Subpart Q

Welding, Cutting & Brazing

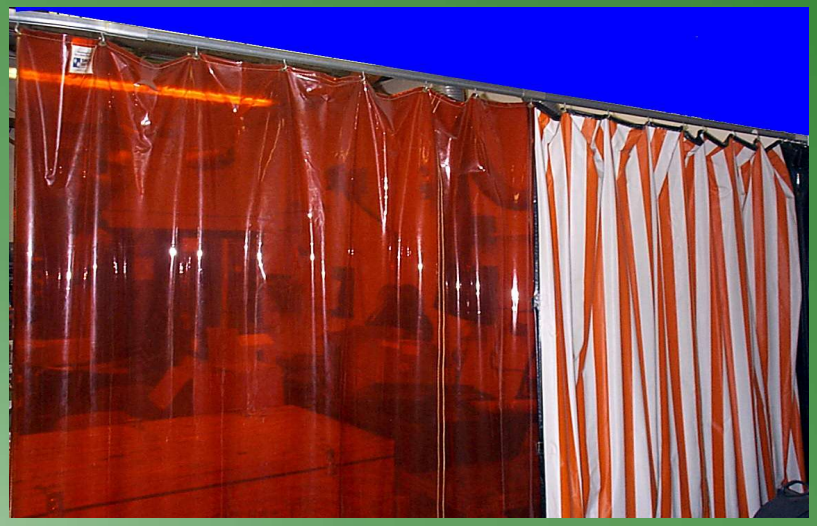
1910.251-255

Trainer Objectives

- Discuss the fire hazards associated with welding
- Discuss the selection of eye protection for welding operations.
- Discuss management's responsibility
- Review General requirements 1910.252
- Discuss Oxygen-fuel gas welding 1910.253
- Discuss Arc welding 1910.254

1910.252 General Requirements

- (a)(1)(i)Fire Protection:
- If the object to be welded or cut cannot readily be moved, all movable fire hazards in the vicinity shall be taken to a safe place.



1910.252 (a)(1)(ii) Guards

- If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards shall be used to confine the heat, sparks, and slag, and to protect the immovable fire hazards.

1910.252 (a)(1)(iii) Restrictions

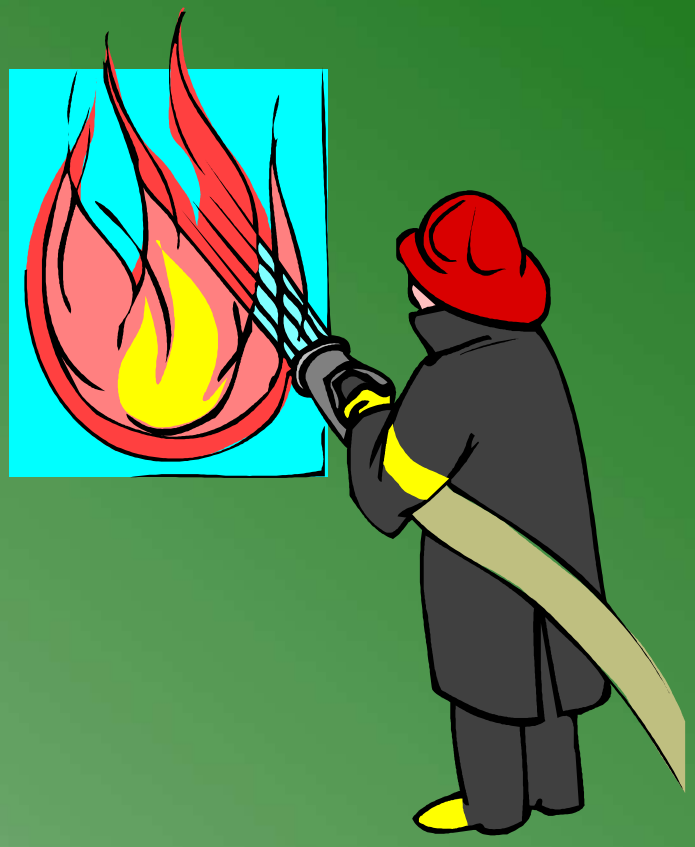
- If the requirements stated in paragraphs(a)(1)(i) and (a)(1)(ii) of this section cannot be followed ***then welding and cutting shall not be performed***

1910.252 (a)(2)(i) Combustible material

- Ensure no combustible materials on the floor below will be exposed to sparks which might drop through the floor
- The same precautions observed with cracks or holes in walls, open doorways and open or broken windows

1910.252 (a)(2)(ii) Fire extinguishers

- Suitable fire extinguishing equipment shall be maintained in a state of readiness for instant use.
- Such equipment may consist of pails of water, buckets of sand, hose or portable extinguishers depending upon the nature and quantity of the combustible material exposed.



1910.252 (a)(2)(iii)(A) Fire watch

- Fire watchers shall be required whenever welding or cutting is performed in locations where other than a minor fire might develop, or any of the following conditions exist:
  - (1)Combustible material closer than 35 feet to the point of operation
  - (2)Combustibles more than 35 feet away but are easily ignited by sparks.

1910.252(a)(iii)(B) Fire watch

- Fire watchers:
  - Shall have fire extinguishing equipment and be trained
  - Familiar with facilities for sounding an alarm
  - Try to extinguish them only when obviously within the capacity of the equipment available, or otherwise sound the alarm
- ***Maintained for at least a half hour after completion of welding or cutting operations***

1910.252 (a)(2)(iv) Authorization

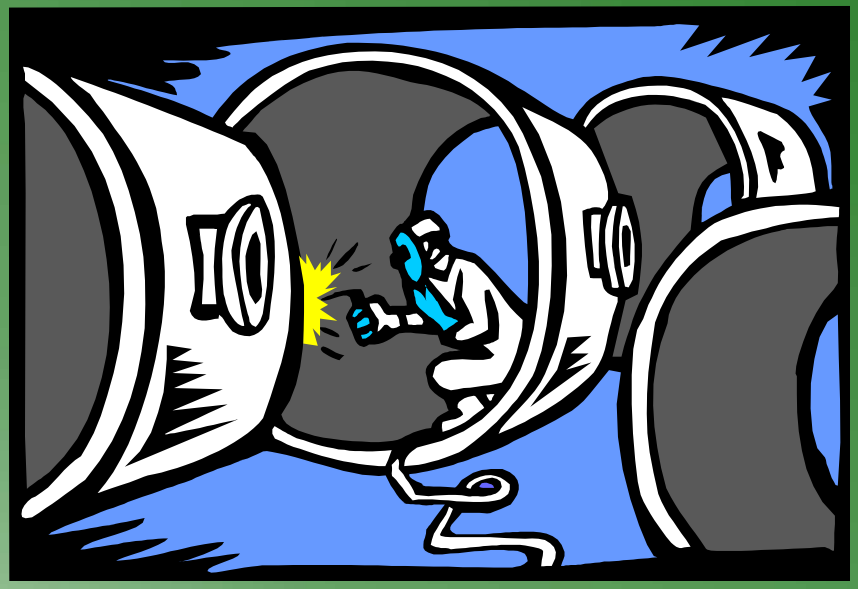
- The individual responsible for authorizing cutting and welding operations must inspect the area before work starts
- He shall designate precautions to be followed in granting authorization to proceed preferably in the form of a written permit.

1910.252 (a)(2)(vi) Prohibited areas

- Cutting or welding shall not be permitted in the following situations:
  - (A)In areas not authorized by management
  - (B)In sprinklered buildings while such protection is impaired
  - (D)In areas near the storage of large quantities of exposed, readily ignitable materials such as bulk sulfur, baled paper, or cotton.

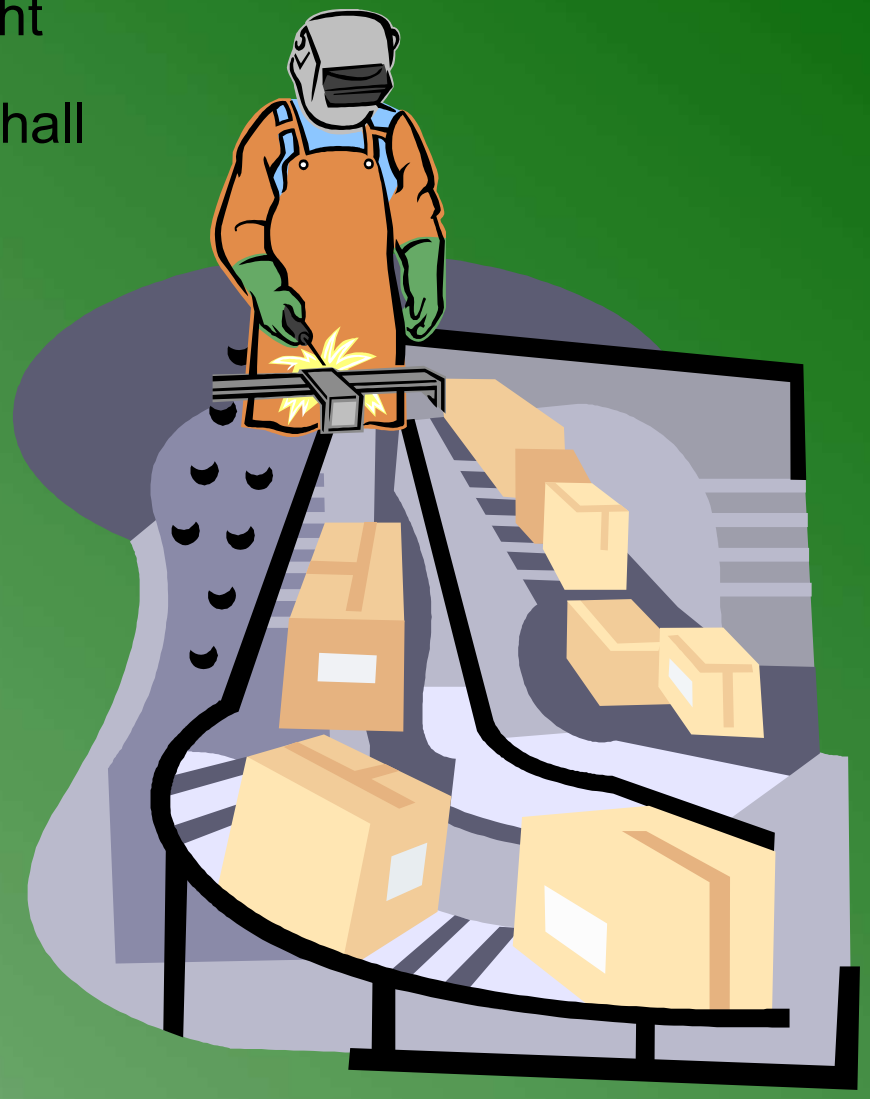
1910.252 (a)(2)(vi) Prohibited areas

- Cutting or welding shall not be permitted in the following situations:
  - (C)In the presence of explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air),
  - (C)or explosive atmospheres that may develop inside uncleaned or improperly prepared tanks or in areas with an accumulation of combustible dusts.



1910.252 (a)(2)(viii) Ducts

- Ducts and conveyor systems that might carry sparks to distant combustibles shall be suitably protected or shut down.

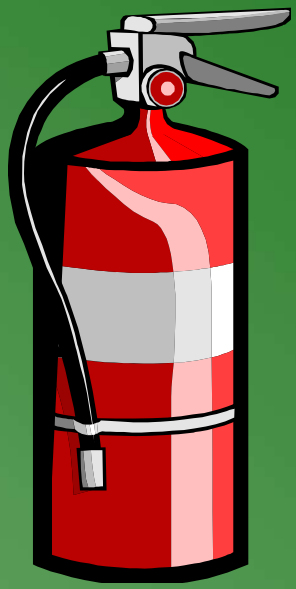


1910.252 (a)(2)(xiii) Management

- Management responsibility for the safe usage of cutting and welding equipment
  - (A) Establish areas for cutting and welding (B)Designate an individual responsible for authorizing cutting and welding operations.
  - (C)Ensure personnel are properly trained
  - (D)Advise all contractors about flammable materials

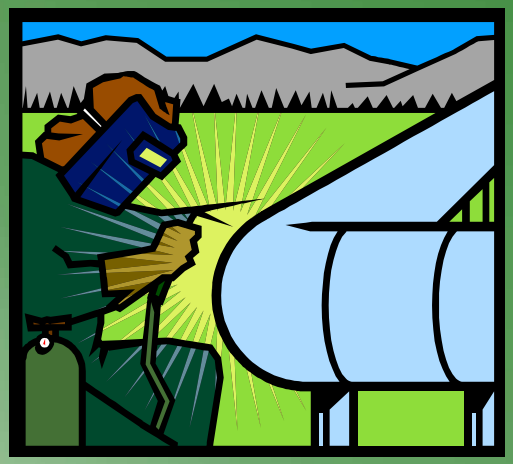
1910.252 (a)(2)(xiv) Supervisor

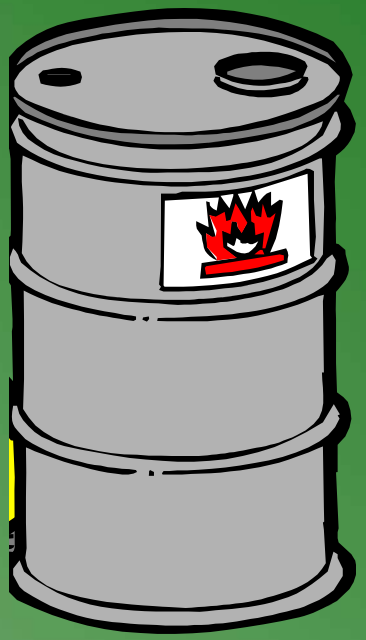
- The Supervisor:
  - Responsible for the safe use of equipment and the safety of the process
  - Approves welding can take place
  - Ensures fire protection



1910.252 (a)(3)(i)Welding or cutting containers

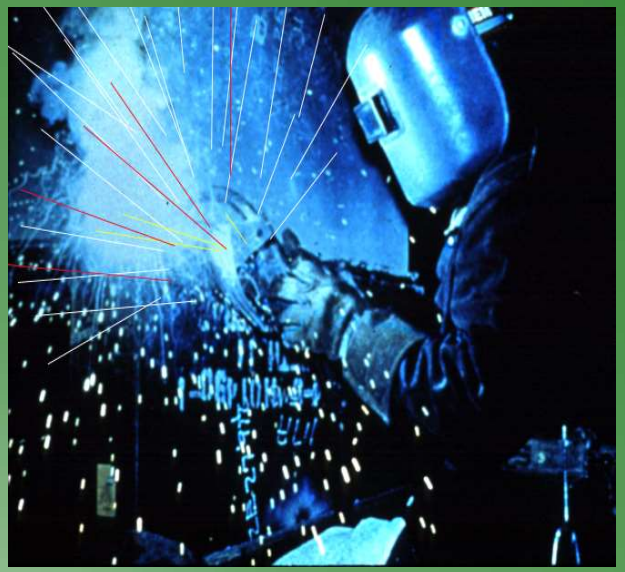
- No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks or other containers until absolutely certain that there are no flammable materials present
- Any pipe lines or connections to the drum or vessel shall be disconnected or blanked





1910.252 (a)(4) Confined spaces

- (i) Accidental contact:
  - When arc welding is to be suspended for any substantial period of time, such as during lunch or overnight, **all electrodes shall be removed from the holders** and the holders carefully located so that accidental contact cannot occur and the machine be disconnected from the power source

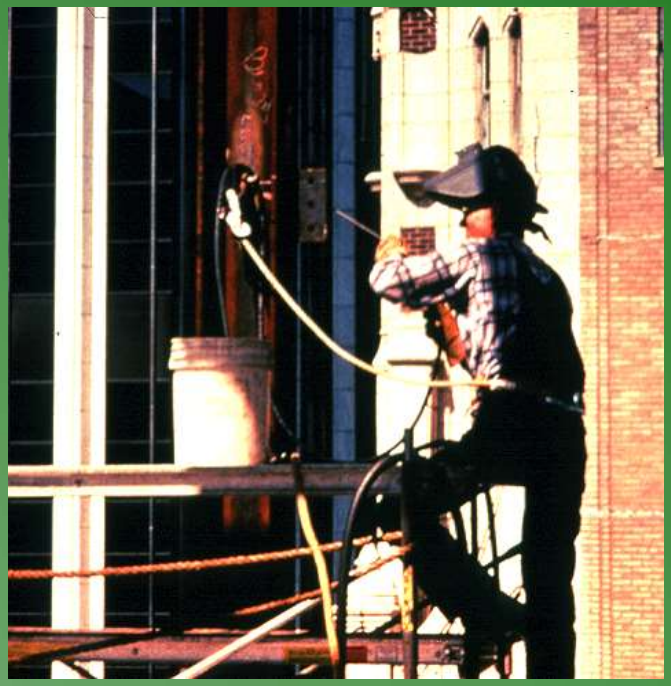


1910.252 (a)(4) Confined spaces

- (ii) Torch valve:
  - Torch valves shall be closed and the gas supply to the torch shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time, such as during lunch hour or overnight
  - Where practicable, the torch and hose shall also be removed from the confined space

1910.252(b) Protection of personnel

- (1)(i) A welder or helper working on platforms, scaffolds, or runways shall be protected against falling
- This may be accomplished by the use of railings,safety belts, life lines, or some other equally effective safeguards



1910.252 (b)(2)(iii) Protection from arc welding rays

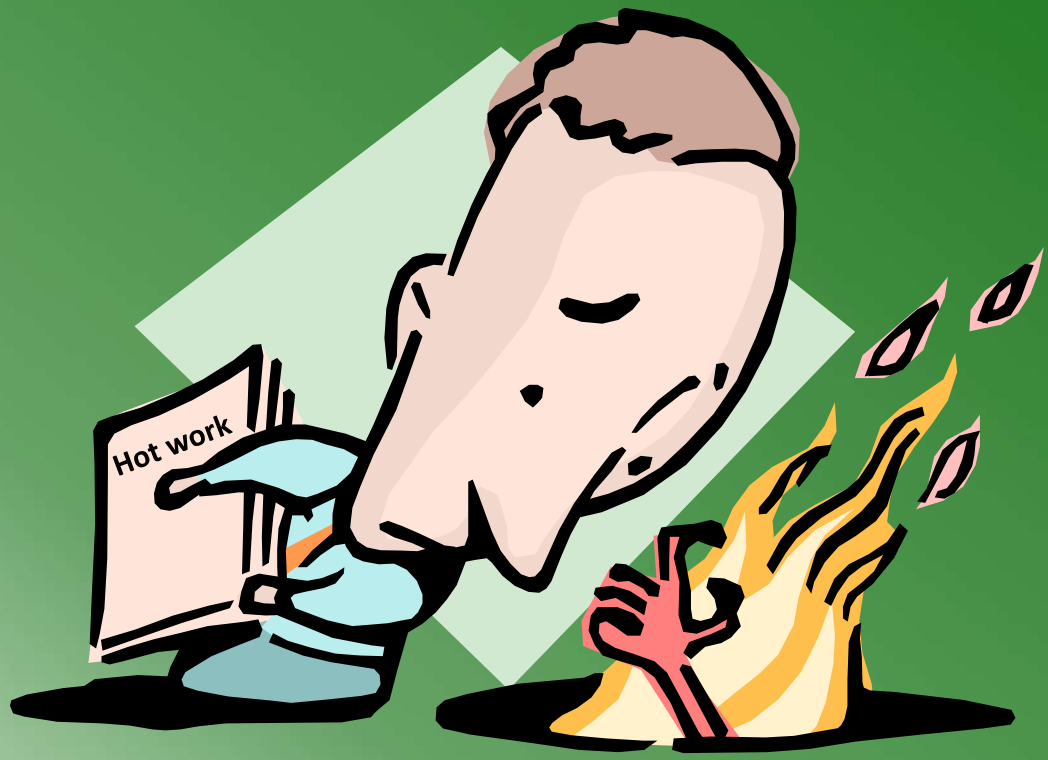
- Suitable PPE for all welders and helpers
- Workers or other persons adjacent to the welding areas protected from the rays by noncombustible or flameproof screens or shields or shall be required to wear appropriate goggles

1910.252 (b)(3) Protective Clothing

- Employees exposed to the hazards created by welding, cutting, or brazing operations protected by personal protective equipment (1910.132)

1910.252 (b)(4)(iii) Securing cylinders and machinery

- When welding or cutting is being performed in any confined spaces the gas cylinders and welding machines shall be left on the outside.



1910.252 (b)(4)(iv) Lifelines

- Where a welder must enter a confined space through a manhole or other small opening, means shall be provided for quickly removing him in case of emergency
- Safety belts and lifelines attached to the welder's body so that his body cannot be jammed in a small exit opening.
- An attendant with a pre-planned rescue procedure stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.

Standard Interpretations 07/30/1993 - Conflict between requirements of 1910.252 and 1910.146

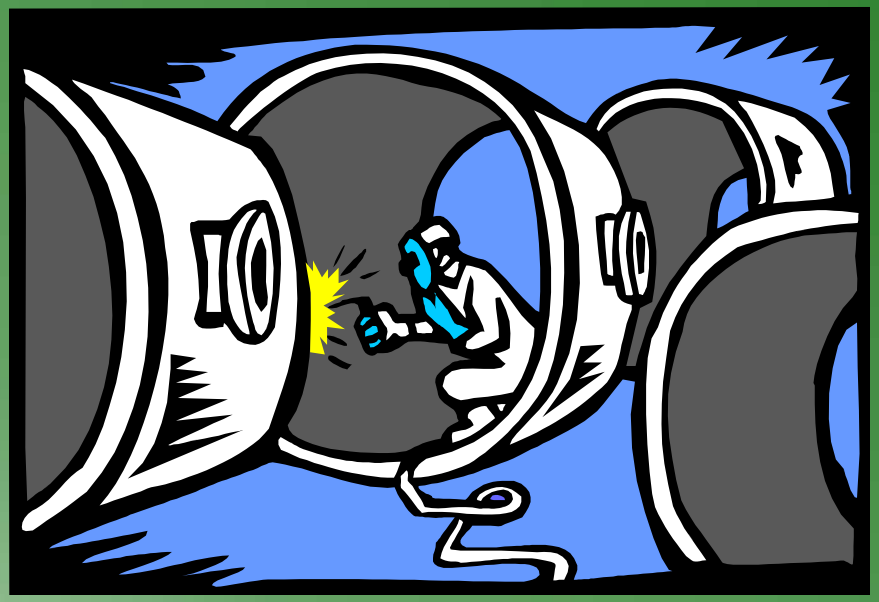
- Section 1910.252(b)(4)(iv) requires that an attendant be stationed outside a confined space which a welder must enter through a manhole or other small opening "to observe" the welder at all times.
- However, Appendix C of 1910.146 lists "tapping or rapping codes on tank walls" as an example of an adequate means of communication and observation between an attendant and a welder working in a permit-required confined space.

Standard Interpretations 07/30/1993 - Conflict between requirements of 1910.252 and 1910.146

- The present requirement in 1910.252(b)(4)(iv) is based upon a similar requirement in an out-of-date voluntary standard (ANSI Z49.1-1967). The most recent version (1988) of the same ANSI standard contains language which is slightly different than that contained in the older version.
- The newer voluntary standard states that the attendant shall "observe the workers inside **or be in constant communication with them.**"

Standard Interpretations
07/30/1993 - Conflict between requirements of 1910.252 and 1910.146

- We believe that "tapping on tank walls" can be an adequate means of communication between an entrant and an attendant.
- OSHA will accept the use of the tapping procedure on the walls of tanks in lieu of the more burdensome requirement in the current 1910.252(b)(4)(iv).



1910.252 (b)(4)(vii) Warning sign

- After welding operations are completed, the welder shall mark the hot metal or provide some other means of warning other workers.

1910.252 (c) Health protection & ventilation

- Three factors govern the amount of contamination to which welders may be exposed:
  - (1)(i)(A)Dimensions of space
  - (1)(i)(B)Number of welders
  - (1)(i)(C)Possible evolution of hazardous fumes
- Management responsible to ensure welders have proper protection & ventilation

NIOSH Study: Control Technology Assessment for Welding Operations

- Epidemiological evidence indicates that welders generally have a 40 percent increase in relative risk of developing lung cancer as a result of their work.
- Other cancers associated with welding include leukemia, cancer of the stomach, brain, nasal sinus, and pancreas.
- Cadmium poisoning can affect the respiratory system and damage the liver and kidneys.

NIOSH Study: Control Technology Assessment for Welding Operations

A common reaction to overexposure to metal fumes, particularly zinc oxide fumes, is metal fume fever, with symptoms resembling the flu.

- Other health hazards during welding can include vision problems and dermatitis arising from ultraviolet radiation exposures, burns, and musculoskeletal stress from awkward work positions.

1910.253 Oxygen-fuel gas welding and cutting

- (a)(1) Mixtures of fuel gases and air or oxygen may be explosive and shall be guarded against
- (a)(2) Under no condition shall **acetylene** be utilized at a pressure in excess of **15 psig**

1910.253 (a)(4) Oxygen-fuel gas welding and cutting

- Workmen in charge of the oxygen or fuel-gas supply equipment, including generators, and oxygen or fuel-gas distribution piping systems shall be instructed and judged competent by their employers

Standard Interpretations 05/13/1998 - Training and competency for oxygen-fuel gas welding equipment

- A workmen who is trained and demonstrates proficiency in following the rules and instructions required under paragraph 1910.253(a)(4) would be considered competent to perform the duties of a workman in charge of an oxygen-fuel gas welding or cutting system.
- The aforementioned rules and instructions must incorporate requirements under §1910.252 and §1910.253 of Subpart Q-Welding, Cutting and Brazing and any other employer determined safety and health requirements that are applicable to the particular workplace application.

1910.253 (b)(1)(ii) Oxygen-fuel gas welding and cutting

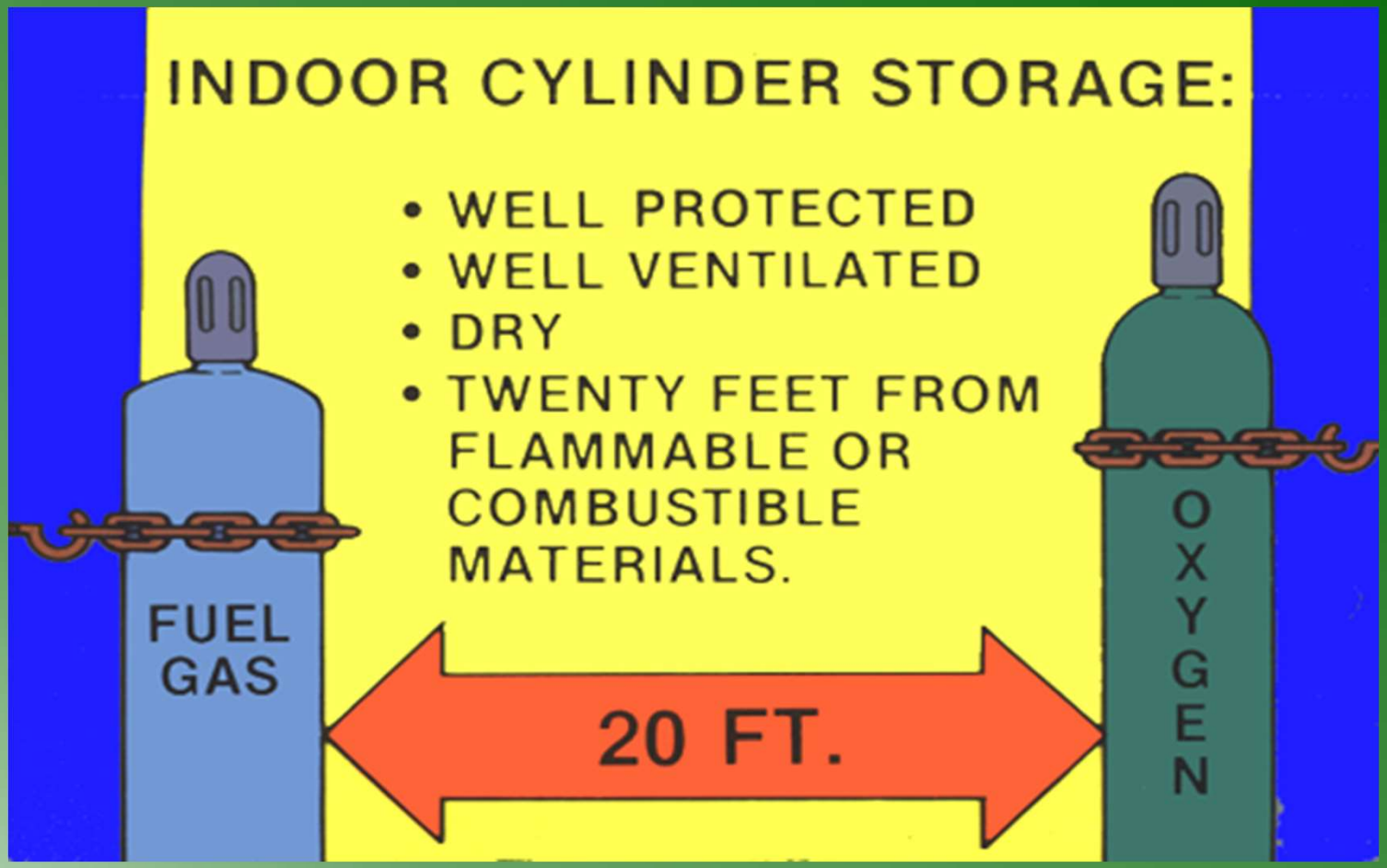
- Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or the trade name of the gas

1910.253 (b)(2) Storage of cylinders-general

- (i)Kept away from radiators and other sources of heat
- (ii)Stored in a well-protected, well-ventilated, dry location, at least 20 (6.1 m) feet from highly combustible materials
- (iii)Empty cylinders shall have their valves closed

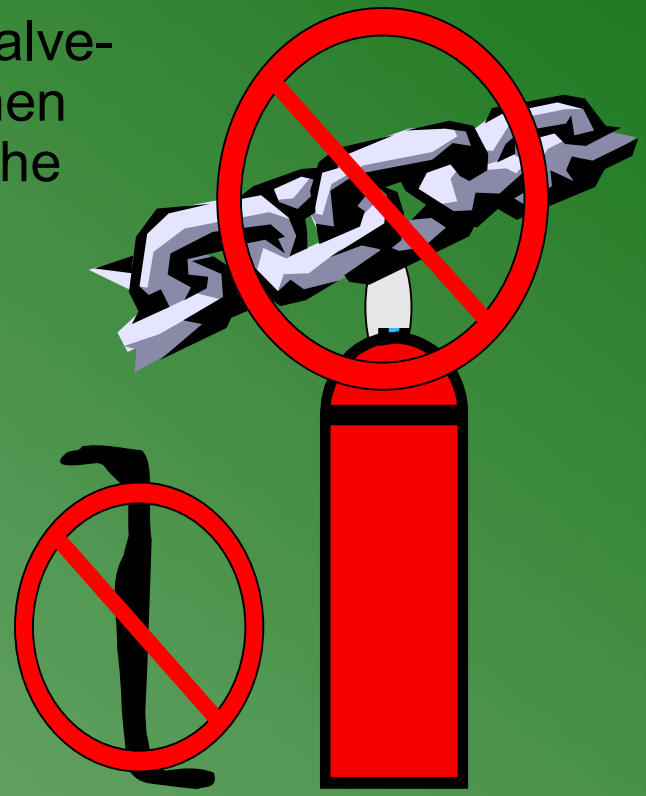
1910.253 (b)(2)(iv) Storage of cylinders-general

- Valve protection caps, where cylinder is designed to accept a cap, shall always be in place, hand-tight, except when cylinders are in use or connected for use



1910.253 (b)(5)(ii)(C) Operating procedures

- Valve-protection caps shall not be used for lifting cylinders from one vertical position to another
- Bars shall not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed; the use of warm (not boiling) water is recommended



1910.253 (b)(5)(ii)(D) Operating procedures

- Unless cylinders are secured on a special truck, regulators shall be removed and valve-protection caps, when provided for, shall be put in place before cylinders are moved

1910.253 (b)(5)(ii)(E) Operating procedures

- Cylinders not having fixed hand wheels shall have keys, handles, or nonadjustable **wrenches on valve stems while cylinders are in service**

1910.253 (b)(5)(iii)(A) Operating procedures

- Fuel-gas cylinders shall be placed with valve end up whenever they are in use.
- Liquefied gases shall be stored and shipped with the valve end up

1910.253 (b)(5)(iii)(C) Operating procedures

- Before connecting a regulator to a cylinder valve, the valve shall be opened slightly and closed immediately
- The valve shall be opened while standing to one side of the outlet; never in front of it
- Never crack a fuel-gas cylinder valve near other welding work or near sparks, flame, or other possible sources of ignition

1910.253 (b)(5)(iii) Operating procedures

- (J)The cylinder valve shall always be opened slowly
- (K)An acetylene cylinder valve shall not be opened more than one and one-half turns of the spindle, and preferably no more than three-fourths of a turn

1910.253 (e)(5) Hose and hose connections

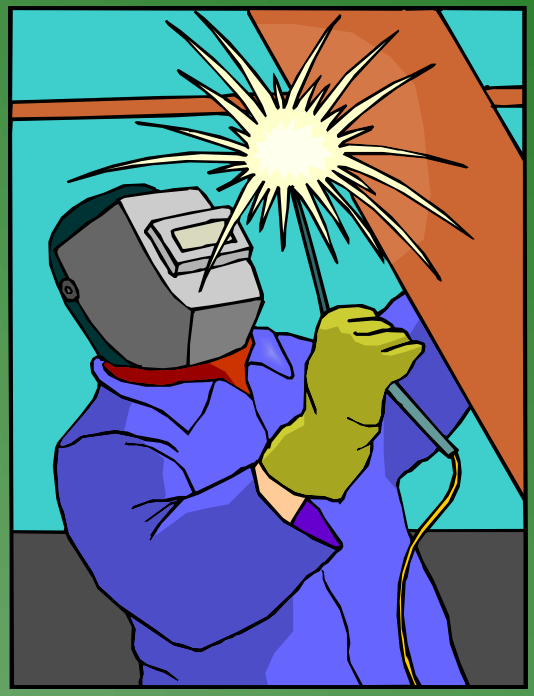
- (i)Hose for oxy-fuel gas service shall comply with the Specification for Rubber Welding Hose, 1958, Compressed Gas Association
- (ii)When parallel lengths of oxygen and acetylene hose are taped together for convenience and to prevent tangling, not more than 4 inches (10.2 cm) out of 12 inches covered by tape

1910.254 Arc welding and cutting

- Assurance of consideration of safety in design is obtainable by choosing apparatus complying with the:
  - Requirements for Electric Arc-Welding Apparatus,
  - NEMA EW-1-1962,
  - National Electrical Manufacturers Association or the Safety Standard for Transformer-Type Arc-Welding Machines,
  - ANSI C33.2-1956,
  - Underwriters' Laboratories,

1910.254 (d)(1) Arc welding and cutting

- Workmen assigned to operate or maintain arc welding equipment shall be acquainted with the requirements of this section and with 1910.252 (a), (b), and (c) of this part



1910.254 (d)(2) Arc welding and cutting

- Before starting operations all connections to the machine shall be checked to make certain they are properly made
- The work lead shall be firmly attached to the work; magnetic work clamps shall be freed from adherent metal particles of spatter on contact surfaces
- Coiled welding cable shall be spread out before use to avoid serious overheating and damage to insulation.

1910.254 (d) Arc welding and cutting

- (7)Electrode holders when not in use shall be so placed that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks
- (8)Cables with splices within 10 feet (3 m) of the holder shall not be used
- The welder should not coil or loop welding electrode cable around parts of his body

weld

safely!