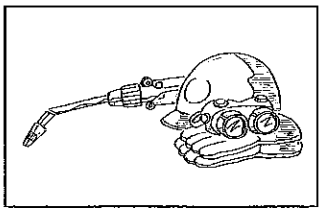


Welding/Cutting — An Overview

Overview Of Topic

There are four types of welding operations:

Welding type:	Description:
Oxygen-fuel gas	Joins metal parts by generating extremely high heat during combustion.
Resistance	Joins metals by generating heat through resistance created to the flow of electric current.
Arc	Joins or cuts metal parts by heat generated from an electric arc that extends between the welding electrode and the electrode placed on the equipment being welded. Includes gas-metal arc welding (also called metal inert gas welding) and flux-core arc welding (mistakenly called core wire welding).
Other	This includes welding/cutting heat sources like friction, lasers, and ultrasonics.

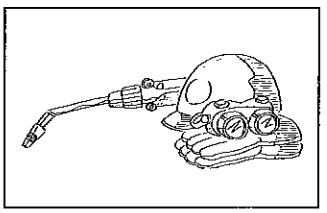
Welding, cutting, and brazing, by the nature of the processes and the materials often involved, pose unique threats to the health and safety of construction workers. Not only the welder, but passersby and nearby flammable materials and structures, are threatened by welding activities. You will find a list of these hazards in the employee handout.

Detailed information on the precautions that must be taken to prevent these hazards are found in 29 CFR 1926.350-.354. Requirements include, among others, safe handling, storage, and use of compressed gas cylinders; safe practices in using compressed gases and torches for gas welding and cutting; safe practices in using arc welding equipment; fire hazard assessment, equipment, and watchers; ventilation and respirator requirements; other PPE; attendants; competent person requirements; and emergency procedures.

Employee Training

An effective training program may include training in:

- Welding hazards at the worksite. Be sure to train the fire watcher the specific anticipated fire hazards and how the firefighting equipment provided is used.



Welding/Cutting — An Overview

- The types of welding used at the worksite.
- The safe operation and maintenance of welding/cutting/brazing equipment.
- Inspection procedures for hoses, torches, pipelines continuously employed as a ground return circuit, resistance of a ground circuit (other than by means of the structure), ground connections.
- Testing methods for hoses which are subject to flashback or show evidence of severe wear or damage, and for determining the flammability of preservative coatings on surfaces.
- Ventilation procedures.
- PPE for welding.
- Housekeeping measures.
- Safe work practices for welding within confined spaces.

Training Tips

As a trainer, you may want to:

- Present typical examples of what welders should look for during equipment inspections. Seeing potential problems is better than a description.
- Explain your company's hot work permitting system.
- Explain when a fire watcher is required.
- Tour the site to show trainees how compressed gases are stored.
- Explain the importance of handling cylinders properly. Bring up "rocketing" (when a compressed gas cylinder ruptures or is damaged, the cylinder can then act like a rocket and break through concrete walls or travel through open spaces). Tell them the danger signals to look for (i.e., leaking, corrosion, cracks).

Where To Go For More Information

29 CFR 1910.251 - .255

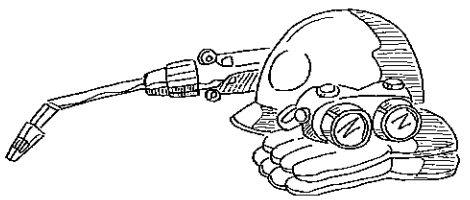
KELLER'S CONSTRUCTION TOOLBOX TALKS

Welding & Cutting Safety

Everyone involved in welding operations must take necessary precautions to prevent fires, explosions, or personal injuries. Even for small or routine jobs, you should always follow established safety procedures and resist the temptation to take shortcuts.

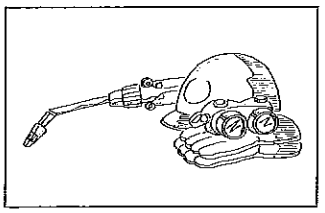
As with any job activity, you will have hazards involved. Some common welding dangers you should be aware of include fumes, gases, radiation, electric shock, fire and explosion, lead poisoning, metal splatter and sparks, noise, and slips, trips and falls. While these are a lot of hazards, OSHA allows a lot of ways to control or eliminate them in order to protect you:

- *Ventilation*—Exhaust hoods at the arc, fans, and open spaces all help to reduce the concentration of hazardous fumes, gases, and dusts, and prevent the accumulation of flammable gases, vapors, and dusts that could cause fire. Know the symptoms of fumes and gases and get out of the area if they develop. Perform atmospheric tests.



- *Respirators*—When ventilation and plume avoidance don't give enough protection or when welding creates an oxygen-deficient area, wear a respirator.
- *Personal protective equipment (PPE)*—This includes flame-resistant aprons; leggings and high boots; ankle-length safety shoes worn under your pant legs; shoulder cape and skull cap; ear plugs or ear muffs; insulated gloves; safety helmets; goggles; helmets; and shields. Use ANSI-approved filter lenses and plates. Protect those nearby by putting up shields.

- *Electrical precautions*—Do not arc weld while standing on damp surfaces or in damp clothing. Properly ground, install, and operate equipment. Do not use defective equipment. Use well-insulated electrode holders and cables. Insulate yourself from both the work and the metal electrode and holder. Don't wrap a welding cable around your body. Wear dry gloves and rubber-soled shoes. Do not use damaged or bare cables and connectors.
- *Fire protection*—Wear flame-resistant clothing. Have someone be your fire watcher when you weld. Move all combustible material at least 35 feet from the work area and try to move away from combustible materials, or cover them with fire resistant material. Don't weld in atmospheres containing dangerously reactive or flammable gases, vapors, liquids, or dust. Clean and purge containers which may have held combustible material before applying heat. Get a hot work permit and follow its safety precautions.
- *Confined space precautions*—Assess limited work spaces and slipping hazards, and evaluate hazardous atmospheres and interior surfaces for flammability, combustibility, or toxic fumes that could result from welding processes.
- *Clothing*—Wear wool, leather, or cotton treated clothing to reduce flammability for gas shielded arc welding. Long sleeves and pants without cuffs/front pockets are recommended to avoid catching sparks.
- **Don't get too close to the fume or plume or weld on lead-painted surfaces.**



Welding/Cutting — An Overview Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Welding/Cutting — An Overview at _____.
(company name)

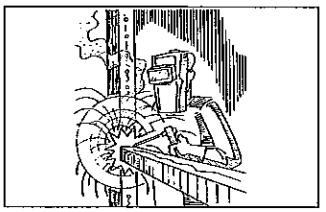
The session covered:

- Welding hazards at the worksite.
- The types of welding used at the worksite.
- PPE for welding including respiratory protection.
- Safe work practices for welding within confined spaces.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**



Welding & Cutting—Arc Welding

Overview Of Topic

Arc welding is the process that joins (or cuts) metal parts by using heat generated from an electric arc. This arc extends between the welding electrode and the electrode placed on the equipment being welded.

It includes gas-metal arc welding (also called metal inert gas welding) and flux-core arc welding (mistakenly called cored wire welding). This type of welding is regulated by OSHA under 29 CFR 1926.351.

Employee Training

According to the standard, OSHA requires your company to instruct employees in the safe means of arc welding and cutting as follows:

- When electrode holders are left unattended, remove the electrodes and place or protect the holders so that they cannot make electrical contact with employees or conducting objects.
- Do not dip hot electrode holders in water; to do so may expose the arc welder or cutter to electric shock.
- When the arc welder or cutter has occasion to leave his/her work or stop work for any appreciable length of time, or when the arc welding or cutting machine is to be moved, open the power supply switch to the equipment.
- Report any faulty or defective equipment to the supervisor.
- Provide a disconnecting means in the supply circuit for each motor-generator arc welder, and for each AC transformer and DC rectifier arc welder which is not equipped with a disconnect mounted as an integral part of the welder.

OSHA state-plan-states: Remember that certain states have more stringent regulations that go above and beyond the OSHA standards.

Training Tips

While covering the rules above, you may want to go over:

- Hazards associated with arc welding (i.e., radiation, fumes and gases, spatter and sparks, fire, electric shock, and noise).

- What defective equipment can look like and who to report to about defects.
- Examples of equipment and PPE used specifically for arc welding at your site.

Where To Go For More Information

29 CFR 1926.350—.354, Subject J–Welding and Cutting.

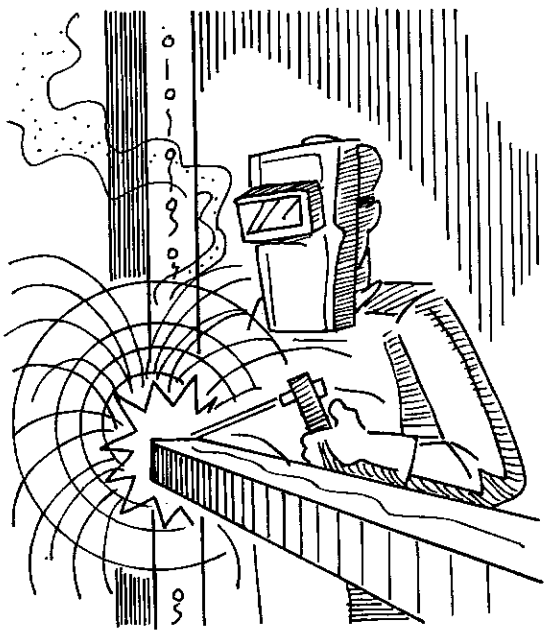
KELLER'S CONSTRUCTION TOOLBOX TALKS

Welding & Cutting—Arc Welding

Gas fumes, radiation, and electric shock are very real hazards that you face on the job as an arc welder. Think about it—a welding arc is hot enough to melt steel, and the light it emits is literally blinding. It generates toxic fumes that are composed of microscopic particles of molten metal. Sparks and molten slag thrown by the arc can fly up to 35 feet and can cause fires and explosions.

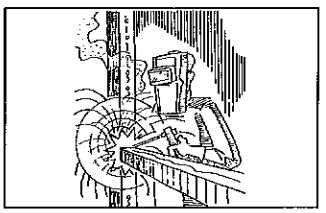
With all these hazards, are you doomed to be injured if you are an arc welder? No, the job can be safe if you take proper precautions and follow safe work practices.

A number of arc welding precautions have been developed by OSHA to protect you from hazards. When you weld, you must:



- Wear personal protective equipment including respirators and eye protection as required.
- Use ventilation as a method to reduce concentrations of hazardous fumes, gases, and dusts which may cause health and fire concerns.
- Have a fire watcher when you weld.
- Know electrical precautions for welding. Insulate yourself from both the work and the metal electrode holder. Don't work while standing on damp surfaces. Check for and report defective equipment.
- Know confined space welding precautions. Confined spaces include manholes, tunnels, trenches, and pits. Monitor for hazardous atmospheres and check interior surfaces for toxic materials.
- Be aware of and protect co-workers beneath you who may be injured by falling sparks and slag.
- Use shielding to protect passersby from looking at the arc radiation and from being injured by flying slag.
- Cover all parts of your body to protect against ultraviolet and infrared ray flash burn. Dark clothing works best to reduce reflection under the face shield. Woolen clothing is preferred for arc welders, as it resists deterioration better than cotton. Wear flame-retardant clothing.

Talk to your supervisor if you have questions regarding safe welding practices.



Welding & Cutting—Arc Welding Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Welding & Cutting — Arc Welding at _____.
(company name)

The session covered:

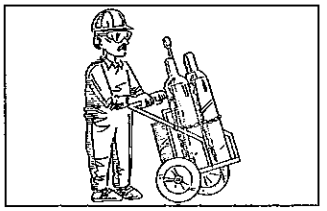
- The hazards of arc welding.
- The PPE required.
- Protecting yourself, and your coworkers, from fire and sparks.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: _____ **Job Location:** _____

Employee Signature	Print Name Here

_____
Supervisor's Signature



Welding & Cutting—Compressed Gas Cylinder

Overview Of Topic

Many welding and cutting operations require the use of compressed gas cylinders. Generally, compressed gas cylinders are perfectly safe. However, if they are not handled, stored, and used properly, compressed gas cylinders can be deadly.

Under 29 CFR 1926.350(a), OSHA incorporated Compressed Gas Association (CGA) Pamphlet P-1-1965 by reference. This consensus standard requires that workers who handle compressed gas cylinders be trained. Compressed gases pose unique workplace hazards because:

- They are stored under pressure, and
- They pose hazards associated with the gases themselves. For example acetylene is a flammable gas and oxygen can accelerate a fire.

Employee Training

An effective training program may include training in:

- The hazards of working with compressed gases. Instruct workers on the hazards of working with pressurized cylinders and flammable gases.
- Identifying cylinder contents by label and not by cylinder color. All cylinders must have a label or they are not to be used.
- Proper cylinder storage procedures.
- Safe working practices for handling, moving, and hoisting cylinders.
- Visual inspection procedures for cylinders, regulators, valves, hoselines, etc.
- Safe working practices when attaching regulators and hoselines and turning gas on.

Training Tips

As a trainer, you may want to:

- Tour the facility to show trainees how compressed gases are stored.
- Identify the gases used at your site and discuss specific hazards associated with each.
- Show typical examples of damaged or worn regulators and hoselines found when performing a visual inspection. Seeing potential problems is better than describing them.
- Demonstrate how to move and secure a cylinder.
- Explain the importance of handling cylinders with the safety cap in place. Bring up "rocketing" hazards, such as when a valve is broken off a cylinder or when a cylinder ruptures.
- Show the different types of threaded connections and demonstrate proper connection technique, such as warning them to use the right connections for the job and not to force connections.
- Demonstrate how to "crack" the valve on a cylinder to blow out the outlet connection.
- Explain housekeeping measures.
- Show trainees where emergency telephone numbers are posted for the gas supplier, fire department, and emergency medical assistance.

Where To Go For More Information

29 CFR 1926.350—Gas welding and cutting.

CGA Pamphlet P-1-1965—Safe Handling of Compressed Gases.

Material safety data sheets (MSDSs) for gases being used, as provided by the gas supplier.

KELLER'S CONSTRUCTION TOOLBOX TALKS

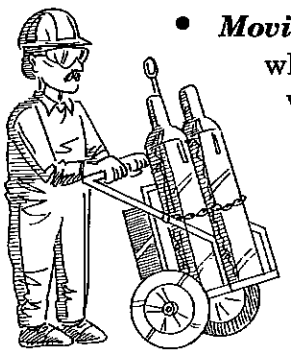
Welding & Cutting—Compressed Gas Cylinder

At some point, everyone involved in gas welding and cutting will have an occasion to work with compressed gas cylinders. When properly handled, compressed gas cylinders are perfectly safe. By learning a few guidelines for working with, storing, handling, and using compressed gas cylinders, you can keep yourself and your co-workers safe.

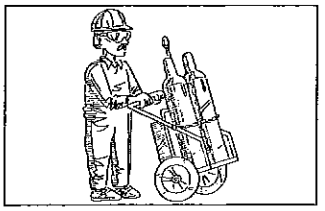
The gases in the cylinder are stored under pressure and are often flammable. Acetylene, for example, is highly flammable. Even the inert gases, such as the shielding gas used for wire feed welding, can cause asphyxiation if used in enclosed spaces. Also, pure oxygen can become explosive if it comes into contact with grease, oil, and other organic materials.

Take a look at these cylinder safety precautions:

- ***Labels:*** All cylinders must have a label listing contents and hazards. Always use the label to identify the gas—don't rely on cylinder color. If a cylinder does not have a label, don't use it. Report it to your supervisor.
- ***Storage:*** Compressed gas cylinders should always be stored in an upright position with valves fully closed and the safety caps on. Secure cylinders to a solid structure or rigid support using a substantial chain, rope, or strap.



- ***Moving cylinders:*** Cylinders are heavy and bulky, so care should be used when moving one. Whenever a cylinder is moved, unless it is in use on a welder or cart, the valve must be completely closed and the safety cap must be in place. Tip the cylinder and roll it on its bottom edge. Always keep the cylinder as upright as possible. When transporting with a cart, secure the cylinder to the cart.
- ***Hoisting Cylinders:*** Whenever cylinders are hoisted, they must be secured on a cradle, slingboard, or pallet. Cylinders should never be hoisted or transported by magnets or choker slings.
- ***Visual inspection of cylinders:*** The gas supplier periodically examines and x-rays cylinders to certify their suitability for use. Users should still visually inspect cylinders as well. Before changing or transporting a cylinder, do a visual inspection to ensure that the label is in place and that the cylinder is not damaged. Examine the valve assembly, and inspect the threaded outlet connector for signs of thread damage or the presence of dirt, grease, or oil. Any damaged cylinders should be returned to the supplier.
- ***Inspecting accessories:*** Perform a visual inspection of all regulators, gauges, and hoselines which will be used with the cylinder. Any damaged accessories should be removed from service.
- ***Cylinders in use:*** Cylinders are to be kept far enough away from the actual welding or cutting activity so that sparks, hot slag, or flame do not reach them. If the cylinders cannot be moved far enough away, they should be protected by a fire-resistant shield.



Welding & Cutting—Compressed Gas Cylinder

This sign-off sheet documents the employees at this company, _____, who have taken part in a training session on Welding & Cutting—Compressed Gas Cylinder. The session covered:

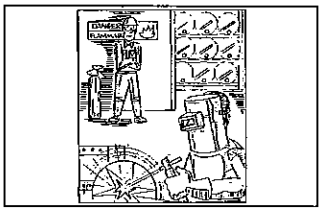
- Hazards of working with compressed gas and gas cylinders.
- Identification of compressed gas cylinder contents.
- Safe work practices for storing, moving, handling, and hoisting cylinders.
- Visual inspection procedures for cylinders and accessories.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	Print Name Here

Supervisor's Signature



Welding & Cutting—Fire Prevention

Overview Of Topic

Welding and metal cutting operations produce molten metal, sparks, weld spatter, slag, and hot work surfaces. All of these can create a situation which can cause fires.

§1926.352 is concerned with fire hazards in situations where:

- Other than a minor fire might develop.
- Combustible material is located within 35 feet of the work.
- Combustible material is located more than 35 feet away but can be easily ignited by sparks.
- Wall or floor openings within 35 feet expose combustible material in adjacent areas or concealed wall or floor spaces.
- Combustible materials are located on the opposite side of surfaces being welded.

It is management's responsibility to perform the site inspection or designate a competent person to inspect for fire hazards prior to the work being performed. Here is how to handle fire hazards:

When the object to be welded, cut, or heated	And	Then
Can be moved	A safe, fire-resistant workplace is available	The object should be moved to that space for working
Cannot be readily moved	All fire hazards are moved at least 35 feet (10 meters) away or are protected	The object can be worked on in place
Cannot be moved	All fire hazards cannot be removed	Steps must be taken to confine the heat, sparks, and slag to protect the immobile fire hazards
Cannot be moved	Normal fire prevention precautions are not sufficient	Additional personnel shall be assigned to guard against fire during the work and for a sufficient amount of time afterward

Welding, cutting, or heating work may not be done where the application of flammable paints, the presence of other flammable compounds, or heavy dust accumulation creates a hazard.

Additional personnel may need to be assigned as fire watchers who:

- Provide additional safeguards against fire during and after the welding, cutting, or heating operations.
- Must be trained on the specific fire hazards for that job and location.
- Know where fire prevention equipment is located and how to use it. Fire prevention equipment must be on hand, and readily available for use.

Employee Training

Fire prevention training might include:

- How to obtain a permit for welding and cutting and who has authority to provide it.
- Inspecting welding and cutting equipment to ensure it is in good repair.
- Checking for fire hazards prior to welding or cutting.
- When it is permissible to weld and cut and when it is not.
- Location of fire extinguishing equipment, how to use it, and how to report fires.
- When a fire watcher is necessary and the responsibilities of the fire watcher.

Training Tips

Show trainees how far 35 feet really is, examples of combustibles and flammables trainees will need to remove from a welding area or cover, and an example of a completed hot work permit. Explain when a fire watcher is required.

Where To Go For More Information

29 CFR 1926.352—Fire prevention.

National Fire Protection Association (NFPA) 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes.*

KELLER'S CONSTRUCTION TOOLBOX TALKS

Welding and Cutting—Fire Prevention

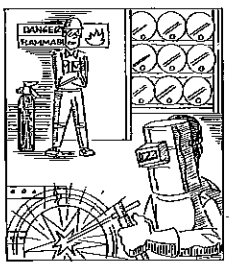
Fire prevention during welding, cutting, or heating operations is important. Many parts of a building are flammable, as are many of the things typically found at or around a jobsite. Paint, insulation, wood and wood chips, paper, plastic, flammable liquids, as well as dried grass, leaves, and brush can ignite if precautions are not taken.

Welding, cutting, or heating are only permitted in a designated safe area, or after all fire hazards have been removed or protected:

When the object to be welded, cut, or heated	And	Then
Can be moved	A safe, fire-resistant workplace is available	The object should be moved to that space for working
Cannot be readily moved	All fire hazards are moved at least 35 feet (10 meters) away or are protected	The object can be worked on in place
Cannot be moved	All fire hazards cannot be removed	Steps must be taken to confine the heat, sparks, and slag to protect the immobile fire hazards
Cannot be moved	Normal fire prevention precautions are not sufficient	Additional personnel shall be assigned to guard against fire during the work and for a sufficient amount of time afterward

Other precautions include:

- Protecting flammable walls, floors, and ceilings, and the spaces in between, with fire-resistant covers.

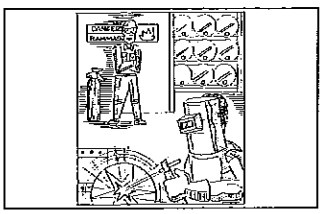


- Keeping combustible floors, other than wood or concrete, wet, covered with damp sand, or protected by fire-resistant shields. If floors are wet, protect workers from possible shock.
- Not welding, cutting, or heating a container that has held combustible materials or an unknown substance.
- Venting closed containers before welding, cutting or heating to avoid explosions due to pressure build up.
- Not welding, cutting, or heating a surface coated by an unknown substance or whose coating can produce flammable, toxic, or reactive vapors.
- Knowing where fire extinguishing equipment is and how to use it.

A fire watcher is required whenever welding, cutting, or heating is done in an area where other than a minor fire could develop, combustibles are within 35 feet, or combustibles are greater than 35 feet away but are easily combustible.

Fire watchers must know the specific fire hazards for that job and location and know where fire prevention equipment is located. They also must thoroughly look for fire following the work. Visible smoke or flames might not be apparent for some time after a fire has started.

If work is being performed on walls, floors, and ceilings where sparks and spatter may enter adjacent areas or areas between floors, walls, or ceilings, then a fire watcher must be stationed on each side of the location where the work is being performed.



Welding & Cutting—Fire Prevention

This sign-off sheet documents the employees at this company, _____, who have taken part in a training session on Welding & Cutting—Fire Prevention. The session covered:

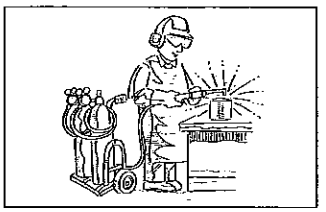
- How to obtain a hot work permit and who can issue that permit.
- Inspecting welding and cutting equipment.
- Checking for fire hazards prior to performing hot work.
- Location of fire extinguishing equipment and how it is used.
- Fire reporting procedures for the worksite.
- When a fire watcher is necessary, and the responsibilities of the fire watcher.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

Supervisor's Signature



Welding & Cutting—Gas Welding

Overview of Topic

Numerous health hazards are associated with exposure to fumes, gases, and ionizing radiation formed or released when welding, cutting, or brazing. The hazards include heavy metal poisoning, lung cancer, metal fume fever, and flash burns. The risks vary, depending on the welding materials used, and surfaces welded.

The following rules are a sampling of gas welding requirements. They are not complete, but do highlight areas of concern for OSHA.

Transportation and storage of compressed gas cylinders

Compressed gas cylinders must be secured in an upright position at all times, if necessary, for short periods of time while cylinders are actually being hoisted or carried.

Placing and treatment of cylinders

Cylinders must be kept far enough away from a welding or cutting project so that sparks, hot slag, or flames do not reach them. When this is impractical, fire shields must be used.

Use of fuel gas

Before a regulator to cylinder valve is connected, the valve must be cracked (opened slightly and closed immediately). This clears the valve of dust or dirt that could enter the regulator.

For gas leakage from a fuel gas cylinder valve, valve stem, fuse plug, or other safety device see 29 CFR 1926.350(d)(5)–(6).

Equipment

Fuel gas and oxygen manifolds—Fuel gas and oxygen manifolds must bear the name of the substance they contain in letters at least one-inch high. The letters must be either painted on the manifold or on a sign permanently attached to it.

Hose connections must be kept free of grease and oil and when not in use, they must be capped.

Hose—Fuel gas and oxygen hose must be easily distinguishable from each other. The contrast may be made by different colors or by surface characteristics readily distinguishable by touch.

Oxygen and fuel gas hoses are not interchangeable. A single hose having more than one gas passage must not be used.

All hoses carrying acetylene, oxygen, natural/manufactured gas, or any ignitable or combustible gas or substance, must be inspected at the beginning of each work shift. Defective hose must be removed from service.

Torches—Clean clogged torch tip holes with suitable cleaning wires, drills, or other devices designed for such purpose.

Inspect torches at the beginning of each working shift for leaks. Defective torches must not be used.

Never light torches with matches or from hot work.

Regulators and gauges—Verify that oxygen and fuel gas pressure regulators, including related gauges, are in good working order.

Oil and grease hazards

Keep oxygen cylinders and fittings away from oil or grease. Keep cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus free from oil or greasy substances. Do not handle with oily hands or gloves.

Employee Training

You must thoroughly instruct your employees in the safe use of fuel gas according to 1926.350(d)(1)–(6).

From ANSI Standard Z49.1-1967, Fire Watch Duties—Fire watchers must be trained in the use of fire extinguishing equipment. They must know where alarms are in the event of a fire.

Training Tips

If you have welders and welders helpers (fire monitors, etc.) extended classroom and hands-on training is required to meet OSHA requirements. This toolbox talk is intended as an overview of welding safety rules.

Where To Go For More Information

29 CFR 1926.350, .352–.354.

For additional details not covered in 29 CFR 1926, Subpart J, applicable technical portions of American National Standards Institute (ANSI), Z49.1-1967, *Safety in Welding and Cutting*, applies.

KELLER'S CONSTRUCTION TOOLBOX TALKS

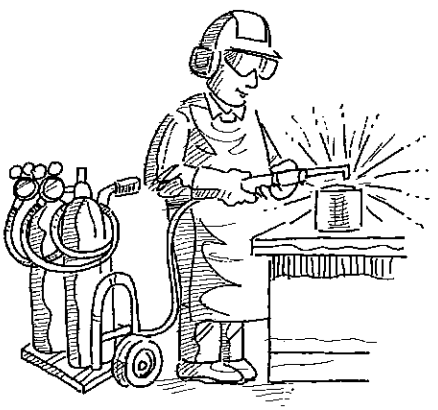
Welding & Cutting—Gas Welding

Numerous health hazards are associated with exposure to fumes, gases, and ionizing radiation formed or released when welding, cutting, or brazing. The hazards include heavy metal poisoning, lung cancer, metal fume fever, and flash burns. The risks vary, depending on the welding materials used, and surfaces being welded.

The following rules are a sampling of gas welding requirements. They are not complete, but do highlight areas of concern for OSHA.

Transportation and storage of compressed gas cylinders—Compressed gas cylinders must be secured in an upright position at all times, if necessary, for short periods of time while cylinders are actually being hoisted or carried.

Placing and treatment of cylinders—Cylinders must be kept far enough away from a welding or cuttiroject so that sparks, hot slag, or flames do not reach them. When this is impractical, fire shields must be used.



Use of fuel gas—Before a regulator to cylinder valve is connected, the valve must be cracked (opened slightly and closed immediately). This clears the valve of dust or dirt that could enter the regulator.

Equipment

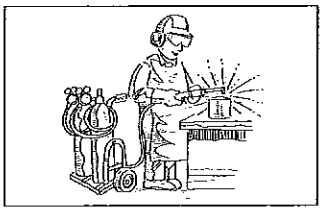
Fuel gas and oxygen manifolds—(1) Fuel gas and oxygen manifolds must bear the name of the substance they contain in letters at least one-inch high. The letters must be either painted on the manifold or on a sign permanently attached to it. (2) Hose connections must be kept free of grease and oil and when not in use, hose connections must be capped.

Hose—(1) Fuel gas and oxygen hose must be easily distinguishable from each other. The contrast may be made by different colors or by surface characteristics noticeable by touch. (2) All hoses carrying acetylene, oxygen, natural/manufactured gas, or any ignitable or combustible gas or substance, must be inspected at the beginning of each work shift. Defective hose must be removed from service.

Torches—(1) Clean clogged torch tip holes with suitable cleaning wires, drills, or other devices designed for such purpose. (2) Inspect torches at the beginning of each working shift for leaks. Defective torches must not be used. (3) Never light torches by matches or from hot work.

Regulators and gages—Verify that oxygen and fuel gas pressure regulators, including related gages, are in good working order.

Oil and grease hazards—Keep oxygen cylinders and fittings away from oil or grease. Keep cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus free from oil or greasy substances. Do not handle with oily hands or gloves.



Welding & Cutting—Gas Welding, Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Welding & Cutting—Gas Welding at _____.

The session covered:

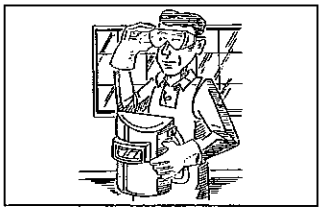
- Transportation and storage of compressed gas cylinders.
- Use of fuel gas.
- Equipment.
- Oil and grease hazards.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	Print Name Here

_____
Supervisor's Signature



Welding & Cutting—Personal Protective Equipment

Overview Of Topic

Welding, oxyacetylene cutting, and brazing or soldering, by the nature of the processes and the material involved, pose unique threats to the health and safety of workers. The risk is not restricted to the worker(s) performing the job; the health of those workers in the immediate area and passersby can also be affected.

Detailed information on the precautions that must be taken to protect workers from welding and cutting hazards are found in 29 CFR 1926.350-.354. Required personal protective equipment is listed in Employee Training below.

Employee Training

Train employees in:

- The hazards of welding fumes and the signs of welding fume sickness, and the choice of appropriate respirator for the job being done.
- The appropriate clothing for welding and cutting operations to protect the worker from burns caused by flying sparks and from burning clothes.
- The use of leather or burn-resistant sleeves, capes, aprons, caps, and covers.
- Proper use of welding helmets, goggles, and shields and how to select the appropriate lens shade for the job.
- Protection from flash burn and ultraviolet and infrared light to prevent injury to eyes or burns to exposed skin.
- Proper footwear and lower leg protection.
- Appropriate hearing and ear protection.
- Use of hard hats and head protection, as required.

Effective PPE training might cover when and what PPE is necessary, how to properly don, doff, adjust, and wear PPE, the limitations of PPE, and the proper care, maintenance, useful life, and disposal of PPE.

Training Tips

As a trainer you may want to:

- Dress in the recommended clothing and personal protective gear, and explain what each piece does to protect the wearer.
- Disassemble a welding mask and show how to clean or change covers and shade lenses.
- Demonstrate how to fit a respirator and explain what to look for in a welding fume respirator.
- Point out that the use of contact lenses has been shown to be safe while welding and suggest that anyone wearing contacts should have a spare pair or a pair of prescription glasses as a backup.
- Explain your worksite policy for use of welding screens or curtains, and how to mark "hot work."
- Tell employees how to take advantage of any safety shoe partnership programs your employer offers.

Where To Go For More Information

29 CFR 1926.350—Gas welding and cutting.

29 CFR 1926.95-.107—Personal protective and life saving equipment.

Compressed Gas Association (CGA) Pamphlet P-1-1965, *Safe Handling of Compressed Gases in Containers.*

Material Safety Data Sheets for welding gases and welding wire, as supplied by the vendor.

Keller's Construction Toolbox Talks, Personal Protective Equipment tab.

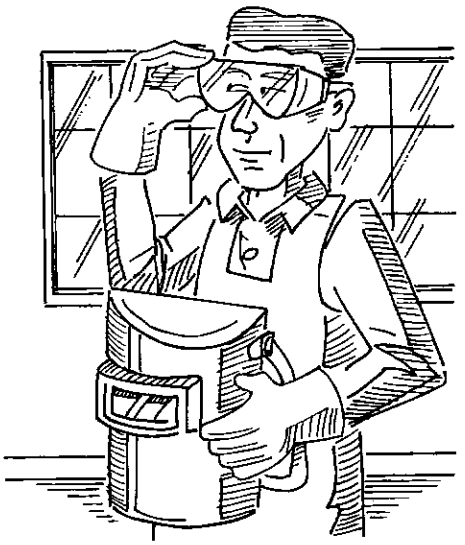
KELLER'S CONSTRUCTION TOOLBOX TALKS

Welding & Cutting—Personal Protective Equipment

There are a variety of hazards associated with welding and cutting. However, personal protective equipment can help protect you on the jobsite. To help prevent injuries from welding and cutting:

- ***Use appropriate respirator***—If necessary, use a respirator designed to protect you from welding fumes and gases. Check with your supervisor or the supplier of your safety equipment for protection information. If welding in a confined space, use the appropriate air-supplied respirator.

- ***Wear the proper clothing***—Wear long-sleeved shirts and pants with no cuffs. Do not wear light colors that can reflect the light from welding. Button the top button of shirts and sleeves. Do not tuck your shirt into your pants. Wool or treated cotton resist burns best. Do not wear clothes with tears, holes, or frays, as these can trap sparks or slag and present a fire hazard.



- ***Understand how to care for welding helmets, shields, and/or goggles***—Welding helmets, welding shields, and goggles protect the eyes from damage caused by looking at a welding arc or cutting torch. Keep lens covers and filter lenses clean. Do not use cracked filter lenses, and select a filter lens appropriate for the type of welding being performed. A flash burn feels like sand in the eyes, and may not be felt until as much as eight hours after exposure. Repeated exposures can permanently damage vision. In areas where other workers are present, use flash shields or welding curtains to help protect them. In addition to protective filter lenses, safety goggles or glasses prevent sparks from getting into your eyes.

- ***Use burn-resistant covers***—Leather or fire-resistant sleeves, capes, aprons, and caps are available to prevent burns and protect clothes. Chaps and leggings are also available.

- ***Wear appropriate footgear***—In addition to being steel-toed, welding shoes should be high-topped and pants should be worn over them to keep sparks and spatter out.

- ***Use hearing and ear protection***—Ear plugs will keep sparks out of the ears. If noise is an issue, wear the appropriate hearing protection.

- ***Use head protection***—You are still required to wear the appropriate head protection as required by the jobsite, to protect against sharp or falling objects.

Welding & Cutting—Personal Protective Equipment

This sign-off sheet documents the employees at this company, _____, who have taken part in a training session on Welding & Cutting—Personal Protective Equipment. The session covered:

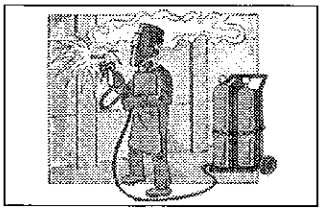
- Protection from welding fumes, the signs of welding fume sickness, and appropriate respirators for the job.
- Selection of appropriate clothing and the use of fire-resistant sleeves, capes, aprons, caps, and covers to prevent fires and burns.
- Proper use of welding helmets or shields, and how to prevent flash burns.
- Proper use of protective footwear, hearing protection, and hard hats.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

Supervisor's Signature



Welding & Cutting—Ventilation

Overview of Topic

Welders can be exposed to a number of fumes, gases, and dusts. These contaminants can harm the health of your workers and/or accumulate to the point of causing a fire. Fortunately, ventilation can help to reduce the concentration of these contaminants. Welding ventilation techniques vary. Often, however, a relatively simple ventilation method like the appropriate use of fans will be all that is required to provide good ventilation during welding operations. OSHA's 29 CFR 1926.353 specifies that if mechanical ventilation is used, it must consist of either of these:

Ventilation method:	Requirements:	Used for welding/cutting/heating involving:
General mechanical ventilation system	Requires sufficient capacity and so arranged as to produce the number of air changes necessary to maintain welding fumes and smoke within safe limits defined in §1926.55.	1. Enclosed spaces and: • Zinc-bearing base or filler metals or metals coated with zinc-bearing materials. • Lead base metals. • Cadmium-bearing filler materials. • Chromium-bearing metals or metals coated with chromium-bearing materials. 2. Confined spaces, unless metals listed in number 2 of local exhaust systems below are involved.
Local exhaust system	Requires a freely movable hood intended to be placed by the welder or burner as close as practical to the work. It must be of sufficient capacity and so arranged as to remove fumes and smoke at the source and keep the concentration of them in the breathing zone within safe limits defined by §1926.55.	1. Enclosed spaces in number 1 above. 2. Enclosed spaces and: • Metals containing lead, other than as an impurity, or metals coated with lead-bearing materials. • Metals coated with mercury-bearing metals. • Cadmium-bearing or cadmium-coated base metals. • Beryllium-containing base or filler metals. Both local exhaust ventilation and an air line respirator are required. 3. Inert-gas metal-arc welding on stainless steel. 4. Confined spaces.

Contaminated air exhausted from the working space must be discharged into open air or otherwise clear of the source of intake air. All air replacing the withdrawn air must be clean and respirable.

Oxygen must not be used for ventilation purposes, comfort cooling, blowing dust from clothing, or for cleaning the work area.

In addition to ventilation, specific respirators are required by the rule for confined space, enclosed space, and open air welding, cutting, or heating work. Also, means (i.e., lifeline) of quickly removing confined space welders, cutters, or heaters are required in case of an emergency. Be sure to protect employees exposed to the same atmosphere as the welders or burners in the same manner as the welder or burner.

Employee Training

You must provide hazard communication training for the materials which produce air emissions and fumes, and areas of such exposure. According to §1926.21 (see the Hazard Recognition, Avoidance, Control, and Prevention chapter), training is also required for those employees who enter into confined or enclosed spaces. They must be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required.

In §1926.353, there are requirements which lend themselves to training. You should train welders so that they can:

- Use and maintain any required air line respirators, filter-type respirators, filter lens goggles and other eye protection, welding helmets, and hand shields.
- Be an attendant for a confined space and maintain communication, know and implement the pre-planned rescue procedure, and use rescue equipment.
- Properly use the appropriate ventilation system for the job.

Training Tips

As a safety trainer, present examples of personal protective equipment (PPE) used at the site.

Where To Go For More Information

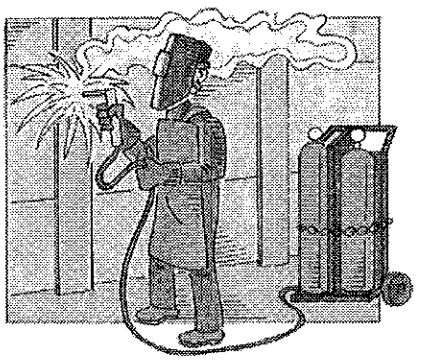
Construction regulatory text: 29 CFR 1926.353—Ventilation and protection in welding, cutting, and heating.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Welding & Cutting—Ventilation

Welding, also known as "hot work", is done frequently in construction. According to OSHA, whenever and wherever hot work is occurring, everyone involved in the operation must be aware of welding fumes and gases and take necessary, especially ventilation, precautions. Even in metal cutting jobs that are considered routine, you should always follow established safety procedures.

Fumes may be released during welding and cutting operations. The type of fume produced depends on the metal, metal preservatives, the electrode, or the filler rod used. Here are some of the common welding fumes that can have negative health effects:



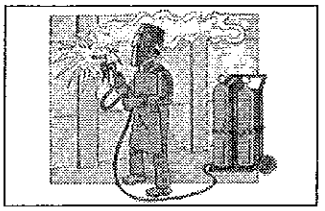
- Barium
- Beryllium
- Cadmium
- Chromium
- Copper
- Fluoride
- Iron
- Lead
- Magnesium
- Manganese
- Zinc

Gases are also released during welding operations. These gases can form in many ways. Carbon monoxide, for example, can form if you use carbon dioxide shielding gas in gas metal arc welding. Nitrogen dioxide, ozone, and phosgene are other gases that can be released. Fortunately, you can protect yourself from welding fumes and gases with ventilation methods and respiratory protection:

- *Ventilation*—Ventilation can be a mechanical or local exhaust system. Mechanical ventilation changes the air. Local exhaust systems, like hoods at the arc and fans, remove fumes and smoke at the source. Both ventilation methods help to reduce the concentration of hazardous fumes and gases. Ventilation also prevents the accumulation of flammable gases, vapors, and dusts that could cause fire. Open spaces, too, can help reduce accumulations.
- *Respirators*—When ventilation doesn't give enough protection or when welding creates an oxygen-deficient area, wear a respirator. There are two major types used in welding: air line, and filter-type respirators. Make sure you are trained in how to use your respirator. Also, get fit tested.

As you work, don't get too close to the fume or gas plume. Know the symptoms of overexposure to fumes and gases and get out of the area if they develop. Perform atmospheric tests.

Confined spaces can pose additional fume and gas hazards. That's because welding fumes and gases can displace oxygen or fill a confined space. Flammable or combustible fumes and gases can accumulate and cause fire, explosion, and asphyxiation. For these reasons, evaluate the atmospheres of the confined space for hazards and use ventilation and respirators properly.



Welding & Cutting—Ventilation, Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Welding & Cutting—Ventilation at _____.
(company name)

The session covered:

- Hazardous fumes and gases to be aware of when welding.
- Types of ventilation systems available for welding jobs which call for ventilation.
- Need for special procedures in confined space or enclosed space entry.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

_____
Supervisor's Signature