CHAPTER 35
WELDING AND OTHER HOT WORK

SECTION FC 3501
GENERAL

3501.1 Scope. This chapter shall govern welding, cutting and other torch and hot work operations and equipment.

3501.2 Permits. Permits shall be required as set forth in FC 105.6.

3501.3 Approved locations. Hot work shall be conducted only in the areas set forth in this section or approved by the commissioner.

3501.3.1 Authorized areas. Hot work may be conducted in the following areas:

1. Areas designed for hot work operations.

2. Areas authorized for that purpose by the responsible person at the premises when precautions have been taken in compliance with the requirements of this chapter.

3501.3.2 Restricted areas. Hot work shall not be conducted in the following areas unless approval has been obtained from the commissioner:

1. Areas where the sprinkler system is impaired.

2. Areas where there exists the potential of an explosive atmosphere, such as locations where flammable gases, liquids or vapors are present.

3. Areas with readily ignitable materials, such as storage of large quantities of bulk sulfur, baled paper, cotton, lint, dust or loose combustible materials.

4. On board marine vessels or watercraft at dock under construction or repair.

3501.4 Containers. Compressed gas containers shall be designed, installed, operated and maintained in accordance with this chapter and FC Chapter 53.

3501.5 Design and installation of oxygen-fuel gas systems. An oxygen-fuel gas system shall be designed and installed in accordance with NFPA 51.

3501.5.1 Oxygen at construction sites. The storage and use of oxygen at a construction site shall additionally comply with the requirements of FC Chapter 33.

3501.6 Torches. Torches and tips that utilize a flammable gas for hot work operations shall be listed.

3501.7 Certificate of approval. Devices used to increase the pressure of piped natural gas in accordance with FC 3509.8 shall be of a type for which a certificate of approval has been issued.

SECTION FC 3502
DEFINITIONS

3502.1 Definitions. The following terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings set forth in FC 202.

COMBUSTIBLE GAS DETECTOR.

HOT TAPPING.

HOT WORK.

HOT WORK AREA.

HOT WORK EQUIPMENT.

HOT WORK PROGRAM.

HOT WORK PROGRAM AUTHORIZATIONS.

RESPONSIBLE PERSON.

TORCH-APPLIED ROOF SYSTEM.

SECTION FC 3503
GENERAL REQUIREMENTS

3503.1 General. Hot work operations, including temporary and fixed hot work areas, shall be conducted in accordance with this chapter.

3503.1.1 Torch operations using LPG. The use of LPG for torch operations shall additionally comply with the requirements of FC Chapter 61.

3503.1.2 Torch operations using CNG. The use of CNG for torch operations shall additionally comply with the requirements of FC Chapter 58.

3503.2 Hot work program. Whenever hot work is performed in any building or structure, on a building roof or on a building setback, the owner shall ensure that such work is performed in accordance with this chapter and shall designate a responsible person to ensure compliance.

3503.2.1 Hot work program responsible person. The responsible person shall ensure that a permit has been obtained from the department when one is required, and ensure that the hot work is performed in compliance with the terms and conditions of the permit. The responsible

person shall inspect the hot work site prior to issuing a hot work program authorization and periodically monitor the work as it is being performed to ensure there are no fire safety hazards.

3503.2.2 Responsible person supervision. Hot work operations shall be conducted under the general supervision of the responsible person.

3503.3 Hot work program authorization. A hot work program authorization bearing the signature of the responsible person shall 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 authorizations, issued by the responsible person, shall 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.

3503.4 Qualifications of operators. An authorization for hot work operations shall not be issued unless the individuals conducting such operations are capable of performing such operations safely. Demonstration of a working knowledge of the provisions of this chapter shall constitute acceptable evidence of compliance with this requirement.

3503.4.1 Torch operations. Any torch operation, including torch operations using a flammable gas, with or without oxygen, and any torch operation for torch-applied roofing systems, shall be personally conducted by a certificate of fitness holder.

Exceptions:

1. Torch operations using oxygen and piped natural gas for manufacturing jewelry or in a dental laboratory may be conducted under the personal supervision of a certificate of fitness holder, who shall be responsible to regulate the pressure and flow of oxygen and natural gas to each torch.

2. Torch operation fueled by a LPG container with a capacity of 16.4 ounces (0.465 kg) or less, except at a construction site.

3. Arc welding authorized by the Department of Buildings.

3503.4.2 Use of portable fire extinguishers. All persons conducting hot work operations shall be trained in the use of portable fire extinguishers, and shall be capable of extinguishing fires when they are limited in size and spread such that they can readily be extinguished using a portable fire extinguisher.

3503.5 Records. The responsible person for the hot work area shall maintain "pre-hot work check" reports in accordance with FC 3504.3.1.

3503.6 Signage. Visible hazard identification signs shall be provided where required by FC Chapter 50. Where the hot work area is accessible to persons other than the operator of the hot work equipment, signs shall be posted in a conspicuous location to warn others before they enter the hot work area. Such signs shall read as follows:

CAUTION
HOT WORK IN PROGRESS
STAY CLEAR.

SECTION FC 3504
FIRE SAFETY REQUIREMENTS

3504.1 Protection of combustibles. Combustible material and combustible waste shall be protected during hot work operations in accordance with FC 3504.1.1 through 3504.1.9.

3504.1.1 Separation from combustibles. Hot work operations involving cutting or welding shall be conducted at least 35 feet (10 668 mm) from combustible materials and combustible waste or shall be provided with appropriate shielding to prevent sparks, slag or heat from igniting exposed combustibles. All other hot work operations shall be conducted at least 25 feet (7620 mm) from combustible materials and combustible waste or shall be provided with appropriate shielding to prevent sparks, slag or heat from igniting exposed combustibles.

3504.1.2 Openings. Openings or cracks in walls, floors, ducts or shafts within 35 feet (10 668 mm) of the hot work area shall be tightly covered to prevent the passage of sparks to adjacent combustible areas, or shielded by metal fire-resistant guards, or provided with curtains to prevent passage of sparks or slag.

3504.1.3 Housekeeping. Combustible waste shall not be allowed to accumulate on floors and other surfaces within the hot work area. Hot work areas shall be regularly cleaned and combustible waste removed and disposed of lawfully.

3504.1.4 Conveyor systems. Conveyor systems that are capable of carrying sparks to distant combustibles shall be shielded or shut down.

3504.1.5 Partitions. Partitions segregating hot work areas from other areas of the building shall be of noncombustible construction. In fixed hot work areas, the partitions shall be securely connected to the floor such that no gap exists between the floor and the partition. Partitions shall prevent the passage of sparks, slag, and heat from the hot work area.

3504.1.5.1 Motor-fuel dispensing facilities. The use of a torch within a repair garage located on a property upon which a motor-fuel dispensing facility is situated shall be conducted within a fire-rated enclosure. All doors of such enclosure shall be fireproof and self-closing.

3504.1.5.2 Repair garages. In a repair garage with a capacity for more than one vehicle, hot work shall be conducted within a fire-rated enclosure in compliance with FC 3504.1.5.1 or behind a noncombustible screen that is positioned and of sufficient size to prevent the passage of sparks, slag and heat from the hot work area.

3504.1.6 Floors. Areas designed for hot work operations shall have floors with noncombustible surfaces.

3504.1.7 Precautions in hot work. Except as otherwise provided in FC 3510.4, hot work shall not be performed on a container or equipment that contains or has contained a flammable solid, flammable or combustible liquid or flammable gas until the container or equipment has been thoroughly cleaned, inerted or purged. Hot work on flammable and combustible liquid storage tanks shall be conducted in accordance with FC 3510. Hot work involving any flammable solid in any form shall be conducted only with the approval of the department.

3504.1.8 Sprinkler protection. Sprinkler system protection shall not be shut off or impaired while hot work is performed unless approved by the commissioner. Where hot work is performed close to sprinklers, noncombustible barriers or damp cloth guards shall shield the individual sprinkler heads and shall be removed when the work is completed. If the work extends over several days, the shields shall be removed at the end of each workday.

3504.1.9 Fire detection systems. Approved precautionary measures shall be taken to avoid accidental operation of automatic fire detection systems.

3504.2 Fire watch. A fire watch shall be maintained and fire guards provided in accordance with FC 3504.2.1 through 3504.2.7.1.

3504.2.1 When required. A fire watch shall be maintained during hot work operations. The fire watch shall continue for a minimum of 30 minutes after the conclusion of the work. The commissioner, or the responsible person implementing a hot work program, may extend the duration of the fire watch based on the hazards or work being performed.

3504.2.2 Location. The fire watch shall observe the entire hot work area. Hot work conducted in areas with vertical or horizontal fire exposures that are not observable by a single individual shall have additional personnel assigned to ensure that exposed areas are monitored, including compliance with FC 3504.2.7.1.

3504.2.3 Duties. Persons conducting a fire watch shall have the duties and responsibilities set forth in FC 901.7.2.1 with respect to the areas being monitored in connection with hot work operations.

3504.2.4 Reserved.

3504.2.5 Fire hoses. Where hose lines are required, they shall be connected, charged and ready for operation.

3504.2.6 Portable fire extinguishers. A minimum of one portable fire extinguisher complying with the requirements of FC 906 and with a minimum 2-A:20-B:C rating shall be provided and readily accessible within a 30 feet (9144 mm) travel distance of the location where hot work is performed and where the fire guards are positioned.

3504.2.7 Fire guards for torch operations. The fire watch for torch operations conducted at the following locations shall be conducted by fire guards:

1. Construction sites.

2. On any rooftop, or in connection with any torch-applied roofing system operation.

3. In any building or structure, when the torch operation is conducted by a person holding a citywide permit for torch operations.

3504.2.7.1 Construction sites and torch-applied roofing systems. A fire watch shall be maintained for each torch operation at a construction site and torch-applied roofing system operations in compliance with the requirements of FC 3504.2.7.1.1 and 3504.2.7.1.2.

3504.2.7.1.1 Fire watch coverage. A fire guard shall be provided for each torch in operation, except that a single fire guard may be designated to conduct a fire watch for more than one torch operation on the same floor or level if each torch operation is not more than 50 feet (15 240 mm) from the fire guard, as measured by the actual path of travel, and the field of view of such fire guard encompasses all of the horizontal fire exposures of such torch operations.

3504.2.7.1.2 Fire watch on floors below. In addition to the fire guard required by FC 3504.2.7.1.1, if the torch operation is being conducted at or near the edge of an unenclosed floor of a building, or near a floor opening, or other location where sparks and slag may travel to one or more lower floors or levels, a fire guard shall conduct a fire watch on each lower floor or level containing combustible surfaces or materials within 35 feet (10 668 mm) of the area of such floor or level that potentially would be exposed to such sparks or slag. Prior to commencement of the torch operation, the fire safety manager or responsible person shall inspect the lower floors or levels and take all necessary and appropriate precautions to protect any combustible surfaces and materials that potentially would be exposed to sparks and slag from the torch operation. A certification to that effect shall be made on the hot work authorization.

Exceptions:

1. A fire watch is not required on the floors or levels below a torch operation on a construction site when:

    1.1. the torch operation is not being conducted at or near the edge of an unenclosed floor of a building;

    1.2. the floor upon which the torch operation is being conducted is of noncombustible construction;

    1.3. there are no floor or exterior building openings within 35 feet (10 668 mm) of the torch operation; and

    1.4. prior to commencement of the torch operation, the fire safety manager or responsible person conducts an inspection and takes the precautions required pursuant to FC 3504.2.7.1.2.

2. Notwithstanding the foregoing exception, if sparks or slag generated by the torch operation are observed to extend beyond 35 feet (10 668 mm), thereby potentially exposing lower floors or levels, the torch operation shall be immediately discontinued, and the floors or levels below shall be inspected for any fire condition. If there is any potential exposure to combustible surfaces or materials on the floors below from such sparks and slag, noncombustible barriers shall be provided and any other necessary or appropriate precautions shall be taken. If such barriers and precautions fail to block the passage of sparks and slag, a fire watch shall be established on the floors or levels below.

3504.3 Area reviews. Before hot work is authorized and at least once per day while the authorization is in effect, the hot work area shall be inspected by the responsible person to ensure that it is a fire safe area.

3504.3.1 Pre-hot work check. A pre-hot work check shall be conducted by the responsible person prior to work to ensure that all equipment is safe and hazards are recognized and protected. A report of the check shall be kept at the work site during the work and for a minimum of 48 hours after work is completed, and made available for inspection by any representative of the department. The pre-hot work check shall be conducted at least once per day and shall verify the following:

1. The hot work equipment is in good working order.

2. The hot work area is clear of combustibles and flammable solids or that such materials present in the area are protected in accordance with FC 3504.1.1.

3. Exposed construction is of noncombustible materials or, if combustible, is protected.

4. Openings are protected.

5. Hot work area floors are clear of combustible waste accumulation.

6. Reserved.

7. Fire watch personnel, where required, are assigned.

8. Approved actions have been taken to prevent accidental activation of fire extinguishing systems and detection equipment in accordance with FC 3504.1.8 and 3504.1.9.

9. Portable fire extinguishers and fire hoses (where provided) are operable and available.

10. All persons performing hot work possess certificates of fitness, where such certificates are required.

11. All persons performing hot work requiring a permit possess a site-specific permit or citywide permit, authorizing such work.

SECTION FC 3505
GAS WELDING AND CUTTING

3505.1 General. Devices or attachments mixing air or oxygen with flammable gases prior to consumption, except at the burner or in a standard torch or blow pipe, shall not be allowed unless approved.

3505.2 Container storage, handling and use. Storage, handling and use of compressed gas containers shall be in accordance with this section and FC Chapter 53.

3505.2.1 Containers connected for use. A single container of oxygen and a single container of flammable gas may be installed on a cart without the separation of containers required by FC 5804.1.3 provided that the containers are connected to regulators, equipped with apparatus designed for cutting, welding or other hot work operation, and are otherwise ready for use, and are stored, handled and used in compliance with the following requirements:

1. Carts shall be designed and used in accordance with FC 5003.10.3.

2. Container valves shall have a fixed hand wheel, or other approved means by which the flow of gas may be immediately shut down during hot work operations.

3. Container valves shall be closed at the end of each workday and whenever work is discontinued or the cart moved.

4. Container valve outlet connections shall conform to the requirements of CGA V-1.

5. Separation of the cart from the hot work operation shall be maintained in accordance with FC 3505.5, or fire-resistant shields shall be provided.

6. A separation distance of 20 feet (6096 mm) shall be maintained between such carts.

3505.3 Precautions. Oxygen containers and oxygen container valves, regulators, hose and other apparatus and fittings shall be kept free of oil or grease. Oxygen containers, apparatus and fittings shall not be handled with oily hands, oily gloves, or greasy tools or equipment.

3505.4 Acetylene gas. Acetylene gas shall not be piped except in approved container manifolds and container manifold connections, or piped or utilized at a pressure exceeding 15 pounds per square inch gauge (psig) (103 kPa). Acetylene gas stored in containers shall be dissolved in a suitable solvent. Acetylene gas shall not be brought in contact with unalloyed copper, except in a torch.

3505.5 Remote locations. Oxygen and fuel gas containers shall be located at a distance from the hot work area sufficient to protect such containers from heat, sparks, slag, or misdirection of the torch flame.

3505.6 Container shutoff. The torch valve shall be closed and the gas supply to the torch completely shut off when hot work operations are discontinued for a period of 1 hour or more.

3505.6.1 Emergency shutoff. Oxygen and fuel gas container valves shall be accessible to the torch operator or fire guard for immediate shutoff of the gas supply in the event of an emergency.

3505.7 Prohibited operations. It shall be unlawful to conduct the following hot work operations:

1. Welding or cutting operations supported by or resting on compressed gas containers.

2. Torch-applied roof system operations on roofs constructed of combustible materials.

3. Use of an acetylene generator for hot work operations.

3505.8 Tests. It shall be unlawful to test piping equipment or systems for leaks using a flame. Tests for suspected leaks in piping equipment and systems shall be made using soapy water.

SECTION FC 3506
ELECTRIC ARC HOT WORK

3506.1 General. The frame or case of electric hot work machines, except internal-combustion-engine-driven machines, shall be grounded. Ground connections shall be mechanically strong and electrically adequate for the required current.

3506.2 Return circuits. Welding current return circuits from the work to the machine shall have proper electrical contact at joints. The electrical contact shall be periodically inspected.

3506.3 Disconnecting. Electrodes shall be removed from the holders when electric arc welding or cutting is discontinued for any period of 1 hour or more. The holders shall be located to prevent accidental contact and the machines shall be disconnected from the power source.

3506.4 Emergency disconnect. A switch or circuit breaker shall be provided so that fixed electric welders and control equipment can be disconnected from the supply circuit. The disconnect shall be installed in accordance with the Electrical Code.

3506.5 Damaged cable. Damaged cable shall be removed from service until properly repaired or replaced.

SECTION FC 3507
RESERVED

SECTION FC 3508
RESERVED

SECTION FC 3509
PIPING MANIFOLDS AND HOSE SYSTEMS FOR FUEL GASES AND OXYGEN

3509.1 General. The use of piping manifolds, protective equipment and hose systems in oxygen-fuel gas systems, including natural gas supplied from a utility for use in an oxygen-fuel gas system, shall be designed, installed, operated and maintained in accordance with FC 3509, FC Chapter 53 and NFPA 51.

3509.2 Protection. Piping shall be protected against physical damage.

3509.3 Signage. Signage shall be provided for piping and hose systems as follows:

1. Aboveground piping systems shall be marked in accordance with ASME A13.1.

2. Station outlets shall be marked to indicate their intended usage.

3. Signs shall be posted, indicating clearly the location and identity of section shutoff valves.

3509.4 Manifolding of containers. Oxygen manifolds shall be located at least 20 feet (6096 mm) away from combustible waste and combustible material, including oil and grease, and gas containers containing flammable gases, unless the gas containers are separated from each other by a fire partition.

3509.5 Identification of manifolds. Signs shall be posted for oxygen manifolds with service pressures not exceeding 250 psig (1379 kPa). Such signs shall read as follows:

LOW-PRESSURE MANIFOLD
DO NOT CONNECT HIGH-PRESSURE CONTAINERS
MAXIMUM PRESSURE 250 PSIG

3509.6 Clamps. Hose connections shall be clamped or otherwise securely fastened.

3509.7 Inspection. Hoses shall be inspected frequently for leaks, burns, wear, loose connections or other defects.

3509.8 Piped natural gas precautions. When piped natural gas is used with oxygen in any hot work operation, a listed protective device that serves as a combination flashback arrester and backflow check valve shall be provided at an approved location on both the natural gas and oxygen supply lines so as to ensure the safe operation of all devices, equipment and systems, including the utility gas meter. Where pressure of the piped natural gas supply is insufficient to ensure such safe operation, approved equipment shall be provided between the gas meter and the fuel-consuming appliance that increases such pressure to the level required for such safe operation. Notwithstanding any section of this code to the contrary, such flashback arresters and check valves, pressure-increasing equipment, shall be installed as components of both new and existing installations. Installations involving the use of piped natural gas with oxygen in any hot work operation shall additionally comply with the rules.

SECTION FC 3510
HOT WORK ON FLAMMABLE AND COMBUSTIBLE LIQUID STORAGE TANKS

3510.1 General. Hot work performed on the interior or exterior of tanks that hold or have held flammable or combustible liquids, when approved, shall be conducted in accordance with this section and NFPA 326.

3510.2 Department approval. Approval shall be obtained from the department prior to conducting hot work on a tank that holds or has held flammable or combustible liquids. The application shall justify the need to conduct such hot work and identify the potential hazards and methods of controlling such hazards.

3510.3 Hazard prevention. A pre-hot work check shall be performed in accordance with FC 3504.3.1. A fire watch shall be maintained with a combustible gas detector, to continuously monitor the work area and any other affected areas.

3510.4 Hot tapping. Hot tapping may be conducted at bulk plants and terminals on tanks and piping only when approved by the department. Such work shall be conducted by persons with approved qualifications.