clinton.
- (D) Barack H. Obama.

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

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

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

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

INTRODUCTION

This document outlines New York City Fire Department regulations for welding, cutting and other torch and hot work operations and equipment. Hot work processes are a necessary part of much construction work and industrial work. However, the improper use is often a major cause of fire and it can result in loss of life and property.

Certificate of Fitness

According with the FDNY regulations, a G-60 Certificate of Fitness is needed for conducting any of the following torch operations:

1. An oxygen-fuel torch using any amount of oxygen and flammable gas
-Exception:
Torch operations using oxygen container and **piped natural gas** for jewelry manufacture may be performed by a person without a C of F, but must be under the personal supervision of a Certificate of Fitness holder. The Certificate of Fitness holder must regulate the pressure and flow of oxygen and natural gas to each torch.
However, if the torch operator for jewelry manufacture involves any oxygen with any fuel gas containers, the operator must be a C of F holder.
2. Any torch operation for torch-applied roof systems.

The Certificate of Fitness holder must keep the Certificates of Fitness upon his or her person or otherwise readily available for inspection by any representative of the Department, at all times while conducting or supervising the material, operation or facility for which the certificate is required.

Hot Work Permit


Permits issued by the FDNY are required to conduct the following hot work :

- (1) storing, using or handling oxygen and a flammable gas,
or
- (2) storing, using or handling any flammable gas (e.g. LPG or CNG or acetylene) in excess of 400 SCF.
or
- (3) storing, using or handling any oxidizing gas (e.g. oxygen) in excess of 504 SCF.

For LPG, 400 SCF is approximately 47 lbs. The following table lists the number of LPG containers for the storage, use, handling or transportation, requiring a permit. This permit will be issued by the Fire Commissioner after the location has been inspected and approved as acceptable for such practices.

LPG Container Capacity	Number of Containers Requiring Permit
14.1 oz	54
16.4 oz	46
20 lbs	3
33.5 lbs	2
40 lbs	2
100 lbs	1

Portable LPG containers that are more than **16.4 oz** must not stored, handled, or used indoors in the following occupancies (as defined in the Building code): residential occupancies, factory and industrial occupancies; educational occupancies; institutional occupancies, except as the commissioner may authorize by rule.


Example of LPG container with a capacity of 20 lbs	Example of LPG container with a capacity of 100 lbs
	

Types of FDNY Permits

(1) Site-specific permit

Such permit authorizes the permit holder to store, handle, or use flammable gases, or conduct a torch operation at a specific premises or location. A site-specific permit may be a permanent permit or a temporary permit. Permanent permits are valid for 12 months only. Every permits or renewal shall require an inspection and shall expire after twelve months. Temporary permit may be valid from one day to 12 months depends on the construction /operation need. For example, a one-week temporary permit may be issued to a construction job which only takes one week. Normally, a hot work operation (e.g. construction site or hot work repair) is issued a temporary permit.

Example of a permanent FDNY permit

FIRE DEPARTMENT, CITY OF NEW YORK					BUREAU OF FIRE PREVENTION				
ACCOUNT NUMBER 77777777	TYPE 10	A.P. P	D.O. 12	ADM. CO. E284	ISSUANCE DATE 01/28/10	PERMIT EXPIRES 01/11			
PREMISES ADDRESS 1111 YORK ST STATEN ISLAND NY 11111				ACCOUNT NAME CARI & RENO					
ITEM CODE 345	SUB CODE 00	QTY 1	DESCRIPTION COMPRESSED GASES ONLY STR/USE		FLOOR NO. 1	FEE PAID			
<table border="1"> <tr> <td>PERMIT TYPE 1</td> <td>ANNUAL FEE</td> <td>PAID</td> </tr> </table>							PERMIT TYPE 1	ANNUAL FEE	PAID
PERMIT TYPE 1	ANNUAL FEE	PAID							
1=REGULAR 2=SUPPLEMENTAL 3=DUPLICATE			CARI & RENO 1111 YORK ST STATEN ISLAND NY 11111						
 20 11012938									
BY ORDER OF THE COMMISSIONER									

Example of a temporary FDNY permit

D.O.	COMPANY	BORO	ACCOUNT NO.	TOTAL FEE	
01		MANH	33333333	\$525.00	022411

Expiration Date: 11/01/11

**THE CITY OF NEW YORK
FIRE DEPARTMENT**

Bureau of Fire Prevention
9 Metro Tech Center
Brooklyn, N.Y. 11201-3857

F 02872

FIRE DEPARTMENT PERMIT

Postal Address of Permit Holder or Agent:

KARLIN PIPING INDUST.
347 REM WAY
WADING RIVER, N.Y., 11792

Occupancy for which this Permit is issued and at which it must be displayed:

1310 WEST 11 STREET
NEW YORK, N.Y., 10011

New York MANHATTAN

Pursuant to the provisions of the administration Code and the regulations made thereunder, the above permittee is hereby authorized by the Fire Commissioner to store and use HAZARDOUS MATERIALS in the quantity specified.

This permit is revocable at the pleasure of the Commissioner, and is issued with the express understanding that the articles herein named are to be stored and kept in accordance with the provisions of the law; that the permittee will use all possible care to avoid accidents; that it is only available for the location and permittee named.

[Signature]
Fire Commissioner

PERMIT COVERS

CODE NO.

345 OXYGEN STORAGE AT CONSTRUCTION SITE

346 ACETYLENE STORAGE AT CONSTRUCTION SITE

347 USE OXYGEN AND ACETYLENE TORCH AT CONSTRUCTION SITE

NOTE:
4 OXYGEN AND 4 ACETYLENE CYLINDERS SEPARATELY STORED IN APPROVED CAGES AT GROUND LEVEL

RF-101 (1/01) 93-111-F25-D470

CASHIER'S COPY

This temporary permit is valid for 7 months.

(2) Citywide permit

A city-wide permit is valid up to 30 days, and all gas containers must be removed from the site at the end of each workday. A new application must be submitted if a single job will last more than 30 days.

Permits for Citywide Hot Work Operations

1. Each vehicle used to transport torches and containers of oxygen and flammable gas for use in citywide hot work operations must be inspected by a Department representative at the Bureau of Fire Prevention's hazardous cargo vehicle inspection facility prior to the issuances of a permit for citywide hot work operations.
2. A city-wide permit is valid up to 30 days. A site-specific citywide permit must be obtained for any hot work operations that are conducted for more than 30 days.
3. A separate permit must be applied for the storage of oxygen or flammable gas at a work site.

All permits are not transferable, and any change in occupancy, operation, tenancy or ownership requires that a new permit be issued. The Certificate of Fitness holder is responsible for making sure that all fire safety regulations and procedures are obeyed on the premises. **Permits shall be readily available on the premise for inspection by Fire Department representatives.**

Hot Work Authorization (Hot Work Program Permit)

A hot work program authorization bearing the signature of the responsible person must be obtained for any project conducted on a premises involving hot work operations by the person in charge of such hot work operations. Hot work authorization should be issued by the responsible person and it must be available for inspection by any representative of the department during the performance of the work, and for **48 hours after the work is complete**. An example of a hot work program permit is shown below.

The operation of gas torches is required to comply with the following FDNY code and rule sections:

- Welding and Other Hot Work: **[FC Chapter 26]**
- Flammable Gases: : **[FC Chapter 35]**
- Liquefied petroleum gases: **[FC Chapter 38]**
- Fire Prevention During Welding, Cutting and Other Hot Work: **[NFPA 51B, 2003 edition]**
- Portable Space Heaters Fueled By Piped Natural Gas at Construction Sites **[Rule 1403-01]**
- Use of Oxygen and a Flammable Gas in Citywide Hot Work Operations **[Rule 2605-01]**
- Piped Natural Gas and Oxygen Consuming Devices and Installations **[Rule 2609-01]**
- Acetylene **[Rule 3501-01]**
- Compressed Natural Gas **[Rule 3507-01]**
- Liquefied Petroleum Gases **[Rule 3809-01]**

HOT WORK AUTHORIZATION PERMIT

Note: This authorization applies only to this job, and in the area specified during the date and time noted.

GENERAL INFORMATION	
Hot Work Performed By: <input type="checkbox"/> Employee <input type="checkbox"/> Contractor <input type="checkbox"/> Off-hours	Authorization #
Employee /	Contractors Name:
Supervisor / Foreman Name:	Supervisor / Foreman - On-site emergency contact phone number:
Location: Building address, room # and/or area of work .	Permit Start Date: _____ Permit Start Time: _____
	Permit Stop Date: _____ Permit Stop Time: _____
	Comments: _____

HOT WORK ACTIVITY				
<input type="checkbox"/> ARC WELDING	<input type="checkbox"/> SOLDERING	<input type="checkbox"/> GRINDING	<input type="checkbox"/> BRAZING	<input type="checkbox"/> USING OXYGEN AND A FLAMMABLE GAS (FDNY PERMIT)
<input type="checkbox"/> MAPP WELDING	<input type="checkbox"/> WELDING	<input type="checkbox"/> CUTTING	<input type="checkbox"/> NON-FIRE WORK	<input type="checkbox"/> OTHER: _____
<i>All hot work activities must be conducted by FDNY Certificate of Fitness holders. Certificate holders shall be responsible for keeping such certificate upon his/her person or otherwise readily available for inspection.</i>				
Torch Operator:		Certificate #:	Exp Date:	
Fire Guard:		Certificate #:	Exp Date:	

ACCEPTANCE BY THE RESPONSIBLE PERSON FOR HOT WORK		
I certify that all applicable codes, procedures, regulations, rules, pre-checks and safety precautions will be followed for as long as the hot work authorization is effective.		
Name:	Signature:	Date:
_____	_____	_____
<input type="checkbox"/> Employee <input type="checkbox"/> Contractor		

DESIGNATED TO AUTHORIZE THE PERFORMANCE OF HOT WORK			
Name:	Signature:	Time:	Date:
_____	_____	_____	_____
Fire alarm precautions taken <input type="checkbox"/> YES <input type="checkbox"/> N/A Type: _____		Pre-hot work check completed: <input type="checkbox"/> YES	
_____		FDNY permit required to conduct hot work?	
		<input type="checkbox"/> YES <input type="checkbox"/> N/A	

This authorization shall be available for inspection by any representative of the fire department during the performance of the work and for 48 hours after the work is complete.

DEFINITIONS

CNG: Compressed Natural Gas.

FIRE GUARD: A person holding a Certificate of Fitness for such purposes, who is trained in and responsible for maintaining a fire watch and performing such fire safety duties as may be prescribed by the commissioner.

FIRE WATCH: A temporary measure intended to ensure continuous and systematic surveillance of a building or portion thereof by one or more qualified individuals for the purposes of identifying and controlling fire hazards, detecting early signs of fire, raising an alarm of fire, and notifying the department.

HOT WORK: Cutting, welding, thermit welding, brazing, soldering, grinding, thermal spraying, thawing pipe, cadwelding, installation of torch-applied system, or any other similar operation or activity.

HOT WORK AREA: The area exposed to sparks, hot slag, radiant heat, or convective heat as a result of hot work.

LPG: Liquefied Petroleum Gases.

NFPA: National Fire Protection Association. NFPA develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks.

PERSONAL SUPERVISION. Supervision by the holder of any department certificate who is required to be personally present on the premises, or other proximate location acceptable to the department, while performing the duties for which the certificate is required.

RESPONSIBLE PERSON: A person trained in the fire safety hazards associated with hot work, and in the necessary and appropriate measures to minimize those hazards, who is designated by the owner of a premises to authorize the performance of hot work at the premises.

SCF: Standard Cubic Feet.

TORCH-APPLIED ROOF SYSTEM: Bituminous roofing systems using membranes that are adhered by heating with a torch and melting asphalt back coating instead of mopping hot asphalt for adhesion.

PART 1. GAS TORCH EQUIPMENT

Gas torches are widely used for different purposes citywide. A fuel gas is used in the equipment to generate a flame to perform heating, cutting welding and brazing. Gas torches utilize two basic types of gas systems: blowtorch (air-fuel) and oxy-fuel.

Example of blowtorch (air-fuel)



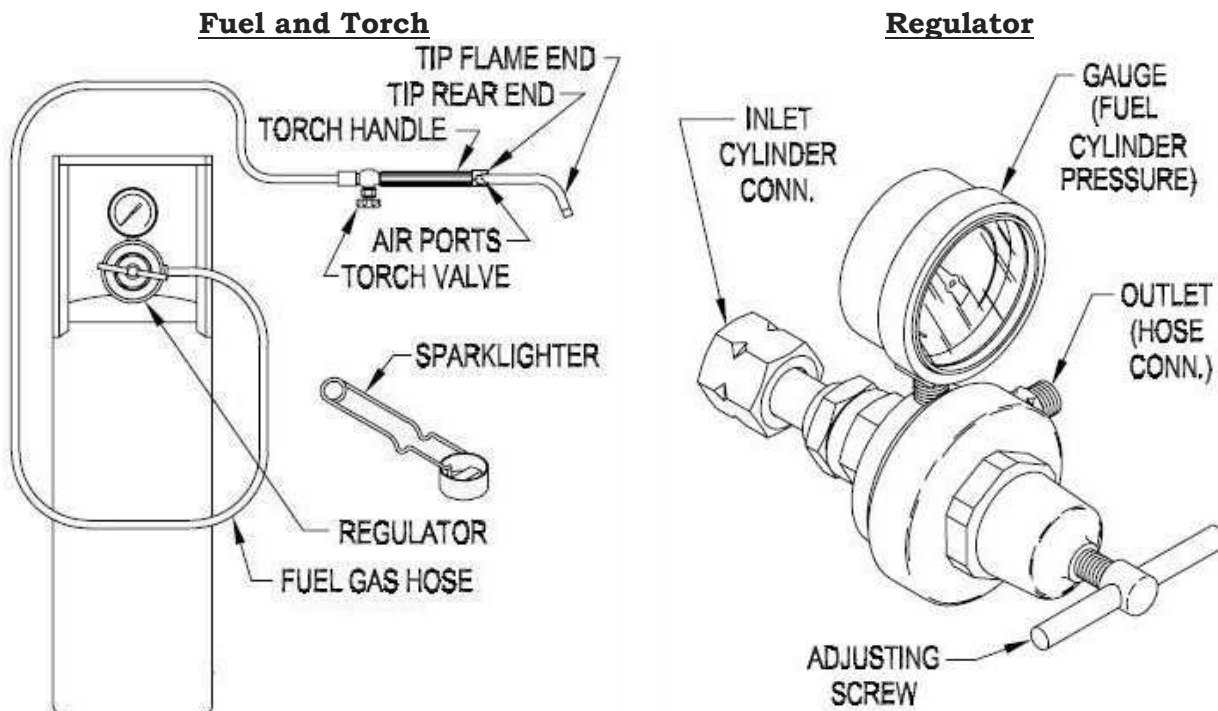
Example of oxy-fuel torch



1.1 Blowtorch (Air-fuel) and Oxy-fuel Torch

1.1.1 Blowtorch (Air-fuel torch or single tank torch)

A propane torch is an example of a blowtorch, commonly used in torch-applied roof system. To provide enough oxygen for the torch to burn the fuel cleanly, the system mixes in air from the surrounding environment prior to ignition and while the torch is running. A container holds the fuel, while a tube carries it up to the nozzle. A valve near the nozzle lets in the air as needed.



Most common fuel gases used in blowtorches are LPG (e.g. butane, propane), natural gas (methane) (either CNG or piped natural gas).

1.1.2 Oxy-fuel Torch

Oxy-fuel or oxygen-fuel gas torches have two separate containers: a pressurized fuel gas container and a pressurized oxygen container. The oxygen cylinder is made of steel and contains 100% oxygen. A mixture of oxygen and a fuel gas is used to generate a flame. The fuel gas is needed because oxygen does not burn by itself. Oxygen supports combustion and it maintains and controls the flame. In other words, the oxygen intensifies the burning of the fuel gas. For this reason, workers should never use oxygen to blow dirt off their clothes. Even a small spark could immediately ignite the clothing and cause serious injury. Using pure oxygen with the fuel makes the torch flame much hotter than the standard blowtorch torch. For example, Oxy-propane torches can produce about 1,500 degrees Fahrenheit higher than the air-propane torch can generate.

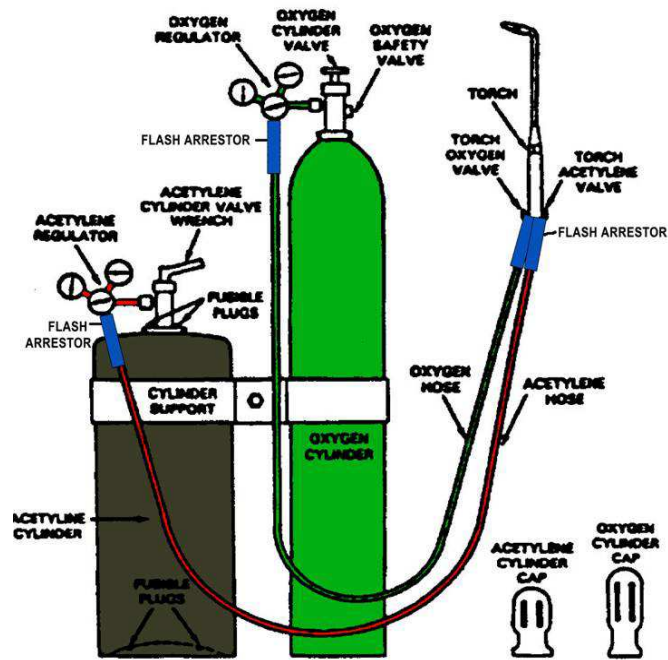
Some of the fuel gases used in oxy-fuel torches are LPG (e.g. butane, propane), natural gas (methane) (either CNG or piped natural gas), and acetylene. Acetylene is used because compared to the other fuel gases it creates the greatest amount of heat when burned (i.e. 3,000 degrees Fahrenheit higher than an air-propane torch).

Both gas containers have control valves on the top of the container. The valves control the discharge of gas from the containers. Gas containers also have a protective cap or protective collar. The protective collar is always located on the top of the LPG container. The caps should be screwed on over the valve when the cylinders are not in use. These caps/collars prevent the valves from being damaged. The oxygen is stored at pressures up to 2200 psi (pounds per square inch). It has a safety disk installed in the control valve connection of the oxygen container. This disk will burst if the oxygen pressure in the cylinder becomes too great. This allows the oxygen to escape into the air and prevents an explosion. The pressure is likely to change if the cylinder becomes hot (e.g. in a fire).

The fuel gas (e.g. propane, natural gas or acetylene) is stored at higher pressures to keep a sufficient amount of fuel available for torch operations. However, it is dangerous to use the fuel gas at pressures above 15 psi, especially for acetylene. For this reason, a regulator is installed on the fuel cylinder. The regulator makes sure that the fuel is discharged from the gas container at a safe pressure range.

The two gases, oxygen and the fuel gases, are mixed inside the torch. The torch operator controls the mixture of the gases by using valves on the torch. Adjusting the valves controls the shape and intensity of the flame. The oxy-fuel mixture is manually ignited by the operator when it leaves the torch.

An example of a typical oxyacetylene welding system is shown below.



A Typical Oxyacetylene Welding System

1.2 Different Use of Gas Torches

1.2.1 Welding and cutting

Welding involves joining two or more pieces of metal together to form a single piece. Molten metal is generated through an intense heat source. Unlike welding processes which join two pieces of metal, cutting processes involve separating or severing a piece of metal through intense heat generated to melt the metal. Both welding and cutting processes often include oxygen and fuel gas. Oxy-acetylene generates the highest temperature which can reach up to 6,000 °F.



A Cutting Torch



A Welding Torch

1.2.2 Brazing and Soldering

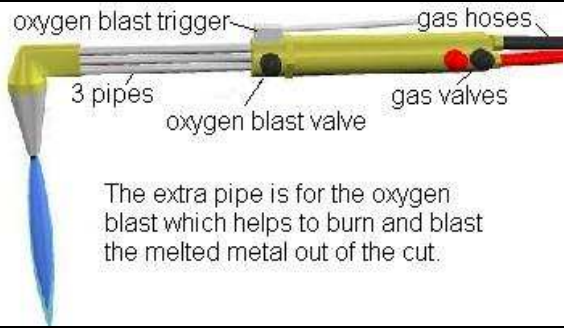
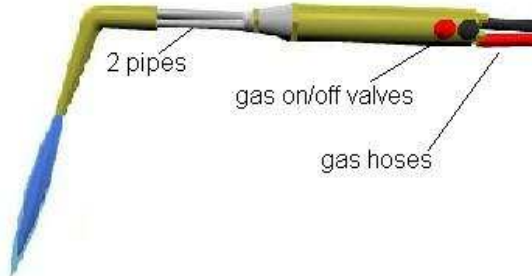




Brazing and soldering are similar to welding in that both the base metal and the filler metals are heated to melting and then solidify to form a joint. However, soldering and brazing temperatures are typically 840 °F. Soldering or brazing typically involves smaller components to be joined and "softer" metals such as lead, tin or silver. Manual soldering processes use a hand-held iron to heat the components to be joined and the filler metals. A propane canister torch is often used for small tin-lead soldering jobs. It is a small disposable container of pressurized propane gas, and the container is attached with a reusable torch.

1.2.3 Other heavy duty application

Gas torches also have applications for burning weeds, melting ice, or applying tar/asphalt to a roof. The flame is often a diffuse high temperature naked flame, heat is required, but not so hot as welding or cutting work. However, the temperature can exceed 2000°F.




Table: Examples of different torch



Use	Temperature	Common Torch Types	Sample Picture
Cutting	> 2, 000 °F	Oxy-fuel torch	 <p>oxygen blast trigger gas hoses 3 pipes oxygen blast valve gas valves</p> <p>The extra pipe is for the oxygen blast which helps to burn and blast the melted metal out of the cut.</p>
Welding	> 2, 000 °F	Oxy-fuel torch	 <p>2 pipes gas on/off valves gas hoses</p>
Brazing and Soldering	Around 840°F	Blowtorch (most common) Oxy-fuel torch (large jobs or jewelry work)	
Other Heavy Duties	Wild range	Blowtorch	 <p>control valve turbo blast trigger torch head</p>

PART 2. TORCH (HOT WORK) OPERATION

Normally, the gas mixture is manually ignited by the operator when it leaves the torch. The flame itself can reach extremely high temperatures. A high temperature flame is needed to heat the metal. However, usually it is not the flame that causes a fire. Instead, it is the thousands of sparks and pieces of hot metal that are generated when using the torch. The sparks and pieces of hot metal are all possible sources of ignition. In fact, sparks and pieces of hot metal are the source of ignition in about 60% of all fires in industrial occupancies. This number is greatly reduced when the operators are trained to use the equipment correctly.

Fire History Summary

Date	Fire Summary	Lessons Learned	
Nov. 2010	<u>Chinese city of Shanghai construction fire</u> Sparks from welding equipment set a light nylon construction netting and bamboo scaffolding that nearly covered the building. 58 people died and 56 still missing, and more than 120 are injured.	There should be a safe distance between the combustible materials (in this case the bamboo scaffolding) the hot work operations area, or there should be a fire guard watching for sparks.	
July 2009	<u>Throgs Neck construction fire, Queens, NY</u> At 5 a.m. a fire started near scaffolding and flammable construction materials on the Queens-side bridge approach by a construction worker's blow torch.	Although still under investigation, the cause reflects a lack of fire safety at the construction site.	
June 2009	<u>5-story apartment construction fire, Renton, WA</u> Several spot fires from a roof torch had fallen into the void between the insulation, ceiling, and roof assembly, and a breeze provided enough air for a fire to flare up early hours later. The fire spread rapidly through the wooden construction. \$12 million damage estimate in this fire.	Sheetrock had not yet been installed to protect the wood framing. There should be a fire guard watching for sparks.	

Date	Fire Summary	Lessons Learned	
Mar. 2009	<u>Casino Fire, Joliet, IL</u> A fire sparked by a construction worker welded a kitchen hood in an area of the casino. The fire caused heavy damage to sections of the Empress Casino and firefighters had to truck in water to contain the blaze. \$340 million damage estimate in this fire.	There should be a fire guard watching for sparks.	
Dec. 2000	<u>Dongdu Commercial Building construction, Luoyang, China</u> Construction workers in the basement dropped molten metal on flannel rags and wooden furniture. The welders fled without warning, and workers on 2 nd and 3 rd floor, as well as 200 guests at an illegal party, were trapped. 309 people died.	Only 60 escaped the fire, as construction material and merchandise blocked exits. Firefighters used cranes to attempt rescues, and the fire took 3 hours to extinguish. The welders who started the fire were performing unlicensed renovation work.	

Sources

Arnold, Jim. "Large Building Fires and Subsequent Code Changes". April 7, 2005.

FDNY: Worker's blow torch started Throgs Neck fire. (2009, July 13). *Newsday*.

Small Fire causes damage at hospital construction site. (2010, February 16). *Daily Sound*.

Stephen G. Badger. "US Large-Loss Fires in 2009". (2010, November/ December). *NFPA Journal*.

A fire guard is responsible for overseeing torch operations. This person ensures that sparks and pieces of hot metal do not cause a fire in the area of hot work or the floor below. Like the torch operator, the fire guard is a Certificate of Fitness holder (F-60), and both must have this in their possession at all times during all torch operations. One fire guard is required for each torch operation, as well as one required below the work area. A portable extinguisher must be within immediate reach to extinguish any potential fire situation.

2.1 Responsible Person and Pre-Hot Work Check

For citywide hot work operations, the owner of the premises of the hot work operation areas must be notified in writing by the citywide permit holder **at least 48 hours before** the hot work is to be started. For all hot work operations, the owner of the hot work operation areas must designate a responsible person. The responsible person must ensure that the hot work is performed in compliance with the terms and conditions of the permit. The person should inspect the hot work site prior to issuing the hot work authorization (hot work program permit) to ensure that it is a fire safe area. He/she also need to periodically monitor the work as it is being performed to ensure there are no fire safety hazards. Hot work operations must be conducted under the general supervision of the responsible person.

The pre-hot work check must be conducted by the responsible person before hot work is authorized and at least once per day. The check reports must be kept at the work site during the work, made available for inspection by a representative of the department, and **maintained on the premises for a minimum of 48 hours after work is complete.**

A pre-hot work check must be conducted at least once per day and must verify the following:

1. Equipment.
 - (1) Available sprinklers, hose streams, and extinguishers are available and operable.
 - (2) Approved actions have been taken to prevent accidental operation of automatic fire detection systems.
 - (3) Hot work equipment in good repair.
2. Requirements within 35 feet of work area.
 - (1) Flammable liquids, dust, lint, and oil deposits removed.
 - (2) Floor swept clean.
 - (3) Combustible floors wet down, covered with fire-resistant sheet.
 - (4) Remove other combustibles where possible, otherwise protect with fire-resistant cover or metal shields.
 - (5) All wall and floor openings covered.
 - (6) Combustibles on other side of walls moved away.
3. Fire watch/ hot work area monitoring.
 - (1) Fire watch will be provided during hot work operations and will continue for a minimum of **30 minutes** after work.
 - (2) Fire watch is supplied with fire extinguishers.
 - (3) Fire watch may be required for adjoining areas and below.
4. Permit and Certificate of Fitness.
 - (1) Required site-specific permit or citywide permit is readily accessible.
 - (2) All persons performing hot work possess Certificate of Fitness (e.g. G-60 C of F for torch operator; F-60 C of F for fire guard).

2.2 Designated Hot Work Area

A designated area (e.g. a cutting and welding station) must be a specific area designed or approved for hot work. Partitions segregating hot work areas from other areas of the building must be of noncombustible or fire-resistive construction. Fixed hot work areas must have floors with noncombustible surfaces, and the partitions must be securely connected to the floor such that no gap exists between the floor and the partition. Partitions must prevent the passage of sparks, slag and heat from the hot work area. This area must be **kept 35 feet away** from any combustible material and combustible waste. Paper, wood shavings, straw and fabric are examples of combustible materials. Some walls, portable partitions, ceilings and floors are also combustible. If possible, the combustible materials should be moved to a safe location. If relocation of the combustible materials is impractical, combustibles, openings or cracks in walls, floors, ducts or shafts within 35 feet of the hot work area must be tightly covered to prevent the passage of sparks to adjacent combustible areas, or shielded by metal or fire-retardant guards, or provided with curtains to prevent passage of sparks or slag. They may also be wetted down as an added precaution. Ducts and conveyor systems that might carry sparks to distant combustibles must be shielded, or shut down, or both. If hot work is done near walls, partitions, ceilings, or roofs, ignition of combustibles on the other side must be prevented. Under no circumstances should hot work be done within 35 feet of flammable or explosive materials.

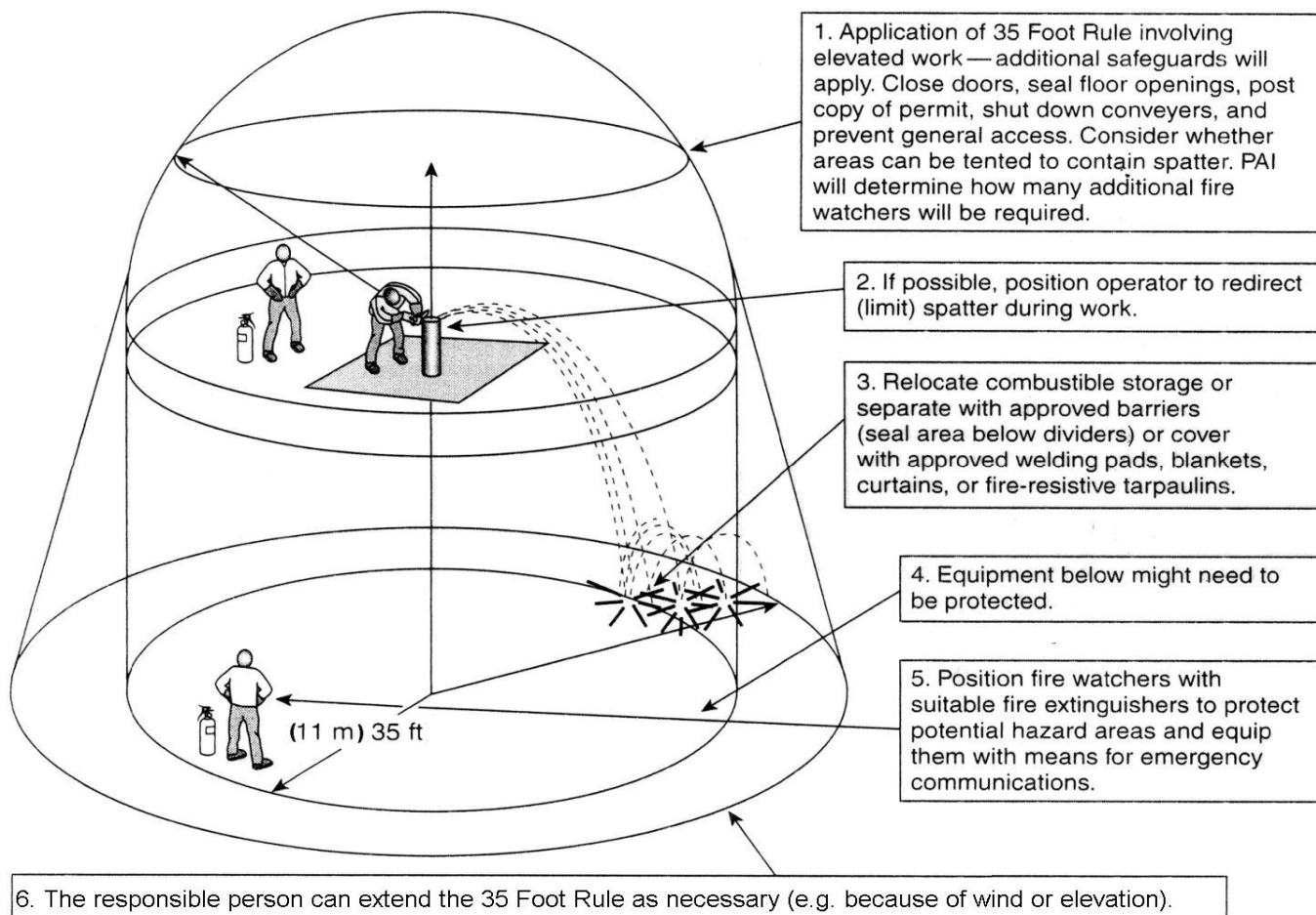
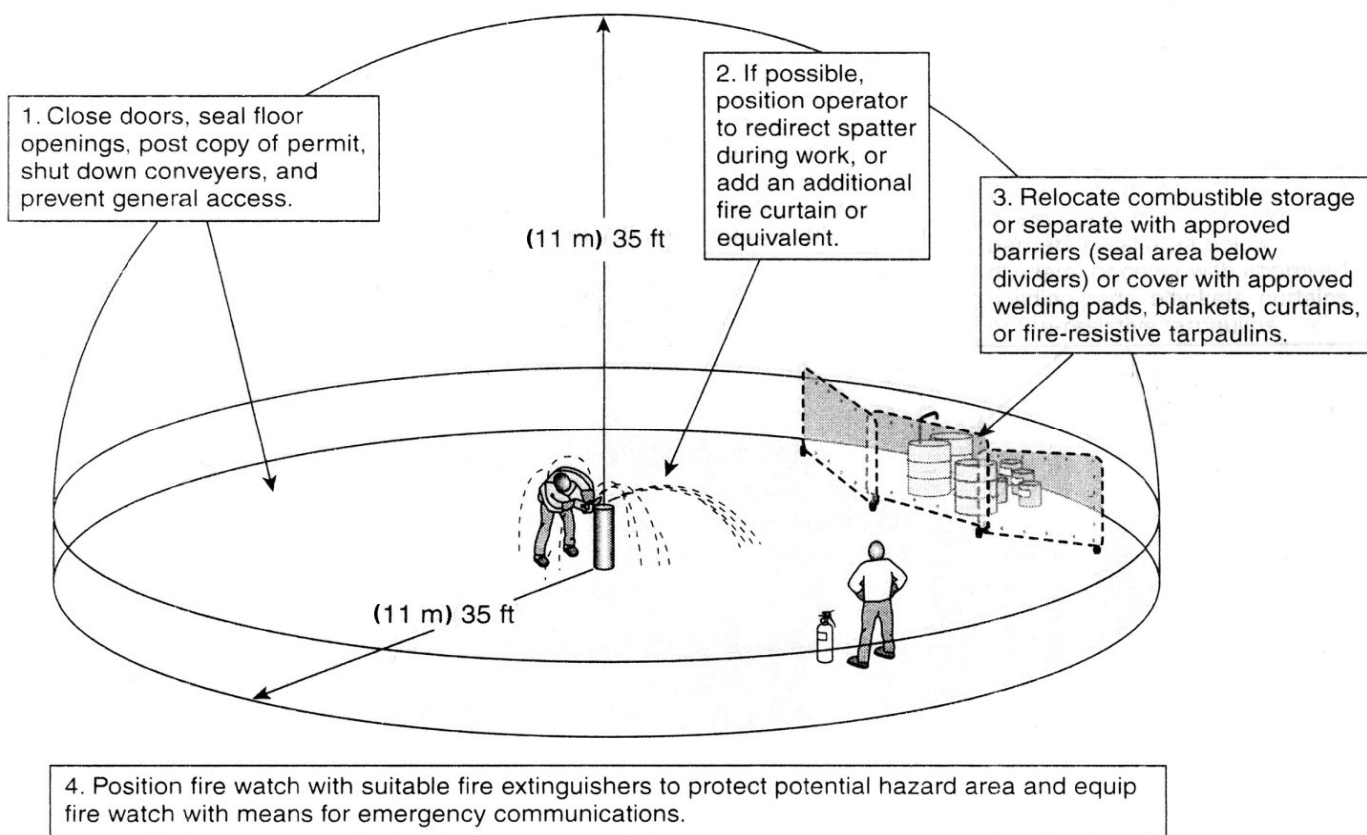
Flammable materials are generally categorized as either liquids or gases that burn. For example gasoline and propane are flammable materials.

A visible hazard identification sign must be posted in a conspicuous location to warn others before they enter the hot work area. An example warning sign is shown below.



A Designated Hot Work Area

The 2009 edition of National Fire Protection Association 51B shows the 35-ft. rule in a 3-D perspective to account for a general fire watch and multiple fire watchers. Detail information refer to Chapter 5 of NFPA 51B, 2009 .



2.3 Fire Watch

FDNY certified fire guards (F-60 C of F holders) must be present to perform fire watch during the hot work operations for the torch operations at the following locations: (1) Construction sites; (2) On any rooftop, or in connection with any torch-applied roof system operation; (3) In any building or structure, when the torch operation is conducted by a person holding a citywide permit for torch operation.

A fire guard may be required for adjoining areas and below. For example, an additional fire guard must be provided on the floor or level below the torch operation if torch operations are performed at the construction site or in connection with torch-applied roofing system operations. The responsible person shall ensure any adjacent structures are adequately protected and monitored (where necessary) by additional fire guard personnel.

The fire guard is responsible for fire safety duties during torch operations. This person ensures that sparks and pieces of hot metal do not cause a fire in the area of hot work or the floor below. Like the torch operator, the fire guard is a Certificate of Fitness holder (F-60), and both must have this in their possession at all times during all torch operations.

The fire watch must be continued after the completion of torch operation. The fire guard must inspect all areas exposed to the effects of torch operations for the purpose of detecting fires. The entire work area should be checked **after completion of hot work** for fires. For all hot work, **the inspection must be conducted 30 minutes after completion of torch operations**. In the best practice, the 2nd inspection should be 1 hour after completion of torch operations. For any CNG or LPG torch operation, the first inspection shall be conducted 30 minutes after completion of torch operations; the second inspection 1 hour after completion of torch operations. This is to make sure that there are no smoldering fires in the building. The fire guards must complete a signed inspection report. The fire guards must complete a signed inspection report (or the log book). This report must be submitted to and retained by the person in charge of the torch operations. The inspection report must be made available to any representative of the Fire Department and should be maintained on the premises for reasonable length of time (e.g. 48 hours) after work is complete.

Such fire guards must not be assigned any duties other than to remain alert and guard against fire, and they must be alert to sparks, the transmission of heat, and the potential ignition of combustible material. They are also authorized to stop work if necessary, and restore safe conditions within the hot work areas. Such fire guards must be responsible for ensuring that fire extinguishing equipment is readily accessible from the time torch operations are commenced until an hour after such operations are completed. **A minimum 2-A:20-B:C rating fire extinguisher must be readily accessible within 30 feet of the hot work location and the fire guard.** Fire guards may use garden hoses connected to a reliable water supply, or buckets of water.



A fireguard should be present with a minimum 2-A:20-B:C rating fire extinguisher to perform fire watch during the hot work operations.



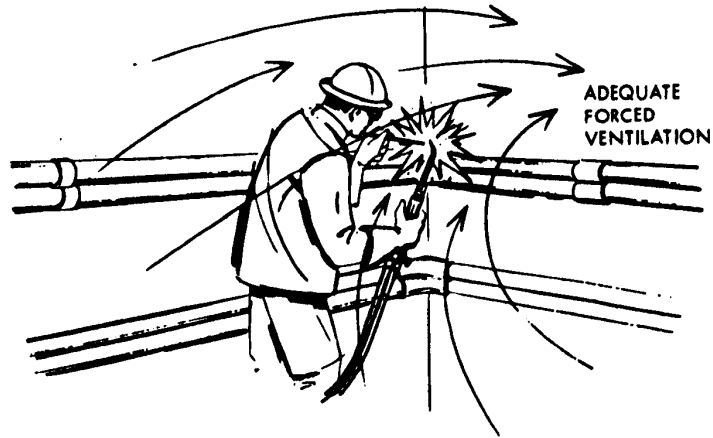
Fire watch is required for adjoining areas and below to make sure that sparks do not cause a fire on the adjoining areas.

2.3.1 Special Regulations of Fire Watch in the Torch-applied Roof System

A torch-applied roof system is a bituminous roofing system using membranes that are adhered by heating with a torch and melting asphalt back coating instead of mopping hot asphalt for adhesion. It is widely used in US, torch-applied operations can be hazardous to roofers and the public. Improper torch use or careless fire watch has caused many rooftop fires. A torch-applied roof system must not be operated on roofs constructed of combustible materials. Fire guards must be on continuous duty during all torch operations on the roof of a building. There must be one fire guard on the roof for each torch operator, and an additional fire guard is required one floor level below the work area. The fire guard makes sure that sparks do not cause a fire on the lower floor. **A minimum 3-A:40-B:C rating fire extinguisher** must be readily accessible within 30 feet of the hot work location and the fire guard. Fire guards may use garden hoses connected to a reliable water supply, or buckets of water.

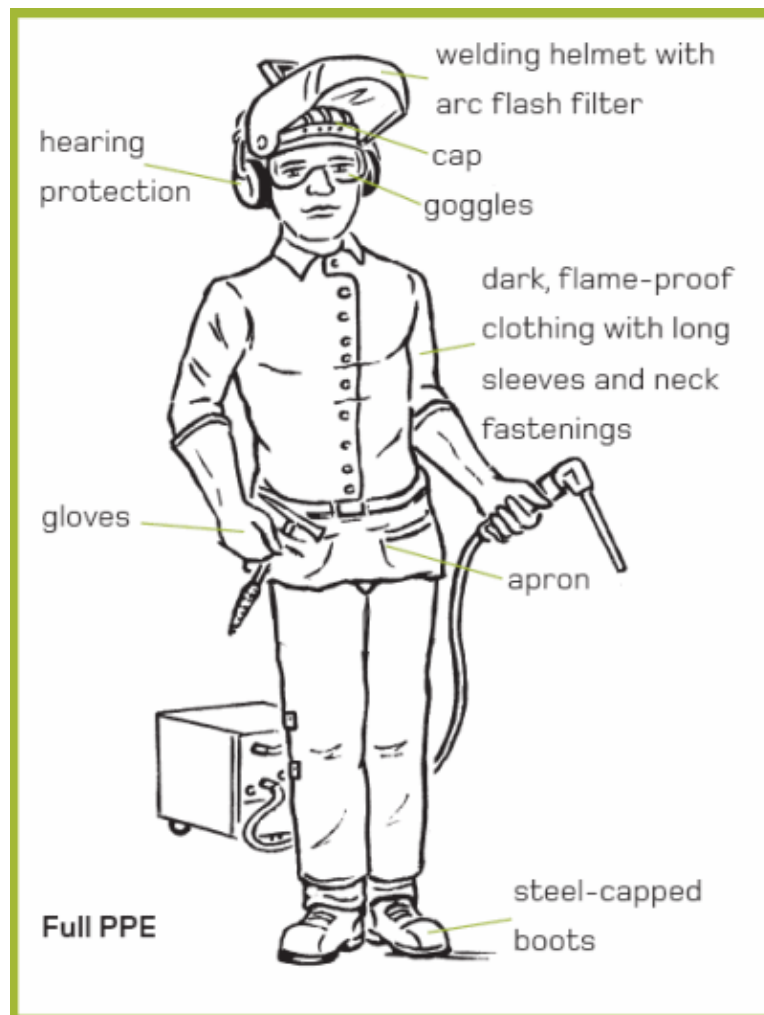
2.4 Personal Protection

The gas-torch equipment should only be used by trained and responsible personnel. Only the equipment approved by the Materials and Equipment Acceptance (MEA) should be used. The work area should be well ventilated. This will prevent the worker from breathing dangerous fumes. Exhaust fans may be used to draw the fumes away from the work area. An example of a well ventilated work area is shown below.



A Well Ventilated Work Area

The workers should wear flame resistant gloves and aprons, skull caps, helmets or goggles, and safety shoes. Clothing with pockets or cuffs should not be worn while working. Sparks or pieces of hot metal might catch in the cuffs or pockets. The following picture shows the appropriate safety clothing to wear while cutting and welding.



Frayed clothing is particularly susceptible to ignition and burning and should NOT be worn when welding or cutting.



Protective Clothing to be Worn While Cutting and Welding

2.5 Gas Torch Operation Precautions

Each person must operate only one torch at a time and such torch must not be left unattended while ignited. Any containers that contain combustible materials must not be cut, welded, or applied any torch operation. The container may catch fire and result in an explosion. Such explosions have caused serious injuries and several deaths. Even containers that have been empty for awhile may be dangerous as they may still contain flammable vapors. All combustible and flammable solids, liquids, dusts, or vapors must be removed from the container before cutting or welding. The containers should be thoroughly cleaned with the correct cleaning solutions.

It is prohibited to perform welding or cutting when supported by or resting on any compressed gas containers. Performing any torch-applied roof operations on any combustible roof (e.g. wood roof) is also prohibited.

The torch equipment should only be used for purposes for which it was intended. It should not be used for any kind of tricks or stunts. This could result in serious or fatal injuries.

Automatic sprinkler protection shall not be shut off while hot work is performed.

Cutting and welding may cause sprinkler heads to accidentally open if the temperature rises near the sprinkler heads. To prevent this the head should be covered by noncombustible barriers or damp cloth. **The covers should be removed immediately after the cutting and welding is finished. If the work extends over several days, the covers shall be removed at the end of each workday.**

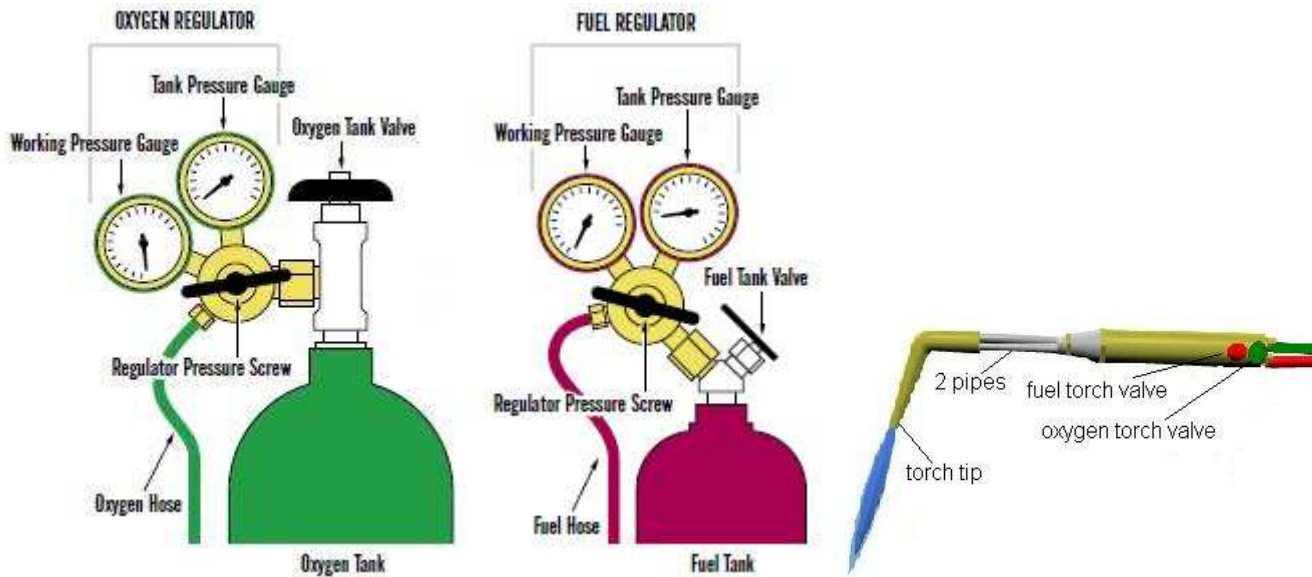
Smoke Eater being used to remove fumes/smoke and prevent unnecessary fire alarm activations.



Posted Hot Work Authorization
(Hot Work Permit)

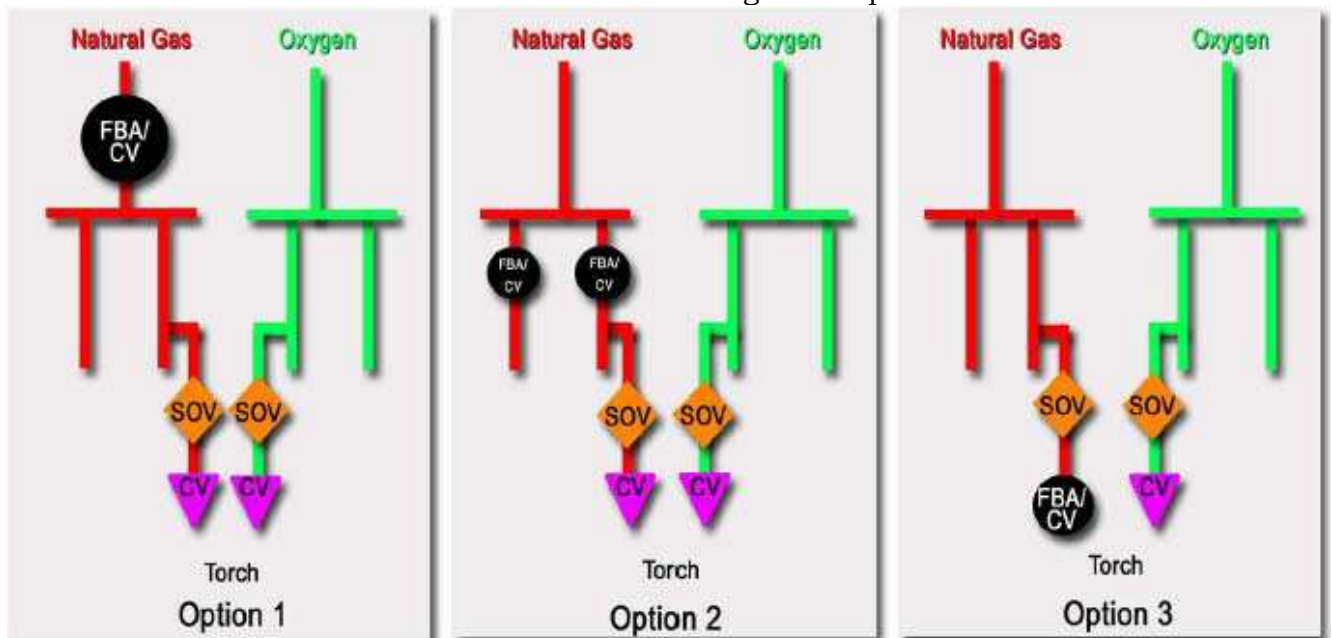
Welding Screen being used to
prevent the passage of sparks, slag
and heat from the hot work area.

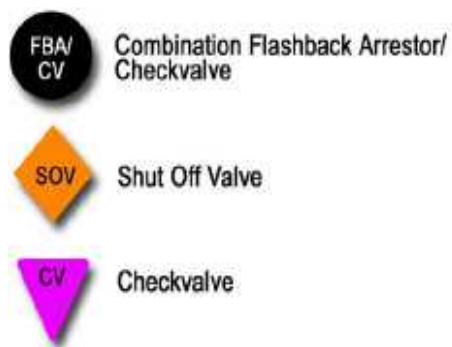
2.6 Guidelines for Using an Oxygen-fuel Torch



2.6.1 Set Up an Oxy-Fuel Torch

- Make sure that the valves and the regulators are clean.
- Do not over-tighten the regulator nut as this may damage the fitting.
- Oxygen and fuel gas container valves must be accessible to the torch operator or fire guard for immediate shutoff of the gas supply in the event of an emergency.
- Maintain a safe distance between the hot work area and the gas containers to protect the containers from heat, sparks, slag, or misdirection of the torch flame.
- Check for leaks. If any leaks are found, shut the supply valve, DISCONTINUE USE and contact the supplier/manufacturer and take the system out of service.
- If the fuel is piped natural gas, required protective flashback arrestor/checkvalve material must be installed as one of the following three options:





NFPA 51 offers three Options for placing the required protective flashback arrestor/check-valve in a manifold pipe system:

- Option 1: Put the flashback arrestor at the head end of the gas supply.
- Option 2: Place flashback arrestors in each branch of the manifold.
- Option 3: Places flashback arrestors at each torch.

Additional check valves are required at each torch in Option 1 & 2 and on the oxygen line in Option 3.

Shutoff valves are required on both natural gas and oxygen lines at each torch location.

2.6.2 Turn On an Oxy-Fuel Torch

- Open the gas container valve slowly and allow pressure to stabilize. The acetylene container valve should be opened by only 1/4 turn. The acetylene pressure should never be above 15 psi. If more acetylene is needed to supply, the larger torch hose should be used.
- Torch should be ignited by friction devices or other approved methods, should not use matches or other hot works.
- Once the flame is lit, open the fuel valve more and open the oxygen torch valve until the desired flame composition is achieved.

2.6.3 Turn Off an Oxy-Fuel Torch

- If the torch operation is to be discontinued for **a period of 1 hour or more**, the torch valve must be closed and the gas supply to the torch also must be completely shut.
- Turn off the gas torch valves. Some manufacturers suggest turning off the oxygen side first to prevent soot from building up inside the torch tip. But some may suggest first turn off the fuel gas torch valve. Then turn off the oxygen. **It is always best to follow the instructions for the torch you are using.**
- Close both the oxygen and fuel container valves completely.
- Open the torch valves, one at a time, to bleed the hoses. The pressure shown on both pressure gauges should drop to zero. Close the torch valves. Turn both regulator pressure screws counter-clockwise until they are loose.
- Disconnect the regulators from the gas containers or disconnect the hoses from the regulators.

2.6.4 Special Precautions for Using Oxy-fuel Equipment

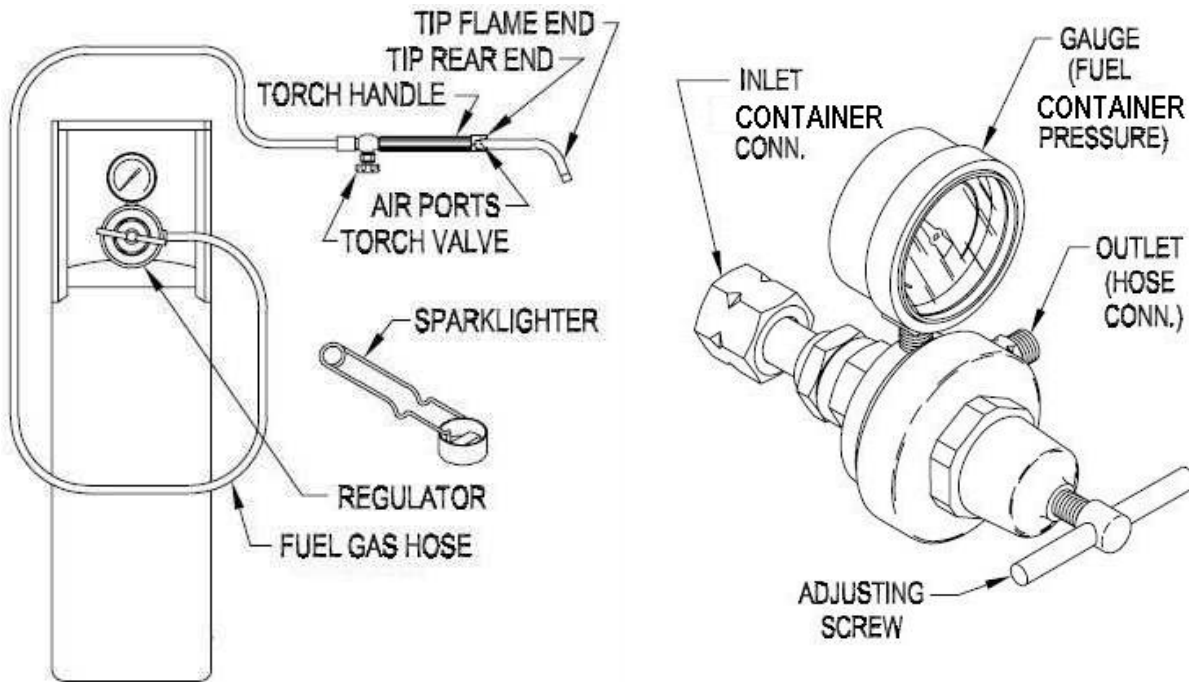
(1) Avoid oil or grease

Containers, valves, regulators, hose and other apparatus and fittings for **oxygen must kept free of oil or grease**. Oxygen containers, regulators must not be handled with oily hands, oily gloves, or greasy tools or equipment. The oil and grease are more likely to ignite in the presence of oxygen. This is because the oxygen intensifies the burning of other materials. The mixture of pressurized oxygen and oil or grease may also cause an explosion.

(2) Never mix gases inside a container

Never attempt to mix oxygen and fuel inside a container. Never attempt to transfer oxygen or acetylene from one gas container to another.

2.7 General Guidelines for Using a Blowtorch



2.7.1 Set Up a Blowtorch

- Make sure that the valves and the regulators are clean.
- Do not over-tighten the regulator nut as this may damage the fitting.
- The fuel gas container valve must be accessible to the torch operator or fire guard for immediate shutoff of the gas supply in the event of an emergency.
- Maintain a safe distance between the hot work area and the gas containers to protect the containers from heat, sparks, slag, or misdirection of the torch flame.
- Check for leaks. If any leaks are found, shut the supply valve, DISCONTINUE USE and contact the supplier/manufacturer and take the system out of service.

2.7.2 Turn On a Blowtorch

- Open the gas container valve slowly and allow pressure to stabilize.
- Open the fuel torch valve a very small amount and light with a spark lighter.
- Torch should be ignited by friction devices or other approved methods, should not use matches or other hot works. Use the torch valve to control the size and heat of flame.

2.7.3 Turn Off a Blowtorch

- If the torch operation is to be discontinued for **a period of 1 hour or more**, the torch valve must be closed and the gas supply to the torch also must be completely shut.
- The torch system must be shut down as follows:
 - a. Close gas container valve.
 - b. Open torch valve and drain regulator and lines. DO NOT discharge toward people, flame or source of ignition.
 - c. Release regulator adjusting knob fully counterclockwise.
 - d. Shut off torch valve. Disconnect torch and regulator, replace the protective cap and plug to the hose end and supply tank respectively for overnight or longer shutdown.

2.8 Common Problems Occur With Torch Operations

2.8.1 Backfire

This occurs when the flame on the torch goes out unexpectedly. A loud snap or pop may occur when the flame goes out. Sometimes the flame will quickly relight. This happens when the working surface area is hot enough to re-ignite the flame. Backfire may be caused by several things that are easy to fix. The following is a list of some conditions that might cause backfire.

- (1) Touching the nozzle tip against the working surface.
- (2) Overheating the nozzle tip.
- (3) The oxygen and/or the fuel gas is set at the wrong pressure.
- (4) The cutting or welding tip is loose or dirty.
- (5) Dirt on the work surface.
- (6) Kinks or blockages in the hoses.
- (7) The nozzle tip is damaged and not seated properly in the torch head.

If backfire is noticed the container valves should be closed and the equipment checked for the symptoms listed above. If any dirt or damage is noticed, it should be cleaned or repaired before the equipment is used again.

2.8.2 Flashback

This occurs when the cutting or welding flame burns inside the torch or the hoses. It is usually accompanied by a whistling or hissing noise. As soon as the hissing or whistling is noticed the torch control valves should be closed. Then the fuel gas container valve should be closed. This allows the flame to burn itself out. After a few minutes the fire should have burned itself out.

Flashback indicates that there is something seriously wrong with the equipment. The equipment should be checked for damage or blockage. Check for the same conditions that might cause backfire. A build up of dirt may also cause the flashback. This can be a very dangerous situation. Care should be taken to make sure that it is fixed properly. If the equipment is not cleaned and repaired correctly it may result in an explosion. The entire system should be cleaned and repaired if needed. If the flashback happens again, a qualified technician should repair the equipment.

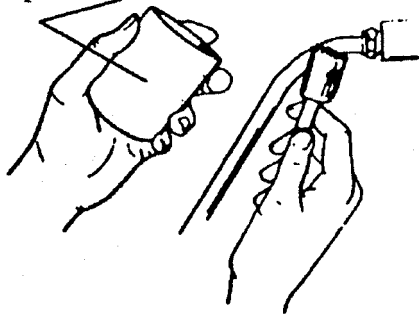
2.8.3 Check for Leaks

The gas containers, valves, hoses, and related equipment should be inspected for physical damage. Special care should be taken to identify any defects that may cause a leak. **Any defective components that are discovered must be marked and be replaced before the equipment may be used again.** If any leak of flammable gases or oxygen is detected, move the gas container to an isolated, well-ventilated area away from combustible materials. Post signs that describe the hazard. The **Certificate of Fitness holder must not attempt to do any repairs, but only take the equipment out of service.** This equipment is very sensitive and must be repaired by the manufacturer only.

After the new container has been connected to the appliance, all connections must be checked for leaks. Most of these leaks occur at the top of the gas container in areas such as the valve threads, pressure safety device, valve stem and valve outlet.

These areas must be checked using a soap and water solution. **NEVER CHECK FOR LEAKS WITH A FLAME.** First make sure that all connections are tight. Then open the container valve. Each connection is checked by brushing or spraying a soap and water mixture on the connection. The connection should be checked to see if any air bubbles are present. If no air bubbles are visible there is no leak. However, if bubbles are present there may be a problem with the connection. The suspected fittings should be disconnected and cleaned. Then the connection is tightened and the checking procedure is repeated. If the bubbles are still visible, there is a problem with the connection. The fittings should be repaired or replaced before the equipment is used again. **A lighted flame (for example, a match) should never be used when checking a connection for a leak.**

Soap and Water Solution



Occasionally, ice or moisture may build up on the regulator. Icy build-up indicates that the compressed gas is leaving the gas container in a liquid state. This is caused by a dangerous defect in the gas container. If ice build-up on appliance or connectors, shut off the main control valve of the fuel container, take it out of service, and return it to the supplier immediately. If the ice build-up is on the gas container itself or its control valve, you should call 911 immediately.

PART 3. COMPRESSED GAS CONTAINER

The gases used by gas torches are commonly supplied in compressed gas containers, which can pose additional handling and transport hazards. All compressed gases are potential hazards because of the pressure within the container, their flammability, and/or their toxicity. The chemical is in gaseous form and pressurized, it can quickly contaminate a large area in the event of a leak.

3.1 Handling, Use, and Storage of Compressed Gas

3.1.1 General Guidance

(1) Label all compressed gas containers clearly

The contents of any compressed gas container must be clearly identified. Gas identification should be stenciled or stamped on the container or a label, and is typically applied near the neck of the container. **Do not rely solely on the color of the container to identify the contents. Do not use any container that is unmarked or has conflicting marking or labels.**

(2) Do not refill container

The gas containers must be replaced when they are empty. It is illegal to refill gas containers in New York City. **Empty containers must be handled in the same manner as full ones.** They should be marked empty, the container valve or regulator tap must be closed and stored separately from full containers. All empty containers must be promptly removed by vendors.

(3) Upright position

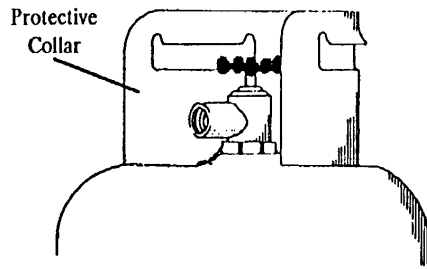
The oxygen and the fuel gas containers should be maintained in an upright position when being used. This is true for both the portable and the manifold system. This is especially important for the acetylene containers. If the acetylene container is used while on its side the acetone may escape. This may result in an explosion inside the gas container. The gas containers used for a portable oxy-fuel torch system are usually secured on a handtruck. The containers are less likely to be damaged when secured to a handtruck. The handtruck permits the gas containers to be moved safely. The portable system is usually used for on-site jobs. All gas containers must be secured from tipping over, and should be stored in an upright position, and be equipped with a pressure regulator designed for the specific gas and marked for its maximum container pressure. You can use appropriate material, such as chain, plastic coated wire cable, commercial straps, etc., to secure gas containers.

(4) Well-ventilated areas

Indoor compressed gas storage and compressed gas use areas must be located in well-ventilation areas.

(5) Always replace the protective cap

Most gas containers have a protective cap, LP Gas containers have a collar. These devices protect the container control valve from physical damage. The protective cap is shaped like an inverted cup. It is screwed on top of the gas container. It must be in place when the gas container is not in use. The protective collar is welded onto the top of the container. The collar extends above the height of the containers control valve. An example of a container with a protective collar installed is shown below.



A Typical Protective Collar

(6) Away from Temperature and Physical Damage

All gas containers and the related equipment must be protected from extreme temperature and physical damage. For example, gas containers for temporary stationary service must be placed on firm and non-combustible foundation. High temperatures (e.g. above 125 °F) can cause the pressure inside the container to increase to a dangerous level. A protective partition must be used to shield the containers that are exposed to hot air blown by a heating appliance. **All containers must be secured in an upright position, and must not be stacked or stored on shelves.**

(7) Regular Inspection

The Certificate of Fitness holder must regularly inspect the compressed gas containers, connections, and appliances for leaks. The damaged containers must be removed from services, repaired and tested by an authorized person.

Quick visual check of compressed gas containers:

- No extreme denting, gouging, or corrosion is on the compressed gas container.
- The container protective cap/collar and the foot ring are intact and are firmly attached.
- The container is painted or coated to minimize corrosion.
- The container pressure relief valve indicates no visible damage, corrosion of operating components, or obstructions.
- There is no leakage from the compressed gas container.
- The container is installed on a firm foundation and is not in contact with the soil.

3.1.2 Related Equipment


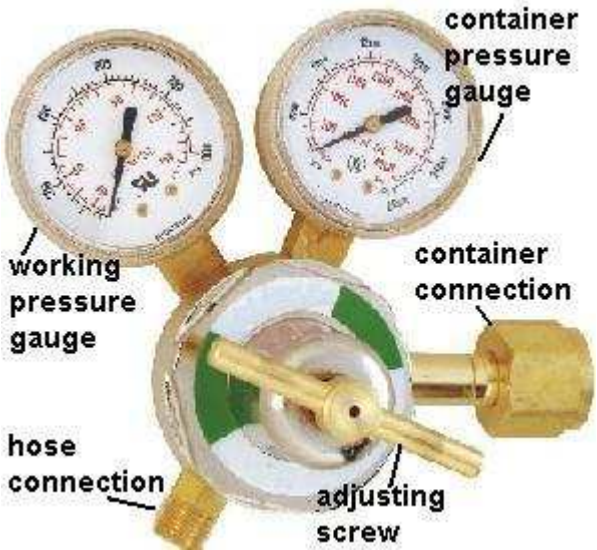

(1) Control valve

A control valve is on the top of each gas container. This valve can be opened or closed to control the discharge of the contents of the gas container. A handle is simply turned to open most gas control valve. **The control valve must be opened by hand.** A special key is needed to open the acetylene control valve. Adjusting the valves controls the shape and intensity of the flame. **Acetylene valves shall not be opened more than 1 1/2 turns.** Container valves shall be closed before moving a gas container, when the torch is not in use, and when the gas container is empty.

(2) Regulator

Before the gas containers can be used, a regulator must be attached to each of the control valves. A regulator is one of the most important parts of a compressed gas system. The purpose of the regulator is to control the flow of gas and lower the pressure from the container to the appliance. The regulator not only acts as a control regarding the flow and distribution of gas, but also as a safety barrier between the high pressure of the gas container and the end use appliance.

Always select the regulators recommended by the manufacturer. Do not interchange regulators between different sizes/types of container without consulting the manufacture. **Do not open the gas container valve or regulator tap until the regulator is securely attached.** Regulator connections to gas container valves must be completely free of dirt, dust, oil, and grease. The regulator controls the discharge rate of gas from the container. Examples of typical regulators are shown below.

A Typical Regulator of LPG Container	A Typical Regulator of Acetylene or Oxygen Container
	
A Typical Regulator of CNG Container	
	

(3) Hose, Piping and Tubing

The regulator is also connected to a hose that supplies the gas to the appliance. This hose must be securely connected to the appliance. A rubber slip connection is prohibited. Only DOT approved hoses designed for a working pressure of 350 psi. are allowed. Generally speaking, nonmetallic pipe, tubing and components for any installation, appliance or equipment using LPG or CNG is prohibited. However, nonmetallic hose may be allowed at construction sites. **Hoses must be as short as practical protecting from mechanical injury**, but they must not be too close to an open flame. Hoses must be protected from physical damage and no hose is allowed to exceed 30 feet. When the gas containers are used inside buildings, the hose must not pass through any partitions, walls, ceilings, or floors. (NFPA 58 6.20.3.2)



This is designed for a rubber slip which is prohibited.

Piping in systems must be run as directly as is practical from one point to another, with as few fittings as practical. The use of nonmetallic pipe tubing, or hose for permanently interconnecting gas containers is prohibited. All piping and tubing must be protected against damage by vehicles and by corrosion-causing substance.

3.1.3 Moving Compressed Gas Containers

A compressed gas container must not be rolled on its side or its rim. It must be moved only by using approved lifting equipment. Containers must never be dropped or thrown from any height. Before transporting any compressed gas containers make sure that the valves are tightly closed.

Compressed gas containers should be moved in an upright position, and must be moved using an approved method. Where containers are moved by hand cart, the hand truck or other mobile device must be designed for the secure movement of containers. Carts and trucks utilized for moving compressed gas containers outdoors must be designed so that the containers will be secured against dropping, or otherwise striking against each other or other surfaces. Ropes, chains or slings must not be used to suspend compressed gas containers unless such containers have been designed for such handling. Valves of compressed gas containers must not be used for lifting.



1. Compressed gas container should be used, handled, and stored in upright position, except those designed for use in a horizontal position.
2. Compressed gas containers placed on carts and trucks must be individually restrained.



Compressed gas containers must be moved using an approved method.

If the compressed gas containers need to be transported between different floors, if possible use an elevator (e.g. freight elevator, construction elevator, or passenger elevator when approved), and such elevator shall be occupied by the minimum number of persons.

All compressed gas containers may be transported only in approved vehicles. A FDNY transportation permit issued by the Bureau of Fire Prevention is required for each vehicle transporting quantities exceeding 400 SCF of any flammable gas (e.g. LPG/CNG), or exceeding 504 SCF of oxygen. Compressed gas containers may be delivered only to sites displaying a permit or Letter of Authorization issued by the Fire Commissioner.

3.1.4 Storing Containers

A permit is required for any storage area storing (1) any flammable gas (e.g. LPG or CNG or acetylene) in excess of 400 SCF; or (2) any oxygen in excess of 504 SCF. The Certificate of Fitness holder is responsible for the safe storage and use of the gas containers. The CNG and LPG and other flammable gases container storage must be located away from the following: Electric power lines; Piping containing flammable or combustible liquids; Piping containing flammable gases; and Piping containing oxidizing materials. **The oxygen containers must be separated from any flammable gas containers (e.g. LPG, CNG, Acetylene) or combustible materials (e.g. oil or grease)** by a minimum distance of 20 feet, or by protective structures at a minimum distance of 5 feet having a minimum fire-resistance of 2 hours.

Unit Size References

- SCF = Standard Cubic Feet
- One standard size Oxygen container (9.27 in x 55.5 in) is approximately 307 SCF
- One standard size Acetylene container (12 in x 48.5 in) is approximately 420 SCF
- 3,500 SCF in total storage / 300 SCF per standard cylinder = 11.40 cylinders
- Brazing is typically done with a B tank set-up. The tank is normally 23 inches high and contains about 40 SCF of gas.

(1) Separation from hazardous conditions

All compressed gas containers and systems in storage or use shall be away from materials and conditions that present potential hazards to them or to which they present potential hazards. It is recommended to group containers according to the type of gas (e.g. flammable, oxidizer) or whether containers are full or empty, if they are stored at the same location. **Fuel gas or oxygen containers in storage must be separated from any combustible materials by a minimum distance of 20 feet.** Oxidizing gases shall not be stored/used or come in contact with oil, grease, or other petroleum base.

Generally, the compressed gas containers shall be kept away from

- Sources of ignition
- Temperature extremes (Above 125 °F or less than mean low atmospheric temperatures)
- Corrosive chemicals or fumes
- Falling objects
- Public tampering
- Ledges, unprotected platforms, and elevators or other areas where the container could drop a distance exceeding one-half the height of the container

(3) Quantity Limitation of Gas Storage

The maximum allowable quantities of different gas storage are listed as below.

Storage Location		Gas Type			
		LPG	CNG	Acetylene	Oxygen
Indoor Storage	Per Storage Area	200 lbs ^b	1,000 SCF ^c	1,000 SCF ^c	1,500 SCF ^{c,d,e}
Outdoor Storage	Per Storage Area	400 lbs	1,000 SCF ^c	1,000 SCF ^c	1,500 SCF ^{d,e}
Construction Outdoor Storage	Per Storage Area	2,500 lbs	21,250 SCF	1,000 SCF ^c	1,500 SCF ^{d,e}
	Max. Quantity ^a	5,000 lbs	42,500 SCF	15,000 SCF ^c	1,500 SCF ^{d,e}
	Min. Separation b/w 2 Areas	50 feet	50 feet	50 feet	20 feet
Construction Indoor Storage	Per Storage Area	1,250 lbs	10,625 SCF	1,000 SCF ^c	1,500 SCF ^{d,e}
	Max. Quantity ^a	2,500 lbs	21,250 SCF	1,000 SCF ^c	1,500 SCF ^{d,e}
	Min. Separation b/w 2 Areas	70 feet	70 feet	50 feet	Not applicable

a. In any single construction site

b. If the indoor storage location is not accessible to the public, such as industrial buildings, the capacity can be up to 300 lbs.

c. Storage in amounts exceeding 1,000 SCF must comply with the requirements of FC Table 2703.1.1(1) or FC3504.

d. Only one liquid oxygen container having a maximum water capacity of 6.2 SCF is allowed.

e. Storage and use of oxygen containers in connection with CNG torch operations must be limited to a total capacity not exceeding 279 SCF.

All empty or in-use gas containers should be counted as full containers. In other words, the quantity of any empty gas container must be subject to the maximum allowable storage quantity.

3.2 Handling and Use of Acetylene Gas

Acetylene gas is a colorless, extremely flammable gas with a garlic-like odor. It is stored as a liquid in containers under pressure. **Copper tubing should never be used to splice the acetylene hose.** The copper tube will react chemically with the acetylene. The reaction may cause an explosion if the tube is subjected to a physical blow. Use of acetylene generators is prohibited in any hot work operations.

For use in welding and cutting, the working pressure must be controlled by a regulator. You should never set the regulator **above 15 psi as the acetylene will decompose explosively.** Acetylene leaks, no matter how small can have serious consequences.

The acetylene containers have safety plugs installed on the top and bottom of the container. These plugs melt if the container becomes too hot for it to be used safely. The melted plugs allow the gas to escape slowly. This prevents the container from exploding.

PART 4. PORTABLE FIRE EXTINGUISHERS

A portable fire extinguisher with at least a 2-A:20-B:C rating (a minimum 3-A:40-B:C rating fire extinguisher on torch-applied roofing system operations) must be readily accessible within 30 feet of the location where hot work is performed and where the fire guards are positioned. In case of fire, 911 must be called.



In the event of a fire extinguisher has been discharged, a fully charged replacement is required before work can resume. **The C of F holder is recommended to be trained for the use of portable fire extinguisher.** Portable fire extinguishers are important in preventing a small fire from growing into a catastrophic fire, however, they are not intended to fight large or spreading fires. **The trained Certificate of Fitness holders should only consider extinguishing fires when they are limited in size and spread such that they can readily be extinguished using a portable fire extinguisher.** By the time the fire has spread, fire extinguishers, even if used properly, will not be adequate to extinguish the fire. Such fires should be extinguished by the building fire extinguishing systems or trained firefighters only. In case of any fire, FDNY must be notified. Fire extinguishers must be used in accordance with the instructions painted on the side of the extinguisher. They clearly describe how to use the extinguisher in case of an emergency. The Certificate of Fitness holder should be familiar with the use of portable fire extinguishers. When it comes to using a fire-extinguisher just remember the acronym P.A.S.S. to help make sure you use it properly. P.A.S.S. stands for Pull,

Aim, Squeeze, Sweep.

All fire extinguishers must be installed so that the top of the extinguisher is not more than 5 ft above the floor and the clearance between the bottom of the extinguisher and the floor is not less than 4 in. In other words, **no fire extinguisher is allowed to put on floor.**



Acceptable

Fire extinguisher in a construction site.



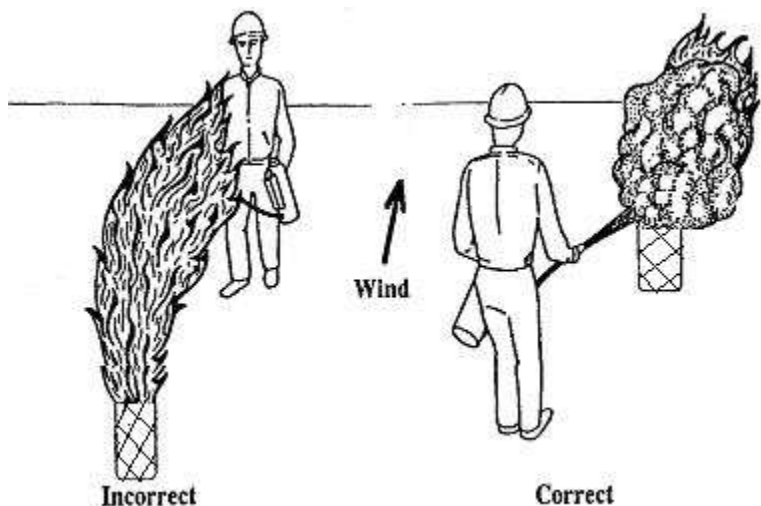
A stackable and portable stand is convenient for temporary extinguisher installation.



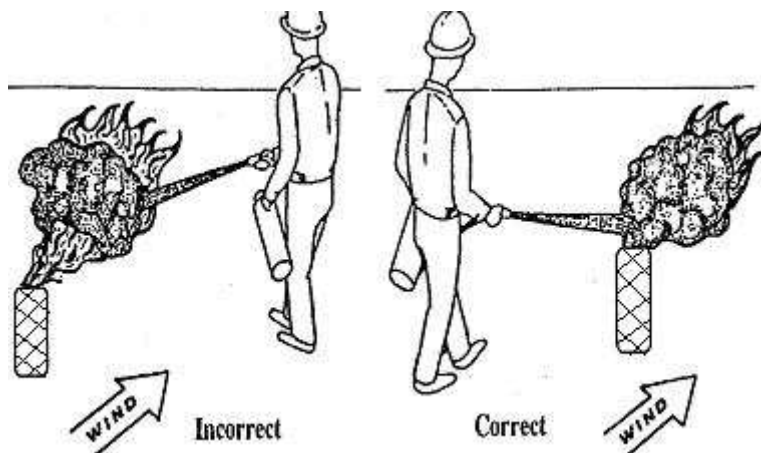
Improper floor placement of Fire Extinguisher.

4.1 Operation Instructions for a Fire Extinguisher

Special care must be taken when extinguishing a gas fire caused by a leak. The easiest way to extinguish the fire is to shut off by using the Emergency Shut Off valve until the flame is extinguished. **In case of any fire, Fire Department must be notified.** The flame must be approached from an upwind direction. This will prevent the Certificate of Fitness holder from being burned by the flames. **Never approach a fire from a downwind direction.** The correct ways to approach a fire are shown below.



The dry chemical stream must be directed toward the point where the flame begins. **Do not direct the chemical stream at the center of the flame.** This will not extinguish the fire. The correct way to direct the dry chemical stream is shown below.



For the piped gas, the gas supply must be shut off first and then call 911. This is safer than allowing the flammable gas (e.g. acetylene or LPG) to leak out. A flammable gas leak could result in a serious explosion if it were ignited. **Never attempt to extinguish the flame unless the gas supply shut. When it is not possible to shut off the gas supply (e.g. the fire is near the control valve or the shut-off valve) and the gas supply is limited (e.g. it is from a cylinder), allow the flame to burn itself out and call 911.** In the mean time, you should try to control the scene and prevent the fire spreading to the surrounding materials. **The**

trained Certificate of Fitness holders should only consider extinguishing fires when they are limited in size and spread such that they can readily be extinguished using a portable fire extinguisher. By the time the fire has spread, fire extinguishers, even if used properly, will not be adequate to extinguish the fire. Such fires should be extinguished by the building fire extinguishing systems or trained firefighters only.

4.2 Fire Extinguishers

The Certificate of Fitness holder must be familiar with the different types of fire extinguishers available at the work site. The Certificate of Fitness holder must know how to operate the extinguishers in a safe and efficient manner. The Certificate of Fitness holder must also know the difference between the various types of extinguishers and when they may be used. A description of the classes of fires and the appropriate extinguishers are described below.

Class A fires are caused by ordinary combustible materials (such as wood, paper, and cloth). To extinguish a Class A fire, these extinguishers utilize either the heat-absorbing effects of water or the coating effects of certain dry chemicals.

Class B fires are caused by flammable or combustible liquids and gases such as oil, gasoline, etc. To extinguish a Class B fire, the blanketing-smothering effect of oxygen-excluding media such as CO₂, dry chemical or foam is most effective.

Class C fires involve electrical equipment. These fires must be fought with fire extinguishers that do not conduct electricity. Foam and water type extinguishers must not be used to extinguish electrical fires. After shutting off the electrical equipment, extinguishers for Class A or B fires may be used.

Class D fires are caused by ignitable metals, such as magnesium, titanium, and metallic sodium, or metals that are combustible under certain conditions, such as calcium, zinc, and aluminum. Generally, water should not be used to extinguish these fires.

A multi-purpose dry chemical fire extinguisher may be used to extinguish more than 2 Classes fires. Examples of some fire extinguishers are shown below.

Examples of fire extinguishers

10-B:C (10BC)	3-A:40-B:C(3A40BC)	3-A:40-B:C(3A40BC), wheeled
		

4.3 Typical Fire Extinguishers

Symbols may also be painted on the extinguisher. The symbols indicate what kind of fires the extinguisher may be used on. Examples of these symbols are shown below.

CLASSES OF FIRES	TYPES OF FIRES	PICTURE SYMBOL				
A	Wood, paper, cloth, trash & other ordinary materials.			Class A, B & C Fires Multi-purpose Fire Extinguisher		
B	Gasoline, oil, paint and other flammable liquids.			Class B & C Fires		
C	May be used on fires involving live electrical equipment without danger to the operator.			Class A & B Fires		
D	Combustible metals and combustible metal alloys.			Class A Fires		
K	Cooking media (Vegetable or Animal Oils and Fats)			Class A Fires		

Fire Extinguisher Identification Symbols

The symbol with the shaded background and the slash indicates when the extinguisher must not be used. The Certificate of Fitness holder must understand these symbols. All fire extinguishers should be kept in good working order at all times.

4.4 Fire Extinguisher Inspections

The extinguishers are required to be inspected monthly. The owner of the premises is responsible to designate a person to perform a monthly inspection. This inspection is a "quick check" that a fire extinguisher is available and will operate. It is intended to give reasonable assurance that the fire extinguisher is fully charged and operable. This is done by verifying that it is in its designated place, that it has not been actuated or tampered with, and that there is no obvious or physical damage or condition to prevent its operation. The information of the monthly inspection record must include the date the inspection was performed, the person performing the inspection, and those portable fire extinguishers found to require corrective action. Such recordkeeping must be either attached to the extinguisher or on an inspection checklist maintained on file. Labels or markings indicating fire extinguisher use, or classification, or both shall be placed on the front of the fire extinguisher. At least once per year, all fire extinguishers must be maintained by a FDNY approved company and a W-96 Certificate of Fitness holder.

Monthly inspection tag.

MONTHLY INSPECTION RECORD		
DATE	NAME	CONDITION
2-10-10	W	Good
4-18-10	SF	Good
5-22-10	SL	Good
6-10-10	W	Good
7-14-10	W	Good
8-11-10	SF	Good
9-12-10	SL	Good
10-10-10	W	Good

Acceptable 11/01/2010