**Chapter 41 Welding, Cutting, and Other Hot Work**

41.1 General

41.1.1

Hot work shall comply with NFPA 51B and this chapter.

41.1.2

Chapter 41 shall apply to the following hot work processes:

Welding and allied processes

Heat treating

Grinding

Thawing pipe

Powder-driven fasteners

Hot riveting

\* Torch-applied roofing in conjunction with the requirements of Section 16.7

Similar applications producing or using a spark, flame, or heat

[51B:1.3.1]

41.1.3

Chapter 41 shall not apply to the following:

Candles

Pyrotechnics or special effects

Cooking operations

Electric soldering irons

Design and installation of gas cutting equipment and welding equipment covered in NFPA 51

Additional requirements for hot work operations in confined spaces

Lockout/tagout procedures during hot work

[51B:1.3.2]

41.1.4

Acetylene cylinder charging plants shall comply with NFPA 55.

41.1.5 Permits

41.1.5.1

Permits, where required, shall comply with Section 1.12.

41.1.5.2

Where an approved facility hot work permit program exists that meets the requirements of Chapter 41, the permit shall be permitted to be issued for an entire facility.

41.2 Responsibility for Hot Work

41.2.1\* Management

Management shall be responsible for the safe operations of hot work activity. [51B:4.1]

41.2.1.1

Management shall establish permissible areas for hot work. [51B:4.1.1]

41.2.1.2

Management shall designate a permit authorizing individual (PAI). [51B:4.1.2]

41.2.1.3

All equipment shall be examined to ensure it is in a safe operating condition. [51B:4.1.3]

41.2.1.4

When found to be incapable of reliable safe operation, the equipment shall be repaired by qualified personnel prior to its next use or be withdrawn from service and tagged out of service. [51B:4.1.4]

41.2.1.5

Management shall ensure that only approved apparatus, such as torches, manifolds, regulators or pressure-reducing valves, and acetylene generators, are used. [51B:4.1.5]

41.2.1.6

Management shall ensure that all individuals involved in the hot work operations, including contractors, are familiar with the provisions of Chapter 41. [51B:4.1.6]

41.2.1.6.1

Individuals involved in hot work operations shall be trained in the safe operation of their equipment and in the safe use of the process. [51B:4.1.6.1]

41.2.1.6.2

Individuals involved in hot work operations shall have an awareness of the inherent risks involved and understand the emergency procedures in the event of a fire. [51B:4.1.6.2]

41.2.1.7

Management shall advise all contractors about site-specific flammable materials, hazardous processes or conditions, or other potential fire hazards. [51B:4.1.7]

41.2.2 Permit Authorizing Individual (PAI)

In conjunction with management, the PAI shall be responsible for the safe operation of hot work activities. [51B:4.2]

41.2.2.1\*

The PAI shall consider the safety of the hot work operator and fire watch with respect to personal protective equipment (PPE) for other special hazards beyond hot work. (See 41.3.1.) [51B:4.2.1]

41.2.2.2

The PAI shall determine site-specific flammable materials, hazardous processes, or other potential fire hazards that are present or likely to be present in the work location. [51B:4.2.2]

41.2.2.3

The PAI shall ensure the protection of combustibles from ignition by the following means:

\* Considering alternative methods to hot work

Moving the work to a location that is free from combustibles

If the work cannot be moved, moving the combustibles to a safe distance or having the combustibles properly shielded against ignition

Scheduling hot work so that operations that could expose combustibles to ignition are not begun during hot work operations

[51B:4.2.3]

41.2.2.4

If the criteria of 41.2.2.3(2) through 41.2.2.3(4) cannot be met, hot work shall not be performed. [51B:4.2.4]

41.2.2.5

The PAI shall determine that appropriate fire protection and extinguishing equipment are located at the hot work site. [51B:4.2.5]

41.2.2.6

Where a fire watch is required (see 41.3.6), the PAI shall be responsible for ensuring that a fire watch is at the site. [51B:4.2.6]

41.2.2.7\*

Where a fire watch is not required, the PAI shall make a final check 1/2 hour after the completion of hot work operations to detect and extinguish smoldering fires. [51B:4.2.7]

41.2.3 Hot Work Operator

The hot work operator shall handle equipment safely and use it as follows so as not to endanger lives and property:

The operator shall have the PATs approval before starting hot work operations.

All equipment shall be examined to ensure it is in a safe operating condition; if found to be incapable of reliable safe operation, the equipment shall be repaired by qualified personnel prior to its next use or be withdrawn from service.

The operator shall cease hot work operations if unsafe conditions develop and shall notify management, the area supervisor, or the PAI for reassessment of the situation.

[51B:4.3]

41.2.4 Fire Watch

41.2.4.1\*

The fire watch shall be trained to recognize the inherent hazards of the work site and hot work operations. [51B:4.4.1]

41.2.4.2

The fire watch shall ensure safe conditions are maintained during hot work operations. [51B:4.4.2]

41.2.4.3

The fire watch shall have the authority to stop the hot work operations if unsafe conditions develop. [51B:4.4.3]

41.2.4.4\*

The fire watch shall have fire-extinguishing equipment readily available and shall be trained in its use. [51B:4.4.4]

41.2.4.5

The fire watch shall be familiar with the facilities and procedures for sounding an alarm in the event of a fire. [51B:4.4.5]

41.2.4.6

The fire watch shall watch for fires in all exposed areas and try to extinguish them only when the fires are obviously within the capacity of the equipment available. If the fire watch determines that the fire is not within the capacity of the equipment, the fire watch shall sound the alarm immediately. [51B:4.4.6]

41.2.4.7\*

The fire watch shall be permitted to perform additional tasks, but those tasks shall not distract him or her from his or her fire watch responsibilities, except as outlined in Section 41.4. [51B:4.4.7]

41.2.5\* Contractors

Before starting any hot work, contractors and their clients shall discuss the planned project completely, including the type of hot work to be conducted and the hazards in the area. [51B:4.5]

41.2.6 Mutual Responsibility

Management, contractors, the PAI, the fire watch, and the operators shall recognize their mutual responsibility for safety in hot work operations. [51B:4.6]

41.3 Fire Prevention Precautions

41.3.1\* Personal Protective Clothing

Clothing shall be selected to minimize the potential for ignition, burning, trapping hot sparks, and electric shock. [51B:5.1]

41.3.2 Fire Extinguishers

Fire extinguishers required by this Code shall be in accordance with Chapter 13 and NFPA 10. [51B:5.2]

41.3.3 Permissible Areas

41.3.3.1 General

Hot work shall be permitted only in areas that are or have been made fire safe. [51B:5.3.1]

41.3.3.2 Designated or Permit-Required Areas

Hot work shall be performed in either designated areas or permit-required areas. [51B:5.3.2]

41.3.3.2.1 Designated Areas

41.3.3.2.1.1

In order for a location to be a designated area, the area shall meet the requirements in 41.3.5.1. [51B:5.3.2.1.1]

41.3.3.2.1.2

Prior to the start of any hot work in a designated area, at a minimum, the hot work operator shall verify all of the following:

The location is fire resistant.

The requirements of 41.3.5.1.3 are met.

Fire extinguishers are in working condition and readily available.

Ventilation is working properly.

Equipment is in working order.

[51B:5.3.2.1.2]

41.3.3.2.1.3

Permanent areas designated for hot work shall be reviewed at least annually by the PAI. [51B:5.3.2.1.3]

41.3.3.2.1.4

Signs shall be posted designating hot work areas as deemed necessary by the PAI. [51B:5.3.2.1.4]

41.3.3.2.2\* Permit-Required Areas

Before hot work operations begin in a permit-required area, a written hot work permit issued by the PAI shall be required in accordance with 41.3.5. [51B:5.3.2.2]

41.3.4\* Nonpermissible Areas

Hot work shall not be permitted in the following:

In areas not authorized by management

\* In buildings where fire protection systems are impaired, unless additional precautions are taken as determined by the PAI or AHJ

\* In the presence of explosive atmospheres

In the presence of uncleaned or improperly prepared equipment, drums, tanks, or other containers that have previously contained materials that could develop explosive atmospheres

In areas with potential fire or flash fire hazards associated with the presence of one or more combustible particulate solids (dusts)

[51B:5.4]

41.3.5\* Hot Work Permit

41.3.5.1

Before a hot work permit is issued, the following conditions in 41.3.5.1.1 through 41.3.5.1.15 shall be verified by the PAI. [51B:5.5.1]

41.3.5.1.1

The hot work equipment to be used shall be in satisfactory operating condition and in good repair. [51B:5.5.1.1]

41.3.5.1.2

Where combustible materials, such as paper clippings, wood shavings, or textile fibers, are on the floor, the floor shall be swept clean for a radius of 35 ft (11 m).[51B:5.5.1.2]

41.3.5.1.2.1

Combustible floors shall be kept wet, covered with damp sand, or protected by a listed welding blanket, welding pad, or equivalent. [51B:5.5.1.2.1]

41.3.5.1.2.2

Where floors have been wet down, personnel operating arc welding equipment or cutting equipment shall be protected from possible electric shock. [51B:5.5.1.2.2]

41.3.5.1.3\*

Combustibles shall be relocated at least 35 ft (11 m) in all directions from the hot work area. [51B:5.5.1.3]

41.3.5.1.3.1

If relocation is impractical, combustibles shall be shielded by a barrier constructed of noncombustible materials or otherwise protected by a listed welding curtain, welding blanket, welding pad, or equivalent. [51B:5.5.1.2]

41.3.5.1.3.2

To prevent the entrance of sparks, the edges of covers at the floor shall be tight, including at the point where covers overlap. [51B:5.5.1.3.2]

41.3.5.1.4

Openings or cracks in walls, floors, or ducts within 35 ft (11 m) of the hot work site shall be covered or sealed with listed fire-rated or noncombustible material to prevent the passage of sparks to adjacent areas. [51B:5.5.1.4]

41.3.5.1.5

Ducts and conveyor systems that might carry sparks to distant combustibles shall be shielded, shut down, or both. [51B:5.5.1.5]

41.3.5.1.6

If hot work is done near walls, partitions, ceilings, or roofs of combustible construction, they shall be protected by a listed welding curtain, welding blanket, welding pad, or equivalent. [51B:5.5.1.6]

41.3.5.1.7

If hot work is done on one side of a wall, partition, ceiling, or roof, the criteria in either 41.3.5.1.7.1 or 41.3.5.1.7.2 shall apply. [51B:5.5.1.7]

41.3.5.1.7.1

Precautions shall be taken to prevent ignition of combustibles on the other side by relocating the combustibles. [51B:5.5.1.7.1]

41.3.5.1.7.2

If it is impractical to relocate combustibles, a fire watch shall be provided on the side opposite from where the work is being performed. [51B:5.5.1.7.2]

41.3.5.1.8

Hot work shall not be attempted on a partition, wall, ceiling, or roof that has a combustible covering or insulation, or on walls or partitions of combustible sandwich-type panel construction. [51B:5.5.1.8]

41.3.5.1.9

Hot work that is performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings, roofs, or other combustibles shall not be undertaken if the work is close enough to cause ignition by conduction. [51B:5.5.1.9]

41.3.5.1.10

Fully charged and operable fire extinguishers that are appropriate for the type of possible fire shall be available immediately at the work area. [51B:5.5.1.10]

41.3.5.1.11

If existing hose lines are located within the hot work area defined by the permit, they shall be connected and ready for service but shall not be required to be unrolled or charged. [51B:5.5.1.11]

41.3.5.1.12\*

During hot work, special precautions shall be taken to avoid accidental activation of automatic fire protection systems. [51B:5.5.1.12]

41.3.5.1.13

The operator and nearby personnel shall be suitably protected against dangers such as heat, sparks, and slag. [51B:5.5.1.13]

41.3.5.1.14\*

In instances where the scope of work and the tools used to conduct hot work result in possible travel of slag, sparks, spatter, or similar mobile sources of ignition farther than 35 ft (11 m), the PAI shall be permitted to extend the distances and areas addressed in 41.3.5.1.2 through 41.3.5.1.4. [51B:5.5.1.14]

41.3.5.1.15\*

In instances where the scope of work and tools used to conduct hot work are known to be incapable of generating slag, sparks, spatter, or similar mobile sources of ignition capable of leaving the immediate area of the applied hot work, the PAI shall be permitted to reduce the distances and areas addressed in 41.3.5.1.2 through 41.3.5.1.4. [51B:5.5.1.15]

41.3.5.2

The PAI shall describe any separation, distance extension, or reduction on the hot work permit. [51B:5.5.2]

41.3.5.3

The PAI shall determine the time period for which the hot work permit is valid. [51B:5.5.3]

41.3.5.4

The hot work permit shall not be valid for a time period exceeding 24 hours. [51B:5.5.4]

41.3.5.5\*

The PAI shall re-inspect the hot work area at least once per shift during the hot work permit time period to ensure a fire-safe area. [51B:5.5.5]

41.3.6 Fire Watch and Fire Monitoring

41.3.6.1\*

A fire watch shall be required by the PAI when hot work is performed in a location where other than a minor fire might develop or where any of the following conditions exist:

\* Combustible materials in building construction or contents closer than 35 ft (11 m) to the hot work operation

Combustible materials more than 35 ft (11 m) away from the hot work operation but easily ignited by sparks

Wall or floor openings within a 35 ft (11 m) radius that expose combustible materials in adjacent areas, including concealed spaces in walls or floors

Combustible materials adjacent to the opposite side of partitions, walls, ceilings, or roofs and likely to be ignited

[51B:5.6.1 ]

41.3.6.1.1

A fire watch shall be maintained for at least 1 hour after completion of hot work operations in order to detect and extinguish smoldering fires. [51B:5.6.1.1]

41.3.6.1.2

The duration of the fire watch shall be permitted to be extended if the PAI determines the fire hazards warrant the extension. [51B:5.6.1.2]

41.3.6.2\*

More than one fire watch shall be required if combustible materials that could be ignited by the hot work operation cannot be directly observed by the initial fire watch. [51B:5.6.2]

41.3.6.3\*

Following the completion of the established fire watch time period, fire monitoring shall be provided within the hot work area for up to an additional 3 hours as determined by the PAI. [51B:5.6.3]

41.3.7\* Hot Tapping

Hot tapping or other cutting and welding on a flammable gas or liquid transmission or distribution utility pipeline shall be performed by a crew qualified to make hot taps. [51B:5.7]

41.3.8 Cylinders

Cylinder use and storage shall be in accordance with Chapter 63. [51B:5.8]

41.4 Sole Proprietors and Individual Operators

41.4.1\* Assignment of PAI and Fire Watch

In a site where hot work operations are not under the control of another authority, the individual hot work operator shall be permitted to serve as PAI and as fire watch, provided that the operator is trained and follows the provisions of Chapter 41. [51B:6.1]

41.4.2 Written Hot Work Permit

A checklist shall be permitted to serve as the written hot work permit. [51B:6.2]

41.5 Public Exhibitions and Demonstrations

41.5.1 Application

The provisions of Section 41.5 shall apply to oxy-fuel gas welding and cutting operations at public exhibitions, demonstrations, displays, and trade shows, referred to hereinafter as the "site," in order to promote the safe use of compressed gases in public gatherings. [51B:7.1]

41.5.2 Supervision

Installation and operation of welding, cutting, and related equipment shall be done by, or under the supervision of, a competent operator, to ensure the personal protection of viewers and demonstrators as well as the protection from fire of materials in and around the site and the building itself. [51B:7.2]

41.5.3 Site

41.5.3.1 Location

Sites involving the use and storage of compressed gases shall be located so as not to interfere with egress during an emergency. [51B:7.3.1]

41.5.3.2 Design

The site shall be constructed, equipped, and operated in such a manner that the demonstration minimizes the possibility of injury to viewers. [51B:7.3.2]

41.5.4 Fire Protection

41.5.4.1 Fire Extinguishers

Each site shall be provided with a portable fire extinguisher of appropriate size and type in accordance with NFPA 10. [51B:7.4.1]

41.5.4.2 Shielding

The public, combustible materials, and compressed gas cylinders at the site shall be protected from flames, sparks, and molten metal. [51B:7.4.2]

41.5.4.3 Fire Department Notification

The fire department shall be notified in advance of the use of a site for public exhibitions, demonstrations, and trade shows. [51B:7.4.3]

41.5.5 Cylinders

41.5.5.1 Gas Capacity Limitation

41.5.5.1.1

Cylinders containing compressed gases for use at the site shall not be charged in excess of one-half their maximum permissible content. [51B:7.5.1.1]

41.5.5.1.2

Cylinders of nonliquefied gases and acetylene shall be charged to not more than one-half their maximum permissible charged gauge pressure [psi (kPa)]. [51B:7.5.1.2]

41.5.5.1.3

Cylinders of liquefied gases shall be charged to not more than one-half the maximum permissible capacity [lb (kg)]. [51B:7.5.1.3]

41.5.5.2 Storage

41.5.5.2.1

Cylinders located at the site shall be connected for use. [51B:7.5.2.1]

41.5.5.2.2

A sufficient number of additional cylinders shall be permitted to be stored at the site to furnish approximately one day's consumption of each gas used. [51B:7.5.2.2]

41.5.5.2.3\*

Other cylinders shall be stored in an approved storage area, but not near a building exit. [51B:7.5.2.3]

41.5.5.3 Transporting Cylinders

Cylinders in excess of 40 lb (18 kg) total weight being transported to or from the site shall be carried on a hand truck or motorized truck. [7.5.3]

41.5.5.4 Process Hose

Process hose shall be located and protected so that they will not be physically damaged. [51B:7.5.4]

41.5.5.5 Cylinder Valves

Cylinder valves shall be closed when equipment is unattended. [51B:7.5.5]

41.5.5.6 Valve Caps

If cylinders are designed to be equipped with valve protection caps, such caps shall be in place, except when the cylinders are in service or are connected and ready for service. [51B:7.5.6]

41.5.5.7 Cylinder Protection

Cylinders shall be secured so that they cannot be knocked over. [51B:7.5.7]

41.6 Arc Welding Equipment

41.6.1 Installation

Electrical equipment shall be of an approved type and shall be installed and used in accordance with Section 11.1 and manufacturers' requirements.

41.6.2

Damaged cables shall be removed from service until repaired or replaced.