Welding and Cutting

- ***29 CFR 1910 - Subpart Q***

Objectives

- In this course, we will discuss:
  - Fire hazards associated with welding
  - Selection of eye protection for welding operations
  - Management's responsibility
  - General requirements - 1910.252
  - Oxygen-fuel gas welding - 1910.253
  - Arc welding - 1910.254

Fire Protection

1910.252(a)(1)(i)

- If object to be welded or cut cannot readily be moved, all movable fire hazards in the vicinity shall be taken to a safe place.

Guards

1910.252(a)(1)(ii)

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

Restrictions

1910.252(a)(1)(iii)

- If these requirements cannot be followed, then welding and cutting shall not be performed.

Combustible Material

1910.252(a)(2)(i)

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

Fire Extinguishers

1910.252(a)(2)(ii)

- Suitable fire extinguishing equipment maintained in 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.

Fire Watch

1910.252(a)(2)(iii)(A)(1)-(2)

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

Fire Watch

1910.252(a)(2)(iii)(B)

- Fire watchers
  - Shall have fire extinguishing equipment available and be trained in use
  - Familiar with facilities for sounding an alarm
  - Try to extinguish fire if within capacity of available equipment, otherwise sound the alarm
  - Watch maintained at least a half hour after completion of welding or cutting operations

Authorization

1910.252(a)(2)(iv)

- Individual responsible for authorizing cutting and welding operations must inspect area before work starts.

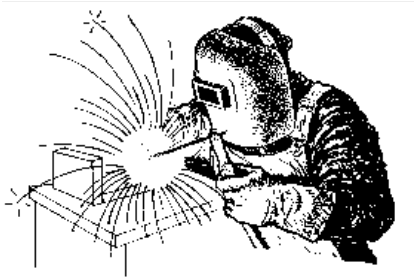
- They shall designate precautions to be followed in granting authorization to proceed preferably in form of a written permit.

Prohibited Areas

1910.252(a)(2)(vi)

- Cutting or welding shall not be permitted in the following situations:
  - Areas not authorized by management.
  - Sprinklered buildings while protection is impaired.
  - Near storage of large quantities of exposed, readily ignitable materials such as bulk sulfur, baled paper, or cotton.

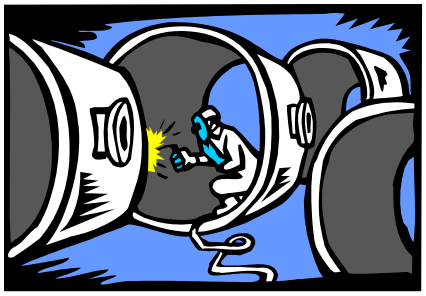
OR …



Prohibited Areas

1910.252(a)(2)(vi)(C)

- In presence of any of the following:
  - Explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air)
  - Explosive atmospheres that may develop inside uncleaned or improperly prepared tanks or equipment
  - Areas that may develop an accumulation of combustible dusts



Ducts

1910.252(a)(2)(viii)

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

Management

1910.252(a)(2)(xiii)

- Responsible for safe use of cutting and welding equipment
  - Establish areas for cutting and welding
  - Designate an individual responsible for authorizing cutting and welding operations
  - Ensure personnel are properly trained in operation and use
  - Advise all contractors about flammable materials or hazardous conditions

Supervisor

1910.252(a)(2)(xiv)

- Responsible for safe handling of equipment and safe use of the process
  - Determines combustible and hazardous areas
  - Protects combustibles from ignition
  - Secures authorization for welding and cutting operations
  - Gives approval to cutter or welder
  - Determines that fire protection and extinguishing equipment are properly located
  - Ensures fire watchers are available

Protection of Personnel

1910.252(b)(1)(i)

- Welder or helper working on platforms, scaffolds, or runways shall be protected against falling
  - May be accomplished by use of railings, safety belts, life lines, or other equally effective safeguards

Protection from Arc Welding Rays 1910.252(b)(2)(iii)

- Where work permits, welders should be enclosed in individual booths or by noncombustible screens.

- Workers adjacent to welding areas shall be protected from rays by noncombustible or flameproof screens/shields or be required to wear appropriate goggles.

Protective Clothing

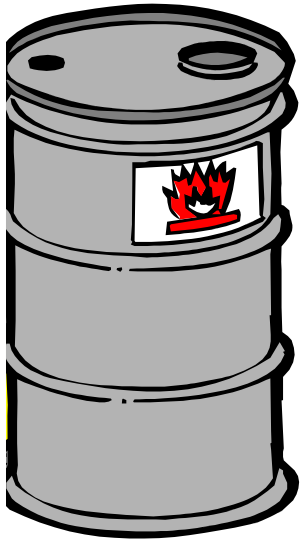
1910.252(b)(3)

- Employees exposed to hazards created by welding, cutting, or brazing operations shall be protected by personal protective equipment.

Welding or Cutting Containers 1910.252(a)(3)(i)

- Welding, cutting, or other hot work ***shall not*** be performed on used drums, barrels, tanks or other containers until thoroughly cleaned.

- Pipe lines and connections to the drum or vessel shall be disconnected or blanked.

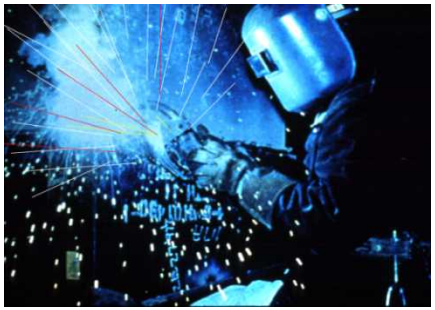


Confined Spaces

1910.252(a)(4)(i)

- When arc welding is suspended for any substantial period, all electrodes shall be removed from holders.
  - Holders located to prevent accidental contact

- Machine shall be disconnected from the power source.



Confined Spaces

1910.252(a)(4)(ii)

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

Confined Spaces

1910.252(b)(4)

- Secure gas cylinders and welding machines outside area.

Confined Spaces

1910.252(b)(4)(iv)

- Lifelines
  - Means shall be provided for rescuing a welder quickly in case of emergency.
  - Lifelines cannot limit the welder's egress though a small exit opening.
  - Must have an attendant with a pre-planned rescue procedure stationed outside.

Standards Interpretation - 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.
  - 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.

Standards Interpretation - 07/30/1993

- **Conflict - RESOLVED**
  - 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.”**

Standards Interpretation - 07/30/1993

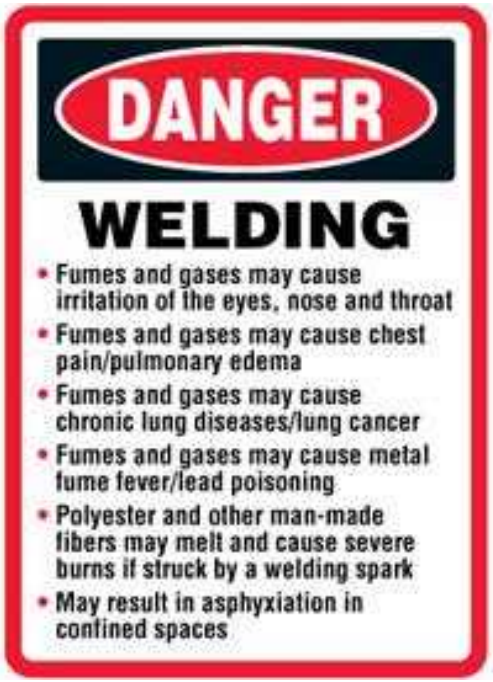
- We believe that “tapping on tank walls” can be an adequate means of communication between an entrant and an attendant.

- OSHA will accept the use of the tapping procedure on the walls of tanks in lieu of the more burdensome requirement in 1910.252(b)(4)(iv).

Warning Sign

1910.252(b)(4)(vii)

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

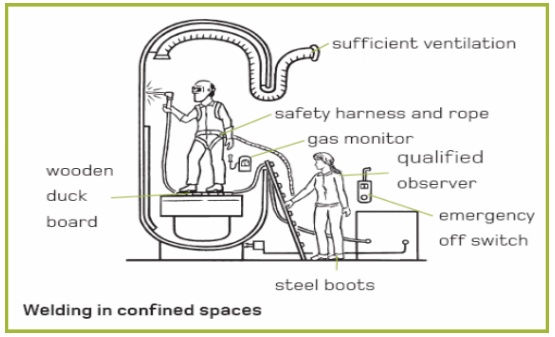


Health Protection and Ventilation

1910.252(c)(1)(i)(A)-(C)

- Three factors govern the amount of contamination to which welders may be exposed:
  - Dimensions of space
  - Number of welders
  - Possible evolution of hazardous fumes, gases, or dust

- Management responsible for ensuring welders have proper protection and ventilation.



Welding in confined spaces

NIOSH Study

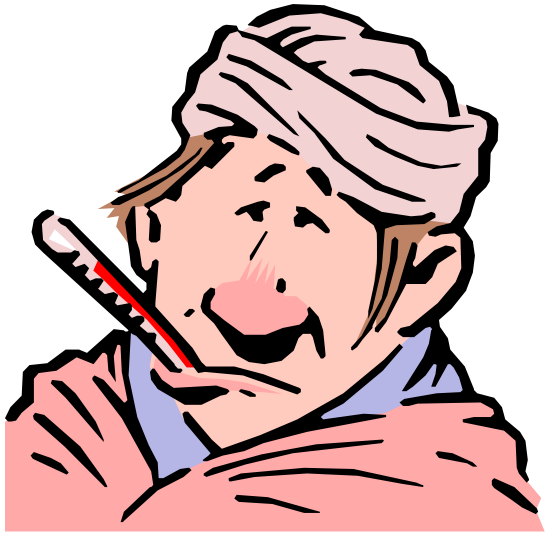
Control Technology Assessment for Welding Operations

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

NIOSH Study

Control Technology Assessment for Welding Operations

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



Oxygen-Fuel Gas Welding/Cutting 1910.253(a)(1)-(3)

- Mixtures of fuel gases and air or oxygen may be explosive and shall be guarded against.
- Under no condition shall acetylene be utilized at a pressure in excess of 15 psig or 30 psia.
- Only approved apparatus may be used.

Oxygen-Fuel Gas Welding/Cutting 1910.253(a)(4)

- 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.

- Rules and instructions covering the operation and maintenance of oxygen or fuel-gas supply equipment shall be readily available.

Standards Interpretation – 05/13/1998

- Training and competency for oxygen-fuel gas welding equipment
  - A trained workmen that 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.

Oxygen-Fuel Gas Welding/Cutting 1910.253(b)(1)(ii)

- 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.

Storage of Cylinders - General 1910.253(b)(2)(i)-(iii)

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

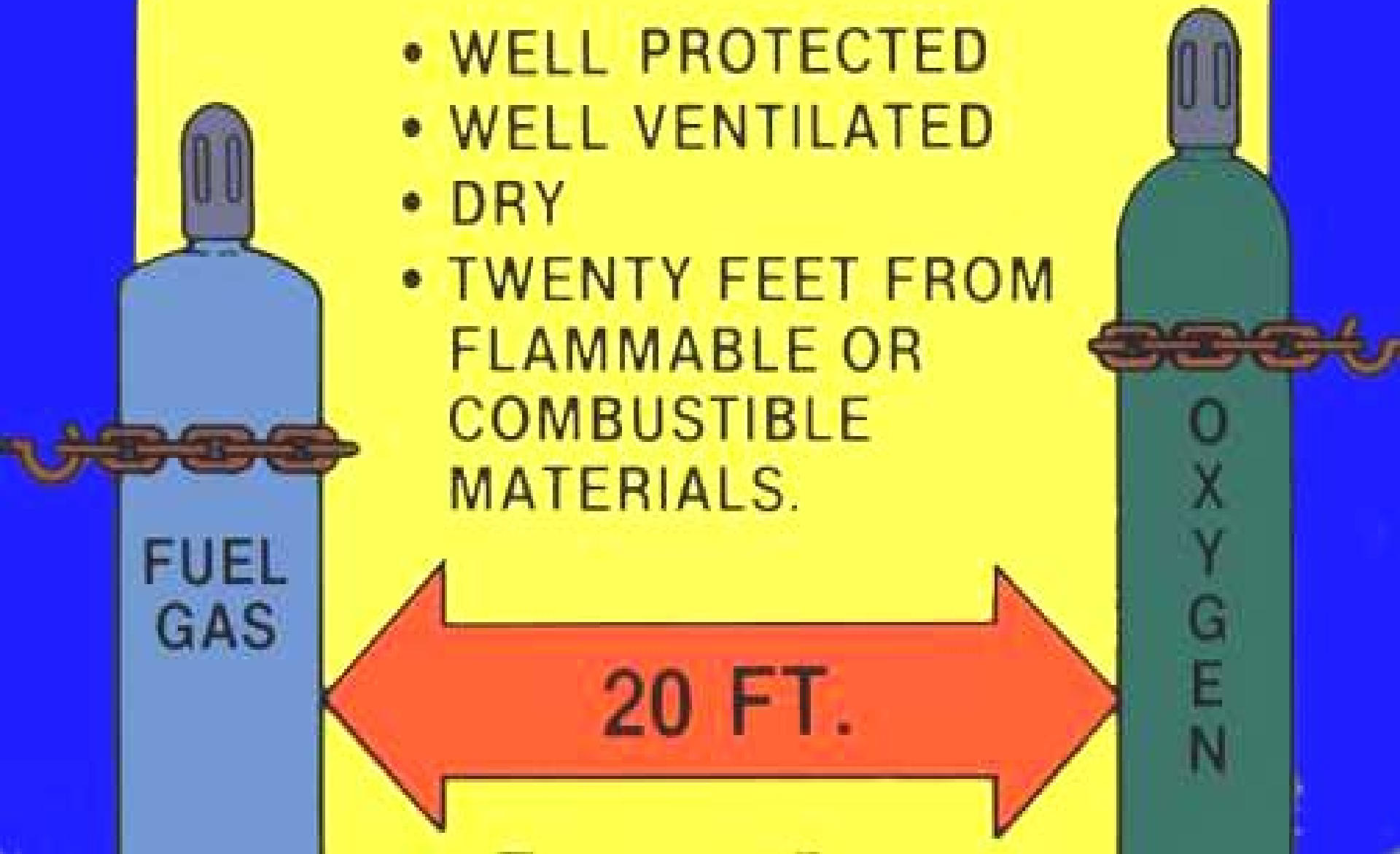
Storage of Cylinders - General

1910.253(b)(2)(iv)

- 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.

INDOOR CYLINDER STORAGE:

- WELL PROTECTED
- WELL VENTILATED
- DRY
- TWENTY FEET FROM FLAMMABLE OR COMBUSTIBLE MATERIALS.



Operating Procedures

1910.253(b)(5)(ii)[C]

- 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.

Operating Procedures

1910.253(b)(5)(ii)[D]

- 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.

Operating Procedures

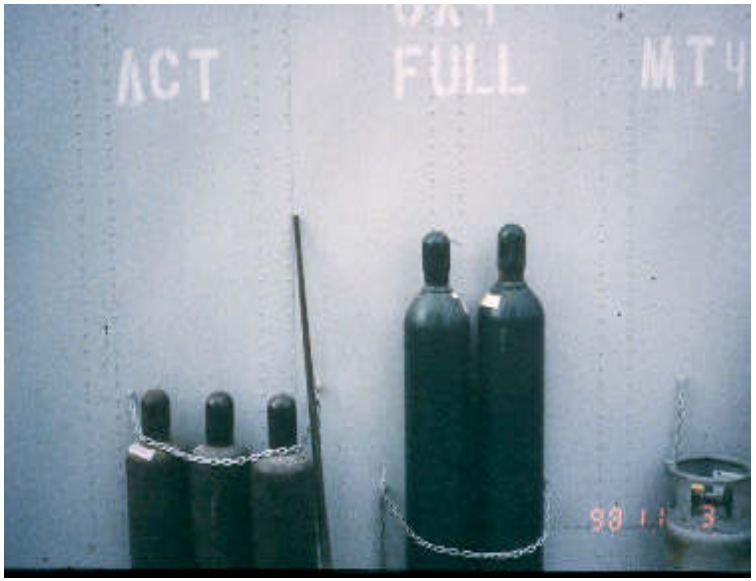
1910.253(b)(5)(ii)[E]

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

Operating Procedures

1910.253(b)(5)(iii)[A]

- 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.



Operating Procedures

1910.253(b)(5)(iii)[C]

- Before connecting a regulator to a cylinder valve, the valve shall be opened slightly and closed immediately.
- 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.

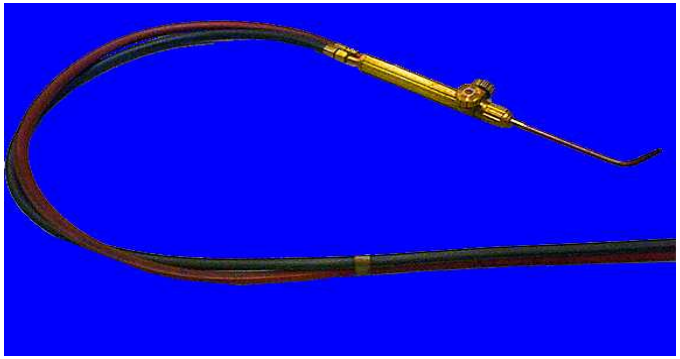
Operating Procedures

1910.253(b)(5)(iii)[J]-[K]

- The cylinder valve shall always be opened slowly.
- 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.

Hose and Hose Connections 1910.253(e)(5)(i)-(ii)

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



Arc Welding and Cutting

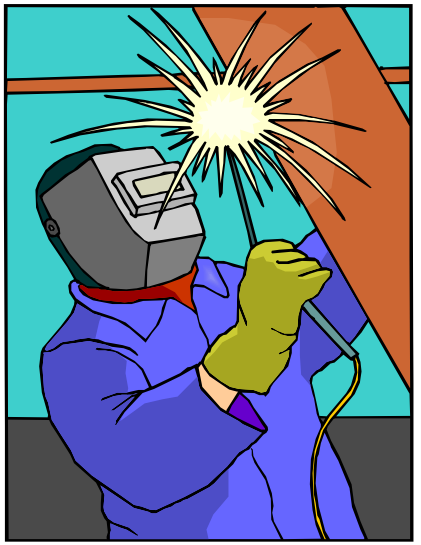
1910.254

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

Arc Welding and Cutting

1910.254(d)(1)

- 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.



Arc Welding and Cutting

1910.254(d)(2)

- Before starting operations, all connections to the machine shall be checked to make certain they are properly made.
- 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.

Arc Welding and Cutting

1910.254(d)(7)-(8)

- 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.
- Electric shock
  - Cables with splices within 10 feet of the holder shall not be used.
  - Welder should not coil or loop welding electrode cable around parts of his body.

Summary

- In this course, we discussed:
  - Fire hazards associated with welding
  - Selection of eye protection for welding operations
  - Management's responsibility
  - General requirements of 1910.252
  - Oxygen-fuel gas welding of 1910.253
  - Arc welding of 1910.254

Thank You For Attending!

Final Questions?