

## CHAPTER 26

# WELDING AND OTHER HOT WORK

### SECTION 2601 GENERAL

**2601.1 Scope.** Welding, cutting, open torches and other hot work operations and equipment shall comply with this chapter.

**Exception:** Hot work on board marine vessels at dock or under construction or repair shall be in accordance with Administrative Rules 26.01.04, Cutting, Welding and Other Hot Work on Marine Vessels and 26.02.04, Designated Hot Work Facilities and Shipyards.

**2601.2 Permits.** Permits shall be required as set forth in Section 105.6.

**2601.3 Restricted areas.** Hot work shall only be conducted in areas designed or authorized for that purpose by the personnel responsible for a Hot Work Program. Hot work shall not be conducted in the following areas unless specific approval has been obtained from the fire code official:

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 ships at dock or ships under construction or repair.
5. At other locations as specified by the fire code official.

**2601.4 Cylinders and containers.** Compressed gas cylinders and fuel containers shall comply with this chapter and Chapter 30.

**2601.5 Design and installation of oxygen-fuel gas systems.** The design and installation of An oxygen-fuel gas system with two or more manifolded cylinders of oxygen shall be in accordance with NFPA 51.

### SECTION 2602 DEFINITIONS

**2602.1 Definitions.** The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

**HOT WORK.** Operations including cutting, welding, Thermit welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof systems, glass-blowing, weed burning, use of any open-flame or arc-producing device and any activity involving riveting, burning, silbrazing, use of powder-actuated tools or any similar spark, arc or flame-producing activity. Grinding, drilling, heating of couplings or other machinery, abrasive blasting and similar spark-producing operations in areas where flammable or

explosive atmospheres may be present or produced may be considered hot work or any other similar activity.

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

**HOT WORK EQUIPMENT.** Electric or gas welding or cutting equipment or any other equipment use for hot work.

**HOT WORK PERMITS.** Permits issued by the responsible person at the facility under the hot work permit program permitting welding or other hot work to be ~~done~~ conducted in locations referred to in Section 2603.3 and pre-permitted by the fire code official.

**HOT WORK PROGRAM.** A permitted program, carried out by approved facilities-designated personnel, allowing them to oversee and issue permits for hot work conducted by their personnel or at their facility. The intent is to have trained, on-site, responsible personnel ensure that required hot work safety measures are taken to prevent fires and fire spread.

**PF DEVICE.** A wet or dry device (or assembly of devices) in a fuel gas line designed to perform the following three functions:

- (a) Prevent backflow of oxygen into the fuel gas supply system;
- (b) Prevent the passage of flame into the fuel gas supply system (flashback);
- (c) Prevent the development of a fuel gas-oxygen mixture at sufficient pressure so that its ignition would achieve combustion pressures that could cause failure to perform functions (a) and (b). This device is given a diagram symbol, PF. A wet PF device is commonly known as a hydraulic seal, hydraulic valve or hydraulic back-pressure valve.

**RESPONSIBLE PERSON.** A person trained in the safety and fire safety considerations concerned with hot work. Responsible for reviewing the sites prior to issuing permits as part of the hot work permit program and following up as the job progresses.

**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.

### SECTION 2603 GENERAL REQUIREMENTS

**2603.1 General.** Hot work conditions and operations shall comply with this chapter.

**2603.2 Temporary and fixed hot work areas.** Temporary and fixed hot work areas shall comply with this section.

**2603.3 Hot work program permit.** Hot work permits, issued by an approved responsible person under a hot work program,

shall be available for review by the fire code official at the time the work is conducted and for 48 hours after work is complete.

**2603.4 Qualifications of operators.** A permit for hot work operations shall not be issued unless the individuals in charge of performing 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.

**2603.5 Records.** The individual responsible for the hot work area shall maintain “prework check” reports in accordance with Section 2604.3.1. These reports shall be maintained on the premises for a minimum of 48 hours after work is complete.

**2603.6 Signage.** Visible hazard identification signs shall be provided where required by Chapter 27. Where the hot work area is accessible to persons other than the operator of the hot work equipment, conspicuous signs shall be posted to warn others before they enter the hot work area. Such signs shall display the following warning:

CAUTION  
HOT WORK IN PROGRESS  
STAY CLEAR.

## SECTION 2604 FIRE SAFETY REQUIREMENTS

**2604.1 Protection of combustibles.** Protection of combustibles shall be in accordance with Sections 2604.1.1 through 2604.1.9.

**2604.1.1 Combustibles.** Hot work areas shall not contain combustibles or shall be provided with appropriate shielding to prevent sparks, slag or heat from igniting exposed combustibles.

**2604.1.2 Openings.** Openings or cracks in walls, floors, ducts or shafts within 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 curtains shall be provided to prevent passage of sparks or slag.

**2604.1.3 Housekeeping.** Floors shall be kept clean within the hot work area.

**2604.1.4 Conveyor systems.** Conveyor systems that are capable of carrying sparks to distant combustibles shall be shielded or shut down.

**2604.1.5 Partitions.** Partitions segregating hot work areas from other areas of the building shall be noncombustible. 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.

**2604.1.6 Floors.** Fixed hot work areas shall have floors with noncombustible surfaces.

**2604.1.7 Precautions in hot work.** Hot work shall not be performed on containers or equipment that contains or has contained flammable liquids, gases or solids until the containers and equipment have been thoroughly cleaned,

inerted or purged; except that “hot tapping” shall be allowed on tanks and pipe lines when such work is to be conducted by approved personnel.

**2604.1.8 Sprinkler protection.** Automatic sprinkler protection shall not be shut off while hot work is performed. Where hot work is performed close to automatic 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. The fire code official shall approve hot work where sprinkler protection is impaired.

**2604.1.9 Fire detection systems.** Approved special precautions shall be taken to avoid accidental operation of automatic fire detection systems.

**2604.2 Fire watch.** Fire watches shall be established and conducted in accordance with Sections 2604.2.1 through 2604.2.6.

**2604.2.1 When required.** A fire watch shall be provided during hot work activities and shall continue for a minimum of 30 minutes after the conclusion of the work. The fire code official, or the responsible manager under a hot work program, is authorized to extend the fire watch based on the hazards or work being performed.

**Exception:** Where the hot work area has no fire hazards or combustible exposures.

**2604.2.2 Location.** The fire watch shall include the entire hot work area and be positioned so that the extinguishment of a spot fire is not delayed. 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 fire watches to ensure that exposed areas are monitored.

**2604.2.3 Duties.** Individuals designated to fire watch duty shall ~~have no other duties except to watch for fire, have fire-extinguishing equipment readily available and shall be trained in the use of such equipment.~~ Individuals assigned to fire watch duty shall be responsible for extinguishing spot fires and communicating an alarm.

**2604.2.4 Fire-extinguishing equipment and training.** The individuals responsible for performing the hot work and individuals responsible for providing the fire watch shall be ~~trained in the use of portable fire extinguishers~~ have fire-extinguishing equipment readily available and shall be trained in the use of such equipment.

**2604.2.5 Fire hoses.** Where hoselines are required, they shall be connected, charged and ready for operation.

**2604.2.6 Fire extinguisher.** A minimum of one portable fire extinguisher complying with Section 906 and with a minimum ~~2-A:20-B:C~~ 2-A:40-B:C rating shall be readily accessible within 30 feet (9144 mm) of the location where hot work is performed.

**2604.3 Area reviews.** Before hot work is permitted and at least once per day while the permit is in effect, the area shall be inspected by the individual responsible for authorizing hot work operations to ensure that it is a fire safe area. Information shown on the permit shall be verified prior to signing the permit in accordance with Section 105.6.

**2604.3.1 Pre-hot-work check.** A pre-hot-work check shall be conducted 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 available upon request. The pre-hot-work check shall determine all of the following:

1. Hot work equipment to be used shall be in satisfactory operating condition and in good repair.
2. Hot work site is clear of combustibles or combustibles are protected.
3. Exposed construction is of noncombustible materials or, if combustible, then protected.
4. Openings are protected.
5. Floors are kept clean.
6. No exposed combustibles are located on the opposite side of partitions, walls, ceilings or floors.
7. Fire watches, where required, are assigned.
8. Approved actions have been taken to prevent accidental activation of suppression and detection equipment in accordance with Sections 2604.1.8 and 2604.1.9.
9. Fire extinguishers and fire hoses (where provided) are operable and available.

## SECTION 2605 GAS WELDING AND CUTTING HOT WORK

**2605.1 General.** Devices or attachments mixing air or oxygen with combustible gases prior to consumption, except at the burner or in a standard torch or blow pipe, shall not be allowed unless approved.

**2605.2 Cylinder and container storage, handling and use.** Storage, handling and use of compressed gas cylinders, containers and tanks shall be in accordance with this section and Chapter 30.

**2605.3 Precautions.** Cylinders, valves, regulators, hose and other apparatus and fittings for oxygen shall be kept free from oil or grease. Oxygen cylinders, apparatus and fittings shall not be handled with oily hands, oily gloves, or greasy tools or equipment.

### **2605.4 Fuel gases and liquid oxygen.**

**2605.4.1 Acetylene and other nonliquefied flammable gases.**

**2605.4.1.1 Prohibitions.** Acetylene gas shall not be:

1. Piped except in approved cylinder manifolds and cylinder manifold connections, or
2. Utilized at a pressure exceeding 15 pounds per square inch gauge (psig) (103 kPa) unless dissolved in a suitable solvent in cylinders manufactured in accordance with DOTn 49 CFR.

**2605.4.1.2 Unalloyed copper.** Acetylene gas shall not be brought in contact with unalloyed copper, except in a blowpipe or torch.

**2605.4.1.3 Maximum acetylene and other nonliquefied flammable gas quantities inside buildings.** The maximum quantity of acetylene and other

nonliquefied flammable gas used and stored inside buildings in conjunction with hot work operations shall be in accordance with this section.

**2605.4.1.3.1 Group A, B, E, I, M and R occupancies.** Acetylene gas and other nonliquefied flammable gas shall not be stored or used in Group A, B, E, I, M or R occupancies.

#### **Exceptions:**

1. Individual cylinders not exceeding 150 cubic feet (4 m<sup>3</sup>) each at normal temperature and pressure (NTP). Aggregate quantity of flammable gas shall not exceed 1,000 cubic feet (28 m<sup>3</sup>) in unsprinklered buildings and 2,000 cubic feet (57 m<sup>3</sup>) in sprinklered buildings.
2. Buildings under construction or demolition where individual acetylene gas and other nonliquefied flammable gas cylinders do not exceed 300 cubic feet (8 m<sup>3</sup>) each at normal temperature and pressure and the aggregate storage quantity inside the building does not exceed 1,000 cubic feet (28 m<sup>3</sup>).

**2605.4.1.3.2 Group F and S occupancies.** Acetylene and other nonliquefied flammable gas shall not be stored or used in Group F and S occupancies in excess of the maximum allowable quantities set forth in Table 2703.1.1 (1).

**2605.4.1.3.3 Mixed use occupancies.** Individual fuel gas cylinders within F or S occupancies in buildings having any other use shall be limited to 250 cubic feet (7 m<sup>3</sup>) at normal temperature and pressure and shall be limited to a total aggregate gas capacity of 1,000 cubic feet (70.8 m<sup>3</sup>) at normal temperature and pressure of acetylene or other nonliquefied flammable gas.

### **2605.4.2 Liquefied petroleum gas (LP-gas) and methylacetylenepropadiene (MAPP gas).**

**2605.4.2.1 Maximum LP-gas and MAPP gas quantities inside buildings.** The maximum quantity of LP-gas and MAPP gas used and stored inside buildings in conjunction with hot work operations shall be in accordance with this section.

#### **Point of Information**

1 pound (.45 kg) LP-gas capacity is equivalent to 2.2 pounds water capacity.

1 gallon (3.8 L) of LP-gas at 60°F (16°C) weighs 4.22 pounds (2 kg).

1 gallon (3.8 L) of water weighs 8.33 pounds (4 kg).

**2605.4.2.1.1 Group A, B, E, I, M and R occupancies.** LP-gas and MAPP shall not be stored or used in Group A, B, E, I, M or R occupancies.

#### **Exceptions:**

1. A single LP-gas or a single MAPP gas cylinder not exceeding 50-pounds water capacity

(nominal 20 pounds LP-gas) in Group E and M occupancies.

2. Individual LP-gas or MAPP gas cylinders not exceeding 12-pounds water capacity (nominal 5 pounds LP-gas) in Group I occupancies.
3. Unoccupied buildings under construction or demolition where individual LP-gas or MAPP gas cylinders do not exceed 240-pounds water capacity (nominal 100 pounds LP-gas) and the aggregate quantity inside the building does not exceed an aggregate water capacity of 735 pounds (nominal 300 pounds LP-gas) on the site.
4. Occupied buildings under construction or demolition where individual LP-gas or MAPP gas cylinders do not exceed 104-pounds water capacity (nominal 43.5 pounds LP-gas) and the aggregate quantity inside the building does not exceed 357-pounds water capacity (nominal 150 pounds LP-gas).

**2605.4.2.1.2 Group F and S occupancies.** LP-gas and MAPP gas shall not be stored or used in excess of 735 pounds aggregate water capacity (nominal 300 pounds LP-gas) in Group F and S occupancies.

**2605.4.2.1.3 Mixed use occupancies.** LP-gas and MAPP gas storage and use inside Group F and S occupancies within buildings having any other use shall be limited to cylinders having an individual water capacity not exceeding 50 pounds (nominal 20 pounds LP-gas) and a total aggregate water capacity not to exceed 144 pounds (nominal 60 pounds LP-gas).

**2605.4.3 Liquid oxygen (LOX).** Liquid oxygen shall not be stored or used in an unsprinklered building in an aggregate quantity exceeding 45 gallons (170 L) per control area or an aggregate quantity of 90 gallons (340 L) per control area in a sprinklered building.

**2605.4.4 Separation of cylinders in storage.** Fuel gas cylinders shall be separated from compressed oxygen cylinders and liquid oxygen containers by a minimum of 20 feet (6.1 m) or by a barrier of noncombustible construction at least 5 feet (1524 mm) high having a fire-resistive rating of at least ½ hour. The barrier shall interrupt all lines of sight between oxygen and fuel gas cylinders within 20 feet (6096 mm) of each other.

**2605.5 Remote locations.** Oxygen and fuel-gas cylinders and acetylene generators shall be located away from the hot work area to prevent such cylinders or generators from being heated by radiation from heated materials, sparks or slag, or misdirection of the torch flame.

**2605.6 Cylinders shutoff.** The torch valve shall be closed and the gas supply to the torch completely shut off when gas welding or cutting hot work operations are discontinued for a period of 1 hour or more.

**2605.7 Prohibited operation.** ~~Welding or cutting~~ Hot work shall not be held or supported on compressed gas cylinders or containers.

**2605.8 Tests.** Tests for leaks in piping systems and equipment shall be made with soapy water. The use of flames shall be prohibited for leak testing.

## SECTION 2606 ELECTRIC ARC HOT WORK

**2606.1 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.

**2606.2 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.

**2606.3 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.

**2606.4 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 ~~IEC~~ *Seattle Electrical Code*.

**2606.5 Damaged cable.** Damaged cable shall be removed from service until properly repaired or replaced.

## SECTION 2607 CALCIUM CARBIDE SYSTEMS

**2607.1 Calcium carbide storage.** Storage and handling of calcium carbide shall comply with Chapter 27 of this code and Chapter 7 of NFPA 51.

## SECTION 2608 ACETYLENE GENERATORS

**2608.1 Use of acetylene generators.** The use of acetylene generators shall comply with this section and Chapter 4 of NFPA 51A.

**2608.2 Portable generators.** The minimum volume of rooms containing portable generators shall be 35 times the total gas-generating capacity per charge of all generators in the room. The gas-generating capacity in cubic feet per charge shall be assumed to be 4.5 times the weight of carbide per charge in pounds. The minimum ceiling height of rooms containing generators shall be 10 feet (3048 mm). An acetylene generator shall not be moved by derrick, crane or hoist while charged.

**2608.3 Protection against freezing.** Generators shall be located where water will not freeze. Common salt such as sodium chloride or other corrosive chemicals shall not be utilized for protection against freezing.

**SECTION 2609  
PIPING MANIFOLDS AND HOSE SYSTEMS FOR  
FUEL GASES AND OXYGEN**

**2609.1 General.** The use of piping manifolds and hose systems shall be in accordance with Section 2609, Chapter 30 and Chapter 3 of NFPA 51.

**2609.2 Protection.** Piping shall be protected against physical damage.

**2609.3 Signage.** Signage shall be provided for piping and hose systems as follows:

1. Above-ground 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.

**2609.4 Manifolding of cylinders.** Oxygen manifolds shall not be located in an acetylene generator room. Oxygen manifolds shall be located at least 20 feet (6096 mm) away from combustible material such as oil or grease, and gas cylinders containing flammable gases, unless the gas cylinders are separated by a fire partition.

**2609.5 Identification of manifolds.** Signs shall be posted for oxygen manifolds with service pressures not exceeding 200 psig (1379 kPa). Such signs shall include the words:

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

**2609.6 Clamps.** Hose connections shall be clamped or otherwise securely fastened.

**2609.7 Inspection.** Hoses shall be inspected frequently for leaks, burns, wear, loose connections or other defects rendering the hose unfit for service.

**2609.8 PF devices.** PF devices shall be designed and installed in fuel gas lines in accordance with NFPA 51.

