STANDARD PRACTICE INSTRUCTION

DATE: Reviewed and Updated July 31, 2023

SUBJECT: Welding, Cutting, and Brazing Safety-Related Work Practices Program

REGULATORY STANDARD: OSHA - 29 CFR 1910.251 - 252
NFPA - Standard 51B, 1962

BASIS: The welding, cutting, and brazing processes expose workers to a variety of hazards including; burns, fire, eye damage, possible lung irritation and damage, electric shock, slips and falls. Numerous injuries and deaths occur each year from the hazards associated with welding, cutting, and brazing operations in the American workplace. Most of these injuries and deaths are preventable.

GENERAL: Salisbury University will ensure that work practices that involve Welding, Cutting and Brazing equipment/operations are evaluated to determine if proper safety precautions are instituted. The Occupational Safety and Health Administration (OSHA) recommends that certain guidelines be adhered to regarding these hazards. This standard practice instruction is intended to address comprehensively the issues of: evaluating and identifying the specific hazards where hot work is performed; communicating information concerning these hazards, and; establishing appropriate procedures, and protective measures for our employees.

RESPONSIBILITY: The Environmental Safety Manager is the University Safety Manage. The Safety Manager is solely responsible for all facets of this program and has full authority to make necessary decisions to ensure success of the program. The Safety Manager will develop written detailed instructions covering each of the basic elements in this program, and is the sole person authorized to amend these instructions. The University has expressly authorized the Safety Manager to halt any operation of the University where there is danger of serious personal injury.

Contents of the Welding, Cutting, and Brazing Safety-Related Work Practices Program

1. **Written Program.**
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Salisbury University Welding, Cutting and Brazing Safety-Related Work Practices Program

1. Written Program. Salisbury University will review and evaluate this standard practice instruction on an annual basis, or when changes occur to 29 CFR 1910.251 - 252, that prompt revision of this document, or when University operational changes occur that require a revision of this document. Effective implementation of this program requires support from all levels of management within the University. This written program will be communicated to all personnel that are affected by it. It encompasses the total workplace, regardless of number of workers employed or the number of work shifts. It is designed to establish clear goals, and objectives.

2. Fire prevention and protection. Fire and explosion pose a serious risk to our employees during welding, cutting, and brazing operations. Sparks can travel as much as 35 feet, and spatter can bounce on the floor or fall through openings, creating hazards in other work areas of our University.

2.1 Basic safety precautions. The below listed basic safety precautions will be followed by University employee's performing welding, cutting, and brazing operations. The basic precautions for fire prevention in welding or cutting work are:

2.1.1 Fire hazards. 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.

2.1.2 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.

2.1.3 Restrictions. If the requirements stated in paragraphs 2.1.1 and 2.1.2 cannot be followed, then welding and cutting shall not be performed.

2.2 Special precautions. When the nature of the work to be performed requires the use of guarding devices certain additional precautions may be necessary:

2.2.1 Combustible material. Wherever there are floor openings or cracks in the flooring that cannot be closed, precautions shall be taken so that no readily combustible materials on the floor below will be exposed to sparks which might drop through the floor. The same precautions shall be observed with regard to cracks or holes in walls, open doorways and open or broken windows.

2.2.2 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, hoses or portable extinguishers,

depending upon the nature and quantity of the combustible material exposed.

2.2.3 Fire watch.

2.2.3.1 Fire watches shall be required whenever welding or cutting is performed in locations where anything other than a minor fire might develop, or any of the following conditions exist:

2.2.3.1.1 Appreciable combustible material, in building construction or contents, closer than 35 feet (10.7 m) to the point of operation.

2.2.3.1.2 Appreciable combustibles are more than 35 feet (10.7 m) away but are easily ignited by sparks.

2.2.3.1.3 Wall or floor openings within a 35 foot (10.7 m) radius expose combustible material in adjacent areas including concealed spaces in walls or floors.

2.2.3.1.4 Combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are likely to be ignited by conduction or radiation.

2.2.3.2 Fire watchers shall have fire extinguishing equipment readily available and be trained in its use. They shall be familiar with facilities for sounding an alarm in the event of a fire. They shall watch for fires in all exposed areas, try to extinguish them only when obviously within the capacity of the equipment available, or otherwise sound the alarm. A fire watch shall be maintained for at least a half hour after completion of welding or cutting operations to detect and extinguish possible smoldering fires.

2.2.4 Authorization. Before cutting or welding is permitted, the area shall be inspected by the individual responsible for authorizing cutting and welding operations. He/she shall designate precautions to be followed in granting authorization to proceed, preferably in the form of a written permit.

2.2.5 Floors. 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 feet (10.7 m). Combustible floors shall be kept wet, covered with damp sand, or protected by fire-resistant shields. Where floors have been wet down, personnel operating arc welding or cutting equipment shall be protected from possible electrical shock.

2.2.6 Prohibited areas. Cutting or welding shall not be permitted in the following situations:

2.2.6.1 In areas not authorized by management.

2.2.6.2 In sprinklered buildings while such protection is impaired.

2.2.6.3 In the presence of explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air), or explosive atmospheres that may develop inside uncleaned or improperly prepared tanks or equipment which have previously contained such materials, or that may develop in areas with an accumulation of combustible dusts.

2.2.6.4 In areas near the storage of large quantities of exposed, readily ignitable materials such as bulk sulfur, baled paper, or cotton.

2.2.7 Relocation of combustibles. Where practicable, all combustibles shall be relocated at least 35 feet (10.7 m) from the work site. Where relocation is impracticable, combustibles shall be protected with flameproofed covers or otherwise shielded with fireproof guards or curtains.

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

2.2.9 Combustible walls. Where cutting or welding is done near walls, partitions, ceiling or roof of combustible construction, fire-resistant shields or guards shall be provided to prevent ignition.

2.2.10 Noncombustible walls. If welding is to be done on a metal wall, partition, ceiling or roof, precautions shall be taken to prevent ignition of combustibles on the other side, due to conduction or radiation, preferably by relocating combustibles. Where combustibles are not relocated, a fire watch on the opposite side from the work shall be provided.

2.2.11 Combustible cover. Welding shall not be attempted on a metal partition, wall, ceiling or roof having a combustible covering nor on walls or partitions of combustible sandwich-type panel construction.

2.2.12 Pipes. Cutting or welding on pipes or other metal in contact with combustible walls, partitions, ceilings or roofs shall not be undertaken if the work is close enough to cause ignition by conduction.

2.2.13 Management. Management shall recognize its responsibility for the safe usage of cutting and welding equipment on its property and:

2.2.13.1 Based on fire potentials of plant facilities, establish areas for cutting and welding, and establish procedures for cutting and welding, in other areas.

2.2.13.2 The Safety Manager will be responsible for authorizing cutting and welding operations in areas not specifically designed for such processes.

2.2.13.3 Ensure that cutters or welders and their supervisors are suitably trained in the safe operation of their equipment and the safe use of the process.

2.2.13.4 Advise all contractors about flammable materials or hazardous conditions of which they may not be aware.

2.2.14 Supervisor. The first line supervisor:

2.2.14.1 Shall be responsible for the safe handling of the cutting or welding equipment and the safe use of the cutting or welding process.

2.2.14.2 Shall determine the combustible materials and hazardous areas present or likely to be present in the work location.

2.2.14.3 Shall protect combustibles from ignition by the following:

2.2.14.3.1 Have the work moved to a location free from dangerous combustibles.

2.2.14.3.2 If the work cannot be moved, have the combustibles moved to a safe distance from the work or have the combustibles properly shielded against ignition.

2.2.14.3.3 See that cutting and welding are so scheduled that plant operations that might expose combustibles to ignition are not started during cutting or welding.

2.2.14.4 Shall secure authorization for the cutting or welding operations from the Safety Manager.

2.2.14.5 Shall determine that the cutter or welder secures his approval and that conditions are safe before going ahead.

2.2.14.6 Shall determine that fire protection and extinguishing equipment are properly located at the site.

2.2.14.7 Where fire watches are required, he/she shall see that they are available at the site.

2.2.15 Fire prevention precautions. Cutting or welding shall be permitted only in areas that are or have been made fire safe. When work cannot be moved practically, as in most construction work, the area shall be made safe by removing combustibles or protecting combustibles from ignition sources.

2.3 Welding or cutting containers.

2.3.1 Used containers. No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks or other containers until they have been cleaned so thoroughly as to make absolutely certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which when subjected to heat, might produce flammable or toxic vapors. Any pipe lines or connections to the drum or vessel shall be disconnected or blanked.

2.3.2 Venting and purging. All hollow spaces, cavities or containers shall be vented to permit the escape of air or gases before preheating, cutting or welding. Purging with inert gas is recommended.

2.4 Confined spaces.

2.4.1 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 shall be disconnected from the power source.

2.4.2 Torch valve. When gas welding or cutting, the torch valves shall be closed and the gas supply to the torch positively 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.

3. Protection of personnel.

3.1 General

3.1.1 Railings. Employee's 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.

3.1.2 Welding cables. Employee's shall place welding cables and other equipment so that it is clear of passageways, ladders, and stairways.

3.2 Eye protection.

3.2.1 Selection.

3.2.1.1 Helmets or hand shields shall be used during all arc welding or arc cutting operations, excluding submerged arc welding. Helpers or attendants shall be provided with proper eye protection.

3.2.1.2 Goggles or other suitable eye protection shall be used during all gas welding or oxygen cutting operations. Spectacles without side shields, with suitable filter lenses are permitted for use during gas welding operations on light work, for torch brazing or for inspection.

3.2.1.3 All operators and attendants of resistance welding or resistance brazing equipment shall use transparent face shields or goggles, depending on the particular job, to protect their faces or eyes, as required.

3.2.1.4 Eye protection in the form of suitable goggles shall be provided where needed for brazing operations.

3.2.2 Specifications for protectors.

3.2.2.1 Helmets and hand shields shall be made of a material which is an insulator for heat and electricity. Helmets, shields and goggles shall be not readily flammable and shall be capable of withstanding sterilization.

3.2.2.2 Helmets and hand shields shall be arranged to protect the face, neck and ears from direct radiant energy from the arc.

3.2.2.3 Helmets shall be provided with filter plates and cover plates designed for easy removal.

3.2.2.4 All parts shall be constructed of a material which will not readily corrode or discolor the skin.

3.2.2.5 Goggles shall be ventilated to prevent fogging of the lenses as much as practicable.

3.2.2.6 All glass for lenses shall be tempered, substantially free from stains, air bubbles, waves and other flaws. Except when a lens is ground to provide proper optical correction for defective vision, the front and rear surfaces of lenses and windows shall be smooth and parallel.

3.2.2.7 Lenses shall bear some permanent distinctive marking by which the source and shade may be readily identified.

3.2.2.8 The following is a guide for the selection of the proper shade numbers. These recommendations may be varied to suit the individual's needs.

Welding operation	Shade No.
Shielded metal-arc welding:	
1/16-, 3/32-, 1/8-, 5/32-inch electrodes	10
Gas-shielded arc welding (nonferrous):	
1/16-, 3/32-, 1/8-, 5/32-inch electrodes	11
Gas-shielded arc welding (ferrous)	
1/16-, 3/32-, 1/8-, 5/32-inch electrodes	12
Shielded metal-arc welding:	
3/16-, 7/32-, 1/4-inch electrodes	12
5/16-, 3/8-inch electrodes	14
Atomic hydrogen welding:	10-14
Carbon arc welding:	14
Soldering:	2
Torch brazing:	3 or 4
Light cutting, up to 1 inch:	3 or 4
Medium cutting, 1 inch to 6 inches:	4 or 5
Heavy cutting, 6 inches and over:	5 or 6
Gas welding (light) up to 1/8 inch:	4 or 5
Gas welding (medium) 1/8 inch to 1/2 inch:	5 or 6
Gas welding (heavy) 1/2 inch and over:	6 or 8

Note: In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter or lens that absorbs the yellow or sodium line in the visible light of the operation.

3.2.2.8 All filter lenses and plates purchased by this University shall meet the test for transmission of radiant energy prescribed in ANSI Z87.1--1968--American National Standard Practice for Occupational and Educational Eye and Face Protection.

3.2.3 Protection from arc welding rays. Where the work permits, the welder should be enclosed in an individual booth painted with a finish of low reflectivity such as zinc oxide (an important factor for absorbing ultraviolet radiations) and lamp black, or shall be enclosed with noncombustible screens similarly painted. Booths and screens shall permit circulation of air at floor level. Workers or other persons adjacent to the welding areas shall be protected from the rays by noncombustible or flameproof screens or shields or shall be required to wear appropriate goggles.

3.3 Protective clothing. General requirements. Supervisors will ensure that employees exposed to the hazards created by welding, cutting, or brazing operations be protected by personal protective equipment in accordance with the requirements of 29 CFR 1910.132 (Personal Protective Equipment, General Requirements). Appropriate protective clothing required for any welding operation will vary with the size, nature and location of the work to be performed.

3.4 Work in confined spaces. **Note: Follow guidelines under the Confined Space Program.**

3.4.1 General. As used herein confined space is intended to mean a relatively small or restricted space such as a tank, boiler, pressure vessel, or small compartment of a ship.

3.4.2 Ventilation. Ventilation is a prerequisite to work in confined spaces. The University confined space procedures will delineate ventilation requirements for specific operations where welding or cutting is required.

3.4.3 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. Before operations are started, heavy portable equipment mounted on wheels shall be securely blocked to prevent accidental movement.

3.4.4 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. When safety belts and lifelines are used for this purpose they shall be so attached to the welder's body that his body cannot be jammed in a small exit opening. An attendant with a preplanned rescue procedure (see University confined space procedures) shall be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.

3.4.5 Electrode removal. 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 disconnected from the power source.

3.4.6 Gas cylinder shutoff. In order to eliminate the possibility of gas escaping through leaks of improperly closed valves, when gas welding or cutting, the torch valves shall be closed and the fuel-gas and oxygen supply to the torch positively 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.

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

4. Health protection and ventilation.

4.1 General

4.1.1 Contamination. The requirements for contamination control have been established on the basis of the following three factors in arc and gas welding which govern the amount of contamination to which welders may be exposed:

4.1.1.1 Dimensions of space in which welding is to be done (with special regard to height of ceiling).

4.1.1.2 Number of welders.

4.1.1.3 Possible evolution of hazardous fumes, gases, or dust according to the metals involved.

4.1.2 Screens. When welding must be performed in a space entirely screened on all sides, the screens shall be so arranged that no serious restriction of ventilation exists. It is desirable to have the screens so mounted that they are about 2 feet (0.61 m) above the floor unless the work is performed at so low a level that the screen must be extended nearer to the floor to protect nearby workers from the glare of welding.

4.1.3 Maximum allowable concentration. Local exhaust or general ventilating systems shall be provided and arranged to keep the amount of toxic fumes, gases, or dusts below the maximum allowable concentration as specified in 29 CFR 1910.1000 (Toxic and Hazardous Substances.)

4.1.4 Precautionary labels. A number of potentially hazardous materials are employed in fluxes, coatings, coverings, and filler metals used in welding and cutting or are released to the atmosphere during welding and cutting. Supervisors will ensure employees under their control are familiar with the Safety Data Sheets (SDS) applicable to the welding materials they are using.

4.2 Ventilation for general welding and cutting.

4.2.1 General. Mechanical ventilation shall be provided when welding or cutting is done on metals other than the following: Fluorine compounds, Zinc, Lead, Beryllium, Cadmium, Mercury, and stainless steels.

4.2.1.1 In a space of less than 10,000 cubic feet (284 m3) per welder.

4.2.1.2 In a room having a ceiling height of less than 16 feet (5 m).

4.2.1.3 In confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross ventilation.

4.2.2 Minimum rate. Such ventilation shall be at the minimum rate of 2,000 cubic feet (57 m3) per minute per welder, except where local exhaust hoods and booths provide an equivalent or better rate, or airline respirators approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health, pursuant to the provisions of 30 CFR part 11, are provided. Natural ventilation is considered sufficient for welding or cutting operations where the following restrictions are not present.

4.2.2.1 In a space of less than 10,000 cubic feet (284 m3) per welder.

4.2.2.2 In a room having a ceiling height of less than 16 feet (5 m).

4.2.2.3 In confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross ventilation.

4.3 Local exhaust hoods and booths. Mechanical local exhaust ventilation may be by means of either of the following:

4.3.1 Hoods. Freely movable hoods intended to be placed by the welder as near as practicable to the work being welded and provided with a rate of air-flow sufficient to maintain a velocity in the direction of the hood of

100 linear feet (30 m) per minute in the zone of welding when the hood is at its most remote distance from the point of welding. The rates of ventilation required to accomplish this control velocity using a 3 inch (7.6 cm) wide flanged suction opening are shown in the following table:

Welding zone	Minimum air flow *(1) cubic feet/ minute	Duct diameter, inches *(2)
4 to 6 inches from arc or torch	150	3
6 to 8 inches from arc or torch	275	3 1/2
8 to 10 inches from arc or torch	425	4 1/2
10 to 12 inches from arc or torch	600	5 1/2

{Footnote}*(1) When brazing with cadmium bearing materials or when cutting on such materials increased rates of ventilation may be required.

{Footnote}*(2) Nearest half-inch duct diameter based on 4,000 feet per minute velocity in pipe.

4.3.2 Fixed enclosure. A fixed enclosure with a top and not less than two sides which surround the welding or cutting operations and with a rate of airflow sufficient to maintain a velocity away from the welder of not less than 100 linear feet (30 m) per minute.

4.4 Ventilation in confined spaces.

4.4.1 Air replacement. All welding and cutting operations carried on in confined spaces shall be adequately ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency. This applies not only to the welder but also to helpers and other personnel in the immediate vicinity. All replacement air shall be clean and respirable.

4.4.2 Airline respirators. In such circumstances where it is impossible to provide such ventilation, airline respirators or hose masks approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health, shall be used.

4.4.3 Self-contained units. In areas immediately dangerous to life and health (IDLH), hose masks with blowers or self-contained breathing equipment shall be used. The breathing equipment shall be approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health.

4.4.4 Outside helper. Where University welding operations are carried on in confined spaces and where welders and helpers are provided with hose masks, hose masks with blowers, or self-contained breathing equipment approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health, a worker shall be stationed on the outside of such confined spaces to insure the safety of those working within. This will be done in accordance with the University confined space standard practice instructions.

4.4.5 Oxygen for ventilation. Because of its' flammable properties, Oxygen shall never be used for ventilation.

4.5 Fluorine compounds.

4.5.1 General. In confined spaces, welding or cutting involving fluxes, coverings, or other materials which contain fluorine compounds shall be done in accordance with the safety precautions and work practices delineated on the MSDS. A fluorine compound is one that contains fluorine, as an element in chemical combination, not as a free gas.

4.5.2 Maximum allowable concentration. The need for local exhaust ventilation or airline respirators for welding or cutting in other than confined spaces will depend upon the individual circumstances. However, experience has shown such protection to be desirable for fixed-location production welding and for all production welding on stainless steels. Where air samples taken at the welding location indicate that the fluorides liberated are below the maximum allowable concentration, such protection is not necessary.

4.6 Zinc.

4.6.1 Confined spaces. In confined spaces welding or cutting involving zinc-bearing base or filler metals or metals coated with zinc-bearing materials shall be done in accordance with the "Ventilation in confined space" section of this SPI.

4.6.2 Indoors. Indoors, welding or cutting involving zinc-bearing base or filler metals coated with zinc-bearing materials shall be done in accordance with the "Local exhaust hoods and booths" section of this SPI.

4.7 Lead.

4.7.1 Confined spaces. In confined spaces, welding involving lead-base metals (erroneously called lead-burning) shall be done in accordance with the "Ventilation in confined space" section of this SPI.

4.7.2 Indoors. Indoors, welding involving lead-base metals shall be done in accordance with the "Local exhaust hoods and booths" section of this SPI.

4.7.3 Local ventilation. In confined spaces or indoors, welding or cutting involving metals containing lead, other than as an impurity, or involving metals coated with lead-bearing materials, including paint shall be done using local exhaust ventilation or airline respirators. Outdoors such operations shall be done using respiratory protective equipment approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health. In all cases, workers in the immediate vicinity of the cutting operation shall be protected as necessary by local exhaust ventilation or airline respirators.

4.8 Beryllium. Welding or cutting indoors, outdoors, or in confined spaces involving beryllium-containing base or filler metals shall be done using local exhaust ventilation and airline respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by 29 CFR 1910.1000. In all cases, workers in the immediate vicinity of the welding or cutting operations shall be protected as necessary by local exhaust ventilation or airline respirators.

4.9 Cadmium.

4.9.1 General. Welding or cutting indoors or in confined spaces involving cadmium-bearing or cadmium-coated base metals shall be done using local exhaust ventilation or airline respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by 29 CFR 1910.1000. Outdoors such operations shall be done using respiratory protective equipment such as fume respirators approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health.

4.9.2 Confined space. Welding (brazing) involving cadmium-bearing filler metals shall be done using ventilation in accordance with the "Ventilation in confined space" and the "Local exhaust hoods and booths" section of this SPI.

4.10 Mercury. Welding or cutting indoors or in a confined space involving metals coated with mercury-bearing materials including paint, shall be done using local exhaust ventilation or airline respirators unless atmospheric tests under the most

adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by 29 CFR 1910.1000. Outdoors such operations shall be done using respiratory protective equipment approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health.

4.11 Cleaning compounds.

4.11.1 Manufacturer's instructions. In the use of cleaning materials, because of their possible toxicity or flammability, appropriate precautions such as manufacturers' instructions shall be followed.

4.11.2 Degreasing. Degreasing and other cleaning operations involving chlorinated hydrocarbons shall be so located that no vapors from these operations will reach or be drawn into the atmosphere surrounding any welding operation. In addition, trichloroethylene and perchlorethylene should be kept out of atmospheres penetrated by the ultraviolet radiation of gas-shielded welding operations.

4.12 Cutting of stainless steels. Oxygen cutting, using either a chemical flux or iron powder or gas-shielded arc cutting of stainless steel, shall be done using mechanical ventilation adequate to remove the fumes generated.

4.13 First-aid equipment. First-aid equipment shall be available at all times. All injuries shall be reported as soon as possible for medical attention. First aid shall be rendered until medical attention can be provided.

5. Industrial applications.

5.1 Transmission pipeline.

5.1.1 General. The requirements of the "Protection of personnel" and the "Health protection and ventilation" sections of this SPI shall be observed.

5.1.2 Field shop operations. Where field shop operations are involved for fabrication of fittings, river crossings, road crossings, and pumping and compressor stations the requirements of the "Fire prevention and protection", "Protection of personnel" and the "Health protection and ventilation" sections of this SPI shall be observed.

5.1.3 Electric shock. When arc welding is performed in wet conditions, or under conditions of high humidity, special protection against electric shock shall be supplied.

5.1.4 Pressure testing. In pressure testing of pipelines, the workers and the public shall be protected against injury by the blowing out of closures

or other pressure restraining devices. Also, protection shall be provided against expulsion of loose dirt that may have become trapped in the pipe.

5.1.5 Construction standards. The welded construction of transmission pipelines shall be conducted in accordance with the Standard for Welding Pipe Lines and Related Facilities, API Std. 1104--1968.

5.1.6 Flammable substance lines. The connection, by welding, of branches to pipelines carrying flammable substances shall be performed in accordance with Welding or Hot Tapping on Equipment Containing Flammables, API Std. PSD No. 2201--1963.

5.1.7 X-ray inspection. The use of X-rays and radioactive isotopes for the inspection of welded pipeline joints shall be carried out in conformance with the American National Standard Safety Standard for Non-Medical X-ray and Sealed Gamma-Ray Sources, ANSI Z54.1--1963.

5.2 Mechanical piping systems

5.2.1 General. The requirements of the "Fire prevention and protection", "Protection of personnel" and the "Health protection and ventilation" sections of this SPI shall be observed.

5.2.2 X-ray inspection. The use of X-rays and radioactive isotopes for the inspection of welded piping joints shall be in conformance with the American National Standard Safety Standard for Non-Medical X-ray and Sealed Gamma-Ray Sources, ANSI Z54.1--1963.

6. Training.

6.1 Types of training. Supervisors will determine whether training required for specific jobs will be conducted in a classroom or on-the-job. The degree of training provided shall be determined by the complexity of the welding, brazing, or cutting requirements of the individual job and the associated hazards.

6.1.1 Initial Training. Prior to job assignment, this employer shall provide training to ensure that the hazards associated with welding, brazing, and cutting operations are understood by employees and that the knowledge and skills required for the safe application and usage of work place equipment are acquired by employees. The training shall include the following:

6.1.1.1 Each authorized employee shall receive training in the recognition of applicable hazards involved with particular job. The methods and means necessary for safe work.

6.1.1.2 Each affected employee shall be instructed in the purpose and use of the confined space entry procedure (where needed).

6.1.1.3 All other employees whose work operations are or may be in an area where welding, brazing, or cutting is to be performed, shall be instructed about the procedure, and about the prohibitions relating to working in that area.

6.1.2 Refresher Training. Scheduled refresher training will be conducted on the following basis:

6.1.2.1 Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in welding equipment, equipment or processes that present a new hazard, when their work takes them into hazardous areas, or when there is a change in the confined space entry procedures (when used).

6.1.2.2 Additional retraining shall also be conducted whenever a periodic inspection reveals, or whenever this employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge of known hazards, or use of equipment or procedures.

6.1.2.3 The retraining shall reestablish employee proficiency and introduce new equipment, or revised control methods and procedures, as necessary.

6.1.3 Certification. This employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain a synopsis of the training conducted, each employee's name, and dates of training.

7. Selection and use of work practices. Supervisors shall develop and ensure use of standardized safety-related work practices to prevent injuries resulting from hot-work accidents. The specific safety-related work practices shall be consistent with the nature and extent of the associated hot-work hazards.

8. Welding safety checklist.

8.1 General safety requirements.

- Has the employee had sufficient training to accomplish the job safely?

Action Taken: **YES (___) NO (___)**

_____

_____

- Has the employee been briefed on hazards unique to this particular job?

Action Taken: **YES (___) NO (___)**

_____

_____

- Has the employee read the manufacturer's instructions, cylinder labels, and MSDSs.?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is heat and impact resistant clothing being used?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is the proper clothing being worn to reduce skin burns.

Action Taken: **YES (___) NO (___)**

_____

_____

- Are leather aprons, leggings, and sleeves worn for very hot work?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are dry welders gloves used during arc welding?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are proper respirators used when welding cadmium, lead or other materials where toxic fumes could form?

Action Taken: **YES (___) NO (___)**

_____

- Have fire resistant shield been place over floors, walls, or other objects that could potentially catch fire?

Action Taken: **YES (___) NO (___)**

_____

_____

- Have all flammable items in the hot work area been removed or covered?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is consumption (eating, drinking, smoking) prohibited while hot work is in progress?

Action Taken: **YES (___) NO (___)**

_____

_____

- Have all ducts that could carry sparks been closed?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is adequate ventilation present in the hot work area?

Action Taken: **YES (___) NO (___)**

_____

_____

- Where welding is conducted near combustible material is a firewatcher routinely posted with operational fire extinguishers?

Action Taken: **YES (___) NO (___)**

_____

_____

8.2 Gas welders:

- Are cylinders regularly checked for leaks?

Action Taken: **YES (___) NO (___)**

_____

_____

- In storage, are cylinders stored upright and secured in a separate, dry, ventilated, fireproof room?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are cylinders always turned off after use?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are workers briefed to never roll or drop cylinders?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are workers briefed to never use oxygen to blow dust away?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is smoking forbidden during welding operations?

Action Taken: **YES (___) NO (___)**

_____

_____

- Do workers regularly review the MSDSs for the gases they are using?

Action Taken: **YES (___) NO (___)**

_____

_____

- Do workers know the proper lubricants to use on compressed oxygen cylinder connections?

Action Taken: **YES (___) NO (___)**

_____

_____

8.3 Arc welders:

- Are welders de-energized before touching electrical parts?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are objects to be welded on, separately grounded?

Action Taken: **YES (___) NO (___)**

_____

_____

- Do welders know the correct size cable, with intact insulation to use for a given operation?

Action Taken: **YES (___) NO (___)**

_____

_____

- Do welders know that jewelry should not be worn when welding?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is the work surface, floor, and object dry before starting to weld?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is it forbidden to weld in the rain?

Action Taken: **YES (___) NO (___)**

_____

_____

8.4 Confined spaces:

- Is the atmosphere tested before entering and while working?

Action Taken: **YES (___) NO (___)**

_____

_____

- Do gas cylinders remain outside at all times?

Action Taken: **YES (___) NO (___)**

_____

_____

- Is the space properly ventilated?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are written procedures available?

Action Taken: **YES (___) NO (___)**

_____

_____

- Has Personal Protective Equipment (PPE) be considered?

Action Taken: **YES (___) NO (___)**

_____

_____

- Are safety attendants properly equipped and is first aid equipment readily available?

Action Taken: **YES (___) NO (___)**

_____

_____

9. Definitions.

Welder and welding operator mean, any operator of electric or gas welding and cutting equipment.

Approved means, listed or approved by a nationally recognized testing laboratory. Refer to 29 CFR 1910.155 for definitions of listed and approved, and 29 CFR 1910.7 for nationally recognized testing laboratory.

All other welding terms are used in accordance with American Welding Society.