

Welding & Material

Joining

Safety and Regulations

Manual

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Introduction

In this manual you'll be able to find all the safety procedures, regulations, and precautions in the Welding and Material Joining lab. All the information in here will be used in either Welding or Material Joining, or possibly in both. The information in this manual is to help to keep you safe and inform you on the equipment and materials you will be working with. Before working with a new piece of equipment or chemical read this so you will know how to use it safely and so you will know what to do in case of an accident.

General Safety

There are many things that you must know and be taught about safety. You should always wear protective clothing and eye wear. Guests and visitors should only stay in unrestricted areas unless given permission; also make sure they wear safety glasses and specific clothing after passing a certain point in the shop. These include many things such as,

CLOTHING

- Button sleeves at wrists and at collar
- High cut steel toe boots
- Fire resistant gloves
- Cotton clothing
- No frays and or holes in clothing
- Long sleeves and full length legged pants
- No baggy clothes
- Shirts tucked in

EYE WEAR

- Goggles
- Helmets
- Cutting shields
- ANSI Z87 approved safety glasses
- Hand shields

School and student safety is a shared responsibility.

School

- Safety glass
- Shirts
- Gloves\ could buy own if wanted
- Wash stations
- Certified instructor
- First aid
- Chemical waste station
- Must meet OSHA safety regulations
- Proper storage of chemicals
- Dispose of waste properly

Student

- Follow safety regulations
- Bring own welding helmet
- Steel toe boots
- No loose clothing, long hair needs to be pulled up
- Don't wear ripped clothing
- Wear safety glasses at all times when in lab
- Know what the machine can do
- Treat the machine like a deadly weapon

Fire Procedure

- 1: Remove anyone from immediate danger.
 - 2: Activate the building fire alarm system and call 911.
 - 3: Confine the fire by closing all windows and door.
 - 4: Evacuate, leave the building
- Extinguish the fire, if it can be done safely.

FIRE SAFETY

If on fire stop drop and roll or use fire blanket.

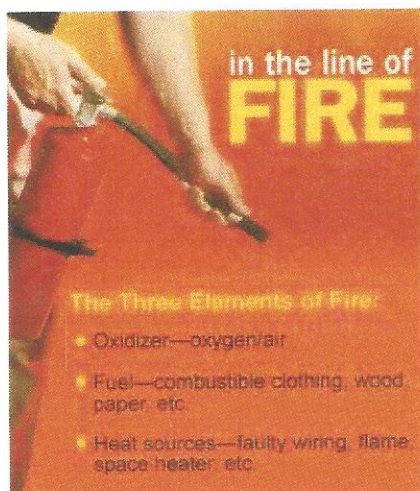
Before using torches or welders make sure all flammable things are out of the way.

Make sure there are no flammable gas leaks around you.

If torch catches fire turn off gas first then oxygen.

In case of fire use one of the fire extinguishers which are by the drench tank and on the wall in the machine shop to put out the fire.

Keep flammables in nonflammable cabinet.



Background Information

This document contains basic guidelines and rules to help ensure the safe handling and storage of compressed gas cylinders. Compressed gases are used in a variety of UWM programs such as instructional and research laboratories, health sciences, fine arts, scientific diving, and welding. Compressed gases serve the university in many ways, but gases under high pressure also present a number of hazards.

Mishandled cylinders may rupture violently, release their hazardous contents or become dangerous projectiles. If a neck of a pressurized cylinder should be accidentally broken off, the energy released would be sufficient to propel the cylinder to over three-quarters of a mile in height. A standard 250 cubic foot cylinder pressurized to 2,500 PSIG can become a rocket attaining a speed of over 30 miles per hour in a fraction of a second after venting from the broken cylinder connection.

Basic Safety:

Select the least hazardous gases that will work.

Purchase only the necessary quantities.

Select gases with returnable containers.

When receiving gas cylinders: °

Check for leaks

Visually inspect the cylinder for damage

Ensure the valve cover and shipping cap is on

Check for proper labeling

If a cylinder is damaged, in poor condition, leaking, or the contents are unknown, contact your cylinder vendor. Have the vendor return the damaged cylinder to the manufacturer.

Wear appropriate foot protection when engaged in moving or transporting cylinders: °

Steel-toed shoes if required by your instructor or department.

Proper personal protective clothing and equipment shall be worn.

Always have an appropriate Material Safety Data Sheet (MSDS) available and be familiar with the health, flammability and reactivity hazards for the particular gas.

Cylinder Markings:

Cylinders must be properly labeled, including the gas identity and appropriate hazards (e.g., health, flammability, reactivity).

Cylinders have several stamped markings.

The top mark is either a DOT or an International Code Council (ICC) marking indicating pertinent regulations for that cylinder. The second mark is the serial number. Under the serial number is the symbol of the manufacturer, user or purchaser. Of the remaining marks the numbers represent the date of manufacture, and retest date (month and year). A (+) sign indicates the cylinder may be 10% overcharged, and a star indicates a ten-year test interval.

Cylinder Storage:

Cylinders should be stored in compatible groups: °

Flammables from oxidizers

Corrosives from flammables

Full cylinders from empties

Empty cylinders should be clearly marked and stored as carefully as those that are full because residual gas may be present.

All cylinders from corrosive vapors.

Store cylinders in an upright position.

Keep oxygen cylinders a minimum of twenty feet from flammable gas cylinders or combustible materials. If this can not be done, separation by a non-combustible barrier at least 5 feet high having a fire-rating of at least one-half hour is required.

Compressed gas cylinders should be secured firmly at all times. A clamp and belt or chain, securing the cylinder between "waist" and "shoulder" to a wall, are generally suitable for this purpose.

Cylinders should be individually secured; using a single restraint strap around a number of cylinders is often not effective.

Keep valve protective caps in place when the cylinder is not in use.

Mark empty cylinders EMPTY or MT.

Keep valves closed on empty cylinders.

Cylinders must be kept away from sources of heat.

Cylinders must be kept away from electrical wiring where the cylinder could become part of the circuit.

Store cylinders in well-ventilated areas designated and marked only for cylinders.

Moving Cylinders:

Use a cylinder cart and secure cylinders with a chain.

Don't use the protective valve caps for moving or lifting cylinders.

Don't drop a cylinder, or permit them to strike each other violently or be handled roughly.

Unless cylinders are secured on a special cart, regulators shall be removed, valves closed and protective valve caps in place before cylinders are moved.

Cylinder Use:

Be sure all connections are tight. Use soapy water to locate leaks.

Keep cylinders valves, regulators, couplings, hose and apparatus clean and free of oil and grease.

Keep cylinders away from open flames and sources of heat.

Safety devices and valves shall not be tampered with, nor repairs attempted.

Use flashback arrestors and reverse-flow check valves to prevent flashback when using oxy-fuel systems.

Regulators shall be removed when moving cylinders, when work is completed, and when cylinders are empty.

Cylinders shall be used and stored in an upright position.

The cylinder valve should always be opened slowly. Always stand away from the face and back of the gauge when opening the cylinder valve.

When a special wrench is required to open a cylinder or manifold valve, the wrench shall be left in place on the valve stem when in use; this precaution is taken so the gas supply can be shut off quickly in case of an emergency; and that nothing shall be placed on top of a cylinder that may damage the safety device or interfere with the quick closing of the valve.

Fire extinguishing equipment should be readily available when combustible materials can be exposed to welding or cutting operations using compressed cylinder gases.

Things Not To Do:

Never roll a cylinder to move it.

Never carry a cylinder by the valve.

Never leave an open cylinder unattended.

Never leave a cylinder unsecured.

Never force improper attachments on to the wrong cylinder.

Never grease or oil the regulator, valve, or fittings of an oxygen cylinder.

Never refill a cylinder.

Never use a flame to locate gas leaks.

Never attempt to mix gases in a cylinder.

Never discard pressurized cylinders in the normal trash.

Saw

The steps to make sure your taking safety procedures are very important when using a cutting tool or joining tool. Saws are used for cutting metals, woods, and other materials. They can cause serious injury or even death

One of the first things you want to make sure you do is to take of gloves if you're wearing them. You don't want to wear gloves because if your hands get caught in the saw it won't cut and rip your fingers it will pull your hand into the blade then injure you worse.

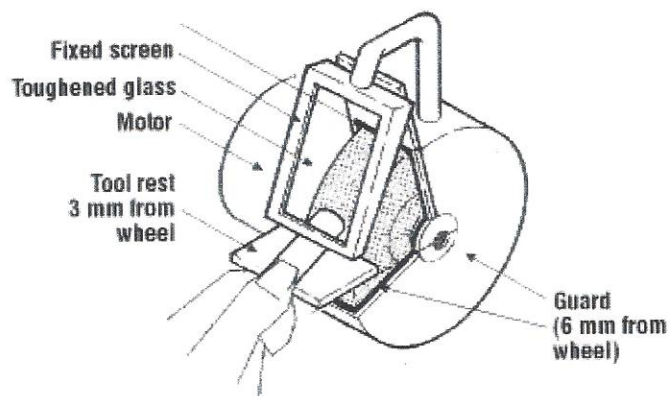
- 1) Always wear safety glasses to insure eye protection.
- 2) Get comfortable before cutting so you don't lean into the blade
- 3) Wear short sleeve shirts, no ties, or strings off sweat shirts, and if you have long hair tie it up.
- 4) Always make sure there is a safety shield on the blade
- 5) Make sure the blade is in good condition



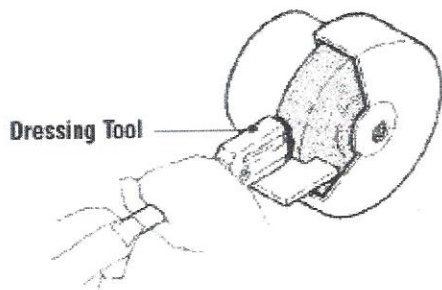
Vasek Smith

What safety procedures should you follow when using bench and pedestal grinders?

- Fasten pedestal and bench grinders securely.
- Ensure all the guards are in place and secure before using a grinder.
- Adjust tool rests to within 3 mm (1/8 in.) of wheels. Never adjust rests while wheels are moving. Work rest height should be on horizontal centre line of the machine spindle.
- Maintain 6 mm (1/4 in.) wheel exposure with a tongue guard or a movable guard.
- Check that wheels have blotters on each side.
- Check the wheel fits properly to the spindle when mounting. If it is loose, get another wheel.



- Stand to one side of the grinder until the wheel reaches operating speed.
- Bring work into contact with the grinding wheel slowly and smoothly, without bumping.
- Apply gradual pressure to allow the wheel to warm up evenly. Use only the pressure required to complete a job.
- Move the work back and forth across the face of the wheel. This movement prevents grooves from forming.
- Wheels are made only for grinding certain items. Do not grind rough forgings on a small precision grinding wheel.



- Dress wheels regularly. Do frequent, light dressings rather than one heavy dressings.
- Support dressing tools so you can apply leverage without undue effort. With revolving cutter dressing tools use the lugs as anchors.
- Replace worn wheels if you cannot dress it.
- Ensure the grinder speed does not exceed the operating speed marked on the wheel.
- Visually inspect wheels for possible damage before mounting.
- Wear proper personal protective equipment:
 - eye, ear and face protection,
 - metatarsal safety boots, where required,
 - respiratory protection may be required, depending on the work.
- Wear gloves only where necessary.

What should you avoid when using bench and pedestal grinders?

- Do not use a wheel that has been dropped.
- Do not use a wheel that does not fit properly to the spindle.
- Do not use excessive force to tighten the nut of the wheel. The force can crack the wheel.
- Do not grind wood, plastics and non-iron metals on ordinary wheels.
- Do not leave grinding wheels standing in liquids. The liquid can cause balance problems.

- Do not grind on the side of a regular wheel.

What safety precautions should you follow when using a portable grinder?

Guards must be provided and adjusted to protect you. Replace damaged guards because if an abrasive wheel breaks while rotating, it can cause a serious injury.

- Clean and service grinders according to manufacturers' recommendations. Record all maintenance for grinders.
- Ensure that a machine will not operate when unattended by checking the dead-man (constant pressure) switch.
- Wear safety glasses, goggles, and face protection to protect against flying particles. Gloves, aprons, metatarsal safety boots, and respiratory protection may be required, depending on the work.
- Ensure the floor around the work area is clean.
- Do not use wheels that are cracked or those that excessively vibrate.
- Do not operate grinder on wet floors.
- Use both hands when holding the grinder.
- Keep the power cord away from the grinding wheel and the material being ground.

What should you do when using portable grinders?

- Check that grinders do not vibrate or operate roughly.
- Use racks or hooks to store portable grinders.
- Stand away from the wheel when starting grinders. Warn co-workers to do the same.
- Inspect all wheels for cracks and defects before mounting.
- Ensure that the mounting flange surfaces are clean and flat.
- Ensure the wheel guard is in place while operating the grinder.
- Use the mounting blotters supplied.
- Run newly mounted wheels at operating speed for 1 minute before grinding.
- Wear appropriate eye, ear and face protection. Use other personal protective equipment or clothing, as required under the circumstances.



Operating Precautions

- Wear safety glasses with side protectors when using a metal lathe.
 - Never wear gloves, a tie, loose clothing, a watch, rings, or jewelry when using a metal lathe. Tie long hair back or secure under a cap.
 - Determine that the work piece is properly centered and securely clamped in the chuck. Remove the chuck key from the chuck before starting the metal lathe.
 - Keep metal lathe cutting tools sharp. Do not use damaged or broken metal lathe cutting tools.
- Center drill the work piece and use a live tail-stock for stability when the work piece is turning.
- Keep your hands and fingers away from metal lathe moving parts and cutting tools.
 - Follow recommended specifications for speeds of rotation and feed and depth of cut for the metal being turned.
 - Assure the adjustment for the cutting tool and tool rest is set slightly above the center of the work piece.
 - Do not measure work or attempt to adjust a chuck or work piece while it is rotating.
 - Start the metal lathe at a slow speed and then gradually increase the rotational speed.
 - Never reach across the rotating chuck or work piece while performing filing or burnishing operations.
 - Back the cutting tool away from the metal being turned and then turn off the metal lathe before adjusting or removing a work piece. Do not use your hand to brake or stop a rotating chuck
 - Clean the metal lathe work area. Use a brush, rather than your fingers or hands, to sweep up waste metal shavings and cuttings.
 - Disconnect the power source before performing metal lathe maintenance.



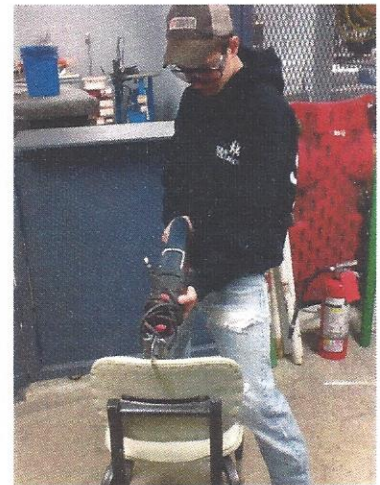
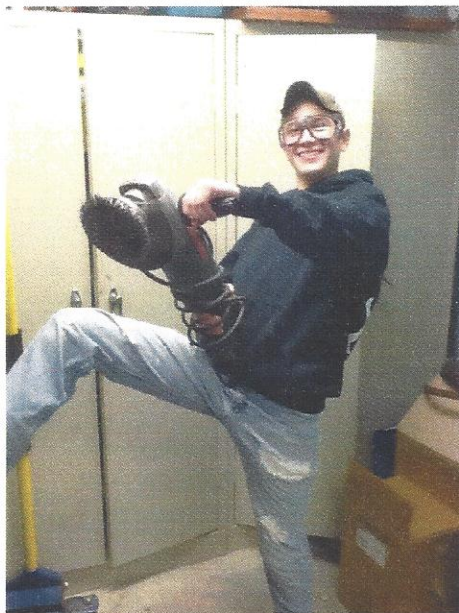
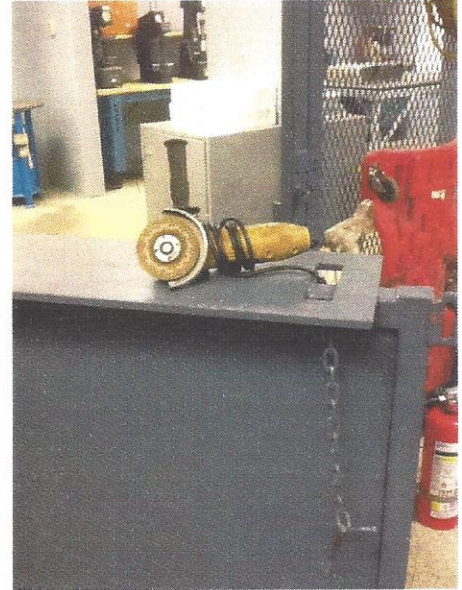
Plate shear safety

1. Use proper lockout procedures when setting up the shear. Shut off the power when leaving the machine unattended, and follow lock out procedures when doing total preventive maintenance.
2. Your foot must be completely removed from the pedal box after completing each cut, on machines that are not equipped with light curtains or other safeguards.
3. In a two-person operation, the helper must give the signal to cycle the shear. Always make sure you know the helper's position before cycling the machine.
4. Always dispose of scrap material into the scrap metal bin to avoid injury on sharp corners.
5. Don't place any part of your body between the blades or between or under hold downs.
6. Always put your tools back after you set up. Practice good housekeeping at all times.
7. On shears equipped with a light curtain verify proper safety function.

8. With the power on, with your hands a safe distance away from the shear blades.

POWER TOOLS

There are many different things you must do when using power tools to keep yourself and others safe. You should wear safety glasses for just about everything. Also, when grinding or using anything that will produce sparks make sure that your skin is covered. And safety glasses are recommended to have the side shields. Pretty much you just have to use common sense about things and play mess around with the tools because people can be seriously injured by stupidity or people thinking that they are funny.



Dean Masters

Safety tips on plasma cutters

For starters don't allow unauthorized personnel use plasma cutters and equipment without supervision or permission. Also before using the plasma cutters warn all other workers in the area that they are going to be used. Also make sure that the individuals are wearing protective gear such as safety goggles or glasses and heat or fire resistant clothing. Plasma cutter arc is so intensely hot and powerful that it provides immediate danger for a possible of fire if you're not safely operating the plasma cutters in your work environment. Keep a fire extinguisher in case of an emergency. Keep a distance of 25 ft. between your cutting material and your surroundings. Always wear rubber gloves while cutting in addition to your welding gloves. Also make sure that your work environment isn't wet or moist plus check your work area isn't wet or moist before starting your work.

SECTION 1 – SAFETY PRECAUTIONS - READ BEFORE USING

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⚠ Protect yourself and others from injury — read, follow, and save these important safety precautions and operating instructions.

1-1. Symbol Usage



DANGER! – Indicates a hazardous situation which, if not avoided, will result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury. The possible hazards are shown in the adjoining symbols or explained in the text.

NOTICE – Indicates statements not related to personal injury.

1-2. Plasma Arc Cutting Hazards



The symbols shown below are used throughout this manual to call attention to and identify possible hazards. When you see the symbol, watch out, and follow the related instructions to avoid the hazard. The safety information given below is only a summary of the more complete safety information found in the Safety Standards listed in Section 1-5. Read and follow all Safety Standards.



Only qualified persons should install, operate, maintain, and repair this unit.



During operation, keep everybody, especially children, away.



CUTTING can cause fire or explosion.

Hot metal and sparks blow out from the cutting arc. The flying sparks and hot metal, hot workpiece, and hot equipment can cause fires and burns. Check and be sure the area is safe before doing any cutting.

- Remove all flammables within 35 ft (10.7 m) of the cutting arc. If this is not possible, tightly cover them with approved covers.
- Do not cut where flying sparks can strike flammable material.
- Protect yourself and others from flying sparks and hot metal.
- Be alert that sparks and hot materials from cutting can easily go through small cracks and openings to adjacent areas.
- Watch for fire, and keep a fire extinguisher nearby.
- Be aware that cutting on a ceiling, floor, bulkhead, or partition can cause fire on the hidden side.
- Do not cut on containers that have held combustibles, or on closed containers such as tanks, drums, or pipes unless they are properly prepared according to AWS F4.1 and AWS A6.0 (see Safety Standards).
- Connect work cable to the work as close to the cutting area as practical to prevent cutting current from traveling long, possibly unknown paths and causing electric shock, sparks, and fire hazards.
- Do not use plasma cutter to thaw frozen pipes.
- Never cut containers with potentially flammable materials inside – they must be emptied and properly cleaned first.
- Do not cut where the atmosphere may contain flammable dust, gas, or liquid vapors (such as gasoline).
- Do not cut pressurized cylinders, pipes, or vessels.
- Wear oil-free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes, and a cap.
- Do not locate unit on or over combustible surfaces.
- Remove any combustibles, such as a butane lighter or matches, from your person before doing any cutting.
- After completion of work, inspect area to ensure it is free of sparks, glowing embers, and flames.
- Use only correct fuses or circuit breakers. Do not oversize or bypass them.
- Follow requirements in OSHA 1910.252 (a) (2) (iv) and NFPA 51B for hot work and have a fire watcher and extinguisher nearby.

☞ Indicates special instructions.



This group of symbols means Warning! Watch Out! ELECTRIC SHOCK, MOVING PARTS, and HOT PARTS hazards. Consult symbols and related instructions below for necessary actions to avoid the hazards.



ELECTRIC SHOCK can kill.

Touching live electrical parts can cause fatal shocks or severe burns. The torch and work circuit are electrically live whenever the output is on. The input power circuit and machine internal circuits are also live when power is on. Plasma arc cutting requires higher voltages than welding to start and maintain the arc (200 to 400 volts dc are common), but may also use torches designed with safety interlock systems which turn off the machine when the shield cup is loosened or if tip touches electrode inside the nozzle. Incorrectly installed or improperly grounded equipment is a hazard.

- Do not touch live electrical parts.
- Wear dry, hole-free insulating gloves and body protection.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground.
- Do not touch torch parts if in contact with the work or ground.
- Turn off power before checking, cleaning, or changing torch parts.
- Disconnect input power before installing or servicing this equipment. Lockout/tagout input power according to OSHA CFR 1910.147 (see Safety Standards).
- Properly install, ground, and operate this equipment according to its Owner's Manual and national, state, and local codes.
- Check and be sure that input power cord ground wire is properly connected to ground terminal in disconnect box or that cord plug is connected to a properly grounded receptacle outlet – always verify the supply ground.
- When making input connections, attach proper grounding conductor first.
- Keep cords dry, free of oil and grease, and protected from hot metal and sparks.
- Frequently inspect input power cord for damage or bare wiring – replace cord immediately if damaged – bare wiring can kill.
- Turn off all equipment when not in use.
- Inspect and replace any worn or damaged torch cable leads.
- Do not wrap torch cable around your body.
- Ground the workpiece to a good electrical (earth) ground if required by codes.
- Use only well-maintained equipment. Repair or replace damaged parts at once.
- Wear a safety harness if working above floor level.
- Keep all panels and covers securely in place.
- Do not bypass or try to defeat the safety interlock systems.
- Use only torch(es) specified in Owner's Manual.
- Keep away from torch tip and pilot arc when trigger is pressed.
- Clamp work cable with good metal-to-metal contact to workpiece (not piece that will fall away) or worktable as near the cut as practical.
- Insulate work clamp when not connected to workpiece to prevent contact with any metal object.

To have well trained operators who understands how to operate powered industrial forklifts safely.

To have well maintained and safe powered industrial forklift equipment.

There is an estimate of 20,000 injuries on a forklift each year.

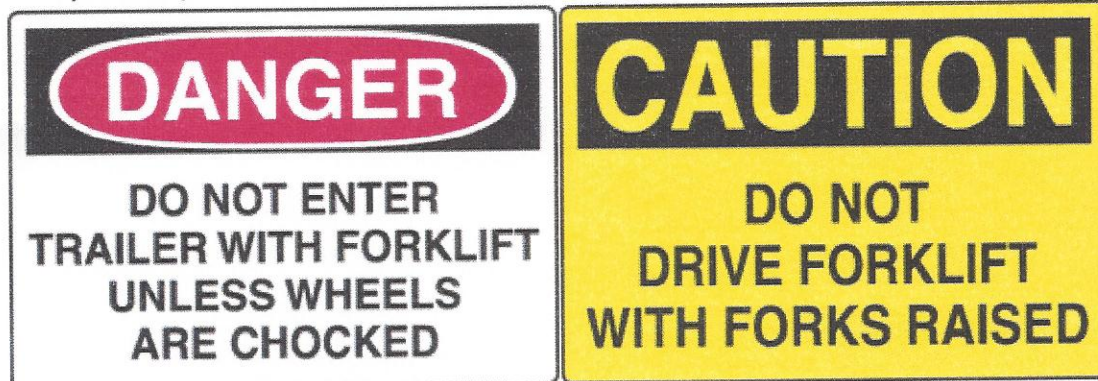
Make sure employees follow the safety operating procedures

Equipment must meet the requirements for the safety, if not the person shall not use it.

The employee must have the proper training to use the forklift properly.

Watch out for others when moving the forklift and be cautious of the height of the ceiling.

Always wear your seat belt and watch for warning signals.



⚠ DANGER



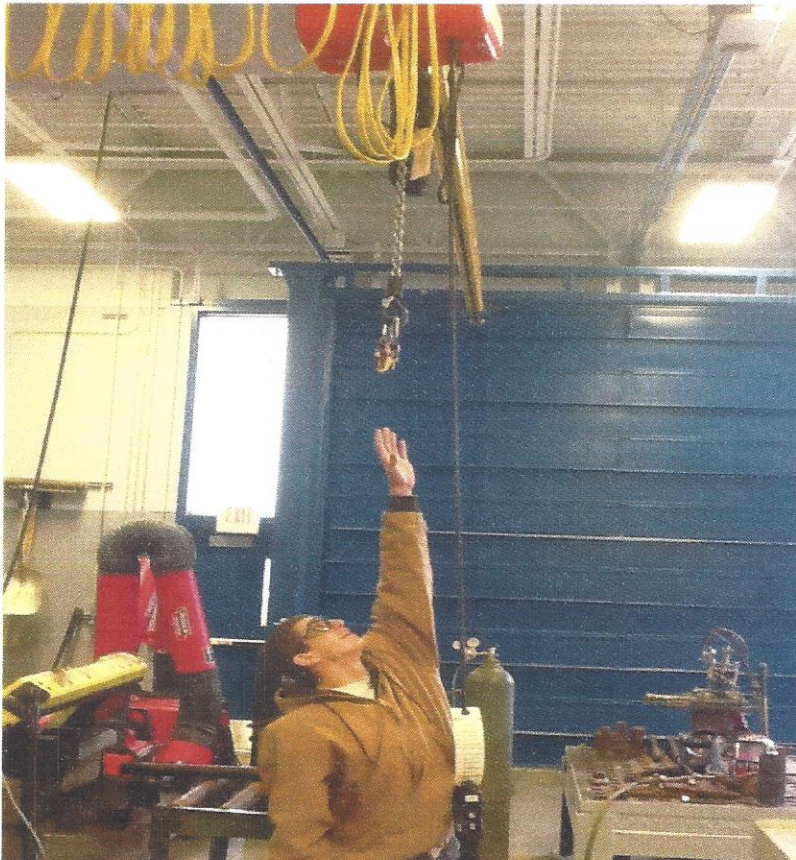
Do not permit
personnel to
stand under forks
or any part of the
lift mechanism.

EN0002



CRANE SAFETY

- **CAN PULL UP TO 2000 LBS.**
- **DO NOT GRAB BY THE REMOTE WIRE.**
- **GRAB BY THE CHAIN.**
- **WATCH SMACKING YOUR FACE INTO IT.**
- **OVERHEAD PARTS BE CAUTIOUS.**
- **DO NOT HANG PEOPLE BY THE CRANE**
- **HAVE A CLEAR AREA WHEN OPERATIONG**



Safety manual for Bobcat Skid steer.

There are many things you shouldn't do while operating a skid steer such as. When the bucket of the skid steer is up in the air you should never walk or be under it for because the hydraulics could go out causing the boom of the skid steer to come down falling on top of you. You should also never be on top on the skid steer while in motion, there is also the chance of being run over and seriously hurt or killed.

Hudson

And

Ben.

Oxyacetylene cutting torches

The oxyacetylene process

The oxyacetylene process produces a high temperature flame, over 3000 degrees C, by the combustion of pure oxygen and acetylene. It is the only gas mixture hot enough to melt steel; other gases (propane, LPG or hydrogen) can be used for lower melting point non-ferrous metals, for brazing and silver soldering and as a preheating/piercing gas for cutting.

Safe storage

Gases are normally supplied under high pressure in steel cylinders; in the UK, the colour coding for the cylinders is in the process of being harmonised across Europe. For acetylene the shoulder of the cylinder is maroon and for oxygen the shoulder is white, although black oxygen cylinders will remain in circulation for some time. The cylinder should also have a label marked with the type of gas. To prevent the interchange of fittings between cylinders containing combustible and non-combustible gases, oxygen cylinders have a right-hand and acetylene have a left-hand thread. All cylinders are opened by turning the key or knob anticlockwise and closed by turning them clockwise.

Oxygen will cause a fire to burn more fiercely and a mixture of oxygen and a fuel gas can cause an explosion. It is, therefore, essential that the oxygen cylinders are separated from the fuel gas cylinders and stored in an area free from combustible material.

Safe practice and accident avoidance

Store the cylinders in a well-ventilated area, preferably in the open air

The storage area should be well away from sources of heat, sparks and fire risk

Cylinders should be stored upright and well secured

Oxygen cylinders should be stored at least 3m from fuel gas cylinders or separated by a 30 minute fire resisting barrier

The store area should be designated 'No Smoking'.

Handling compressed gases

Cylinders are fitted with regulators to reduce the gas pressure in the cylinder to the working pressure of the torch. The regulator has two gauges, a high pressure gauge for the gas in the cylinder and a low pressure gauge for the gas being fed to the torch. The gas flow rate is controlled by a pressure adjusting screw which sets the outlet gas pressure. The BCGA Code of Practice CP7 recommends the gauges are checked annually and replaced every 5 years.

Factors to be considered are that the gas system is suitable for the pressure rating and the hoses are connected without any leaks. Valve threads should be cleaned before screwing in the regulator. The valve of an acetylene cylinders can be opened slightly to blow out the threads but the threads in oxygen cylinders are best cleaned using clean compressed air (the threads on hydrogen cylinders must always be blown out using compressed air).

As oxygen can react violently with oils and grease, lubricating oils or sealant for the threads must not be used.

Safe practice and accident avoidance

Cylinders are very heavy and must be securely fastened at all times

Cylinder valves or valve guards should never be loosened

Check the regulator is rated for the pressure in the cylinder

When attaching the regulator to the cylinder the joints must be clean and sealant must not be used

Before attaching a regulator, the pressure adjustment screw must be screwed out to prevent unregulated flow of gas into the system when the cylinder valve is opened

Using compressed gases

Gases are mixed in the hand-held torch or blowpipe in the correct proportions. Hoses between regulator and torch should be colour coded; in the UK, red for acetylene and blue for oxygen. Hoses should be kept as short as possible and users should check periodically that they are not near hot or sharp objects which could damage the hose wall. Acetylene cylinders must always be used upright.

When connecting the system, and at least at the start of each shift, hoses and torch must be purged to remove any inflammable gas mixtures. It is essential the oxygen stream does not come into contact with oil which can ignite spontaneously. Purging should also not be carried out in confined spaces.

The torch should be lit with a friction lighter or stationary pilot flame to avoid burning the hands; matches should not be used and the flame should not be reignited from hot metal, especially when working in a confined space.

The cylinders should not become heated, for example by allowing the torch flame to heat locally the cylinder wall. Similarly, arc welding too close to the cylinder could result in an arc forming between the cylinder and workpiece/electrode.

Although very little UV is emitted, the welder must wear tinted goggles. The grade of filter is determined by the intensity of the flame which depends on the thickness of metal being welded; recommendations for filters according to the acetylene flow rate are given in the table (BSEN 169:1992).

Safe practice and accident avoidance

When cleaning the cylinder threads, connecting the regulator and purging the hoses, protect face and eyes by wearing the appropriate head shield

Use a suitable welding shield equipped with the appropriate ocular protection filter

Wear non-combustible clothing

Ensure the cylinder is not heated by the flame or by stray arcs from adjacent electrical equipment

Leak detection

Joints and hoses should be checked for leaks before any welding is attempted. Whilst acetylene may be detected by its distinctive smell (usually at levels of less than 2%) oxygen is odourless.

Leak detection is best carried out applying a weak (typically 0.5%) solution of a detergent in water or a leak detecting solution from one of the gas supply companies. It is applied to the joints using a brush and the escaping gas will form bubbles. On curing the leak, the area should be cleaned to remove the residue from the leak detecting solution

Backfire and flashback

A backfire (a single cracking or 'popping' sound) is when the flame has ignited the gases inside the nozzle and extinguished itself. This may happen when the torch is held too near the workpiece.

A flashback (a shrill hissing sound) when the flame is burning inside the torch, is more severe. The flame may pass back through the torch mixing chamber to the hose. The most likely cause is incorrect gas pressures giving too low a gas velocity. Alternatively, a situation may be created by a higher pressure gas (acetylene) feeding up a lower pressure gas (oxygen) stream. This could occur if the oxygen cylinder is almost empty but other potential causes would be hose leaks, loose connections, or failure to adequately purge the hoses.

Non-return valves fitted to the hoses will detect and stop reverse gas flow preventing an inflammable oxygen and acetylene mixture from forming in the hose. The flashback arrestor is an automatic flame trap device designed not only to quench the flame but also to prevent the flame from reaching the regulator.

Backfire or flashback procedure

After an unsustained backfire in which the flame is extinguished:

close the blowpipe control valves (fuel gas first)

check the nozzle is tight

check the pressures on regulators

re-light the torch using the recommended procedure

If the flame continues to burn:

- close the oxygen valve at the torch (to prevent internal burning)
- close the acetylene valve at the torch
- close cylinder valves or gas supply point isolation valves for both oxygen and acetylene
- close outlets of adjustable pressure regulators by winding out the pressure-adjusting screws
- open both torch valves to vent the pressure in the equipment
- close torch valves
- check nozzle tightness and pressures on regulators
- re-light the torch using the recommended procedure

If a flashback occurs in the hose and equipment, or fire in the hose, regulator connections or gas supply outlet points:

- isolate oxygen and fuel gas supplies at the cylinder valves or gas supply outlet points (only if this can be done safely)
- if no risk of personal injury, control fire using first aid fire-fighting equipment
- if the fire cannot be put out at once, call emergency fire services
- after the equipment has cooled, examine the equipment and replace defective components

When a backfire has been investigated and the fault rectified, the torch may be re-lit. After a flashback, because the flame has extended to the regulator it is essential not only to examine the torch, but the hoses and components must be checked and, if necessary, replaced. The flashback arrestor should also be checked according to manufacturer's instructions and, with some designs, it may be necessary to replace it. BCGA Code of Practice CP7 recommends that non-return valves and flashback arrestors are replaced every 5 years.

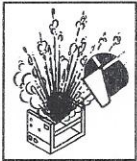




ELECTRIC SHOCK can kill.

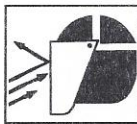
SIGNIFICANT DC VOLTAGE exists in inverter power sources **AFTER** the removal of input power.

- Turn Off unit, disconnect input power, check voltage on input capacitors, and be sure it is near zero (0) volts before touching any parts. Check capacitors according to instructions in Maintenance Section of Owner's Manual or Technical Manual before touching any parts.



EXPLODING PARTS can injure.

- On inverter power sources, failed parts can explode or cause other parts to explode when power is applied. Always wear a face shield and long sleeves when servicing inverters.



FLYING SPARKS can injure.

Sparks and hot metal blow out from the cutting arc. Chipping and grinding cause flying metal.

- Wear approved face shield or safety goggles with side shields.
- Wear proper body protection to protect skin.
- Wear flame-resistant ear plugs or ear muffs to prevent sparks from entering ears.



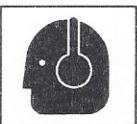
ARC RAYS can burn eyes and skin.

Arc rays from the cutting process produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.

- Wear face protection (helmet or shield) with a proper shade of filter lenses to protect your face and eyes from arc rays and sparks when cutting or watching. ANSI Z49.1 (see Safety Standards) suggests a No. 9 shade (with No. 8 as minimum) for all cutting currents less than 300 amperes. Z49.1 adds that lighter filter shades may be used when the arc is hidden by the workpiece. As this is normally the case with low current cutting, the shades suggested in Table 1 are provided for the operator's convenience.
- Wear approved safety glasses with side shields under your helmet or shield.
- Use protective screens or barriers to protect others from flash, glare and sparks; warn others not to watch the arc.
- Wear protective clothing made from durable, flame-resistant material (leather, heavy cotton, or wool) and foot protection.

Table 1. Eye Protection For Plasma Arc Cutting

| Current Level In Amperes | Minimum Shade Number | |
|--------------------------|----------------------|----|
| Below 20 | | #4 |
| 20 - 40 | | #5 |
| 40 - 60 | | #6 |
| 60 - 100 | | #8 |



NOISE can damage hearing.

Prolonged noise from some cutting applications can damage hearing if levels exceed limits specified by OSHA (see Safety Standards).

- Use approved ear plugs or ear muffs if noise level is high.
- Warn others nearby about noise hazard.



FUMES AND GASES can be hazardous.

Cutting produces fumes and gases. Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use local forced ventilation at the arc to remove cutting fumes and gases.
- If ventilation is poor, wear an approved air-supplied respirator.
- Read and understand the Material Safety Data Sheets (MSDSs) and the manufacturer's instruction for metals to be cut, coatings, and cleaners.
- Work in a confined space only if it is well ventilated, or while wearing an air-supplied respirator. Fumes from cutting and oxygen depletion can alter air quality causing injury or death. Be sure the breathing air is safe.
- Do not cut in locations near degreasing, cleaning, or spraying operations. The heat and rays of the arc can react with vapors to form highly toxic and irritating gases.
- Do not cut on coated metals, such as galvanized, lead, or cadmium plated steel, unless the coating is removed from the cutting area, the area is well ventilated, and while wearing an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes when cut.
- Do not cut containers with toxic or reactive materials inside or containers that have held toxic or reactive materials – they must be emptied and properly cleaned first.



PLASMA ARC can injure.

The heat from the plasma arc can cause serious burns. The force of the arc adds greatly to the burn hazard. The intensely hot and powerful arc can quickly cut through gloves and tissue.

- Keep away from the torch tip.
- Do not grip material near the cutting path.
- The pilot arc can cause burns – keep away from torch tip when trigger is pressed.
- Wear proper flame-retardant clothing covering all exposed body areas.
- Point torch away from your body and toward work when pressing the torch trigger – pilot arc comes on immediately.
- Turn off power source and disconnect input power before disassembling torch or changing torch parts.
- Use only torch(es) specified in the Owner's Manual.








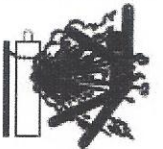


CYLINDERS can explode if damaged.

Compressed gas cylinders contain gas under high pressure. If damaged, a cylinder can explode. Since gas cylinders are normally part of metalworking processes, be sure to treat them carefully.

- Protect compressed gas cylinders from excessive heat, mechanical shocks, physical damage, slag, open flame, sparks, and arcs.
- Install and secure cylinders in an upright position by chaining them to a stationary support or equipment cylinder rack to prevent falling or tipping.
- Keep cylinders away from any cutting or other electrical circuits.
- Never allow electrical contact between a plasma arc torch and a cylinder.
- Never cut on a pressurized cylinder – explosion will result.
- Use only correct compressed gas cylinders, regulators, hoses, and fittings designed for the specific application; maintain them and associated parts in good condition.
- Turn face away from valve outlet when opening cylinder valve.
- Keep protective cap in place over valve except when cylinder is in use or connected for use.
- Use the right equipment, correct procedures, and sufficient number of persons to lift and move cylinders.
- Read and follow instructions on compressed gas cylinders, associated equipment, and Compressed Gas Association (CGA) publication P-1 listed in Safety Standards.

WELDING SAFETY CHECKLIST

| HAZARD | FACTORS TO CONSIDER | PRECAUTION SUMMARY |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Electric shock can kill</p>  | <ul style="list-style-type: none"> • Wetness • Welder in or on workpiece • Confined space • Electrode holder and cable insulation | <ul style="list-style-type: none"> • Insulate welder from workpiece and ground using <i>dry</i> insulation. Rubber mat or dry wood. • Wear <i>dry, hole-free</i> gloves. (Change as necessary to keep dry.) • Do not touch electrically "hot" parts or electrode with bare skin or wet clothing. • If wet area and welder cannot be insulated from workpiece with dry insulation, use a semiautomatic, constant-voltage welder or stick welder with voltage reducing device. • Keep electrode holder and cable insulation in good condition. Do not use if insulation damaged or missing. |
| <p>Fumes and gases can be dangerous</p>  | <ul style="list-style-type: none"> • Confined area • Positioning of welder's head • Lack of general ventilation • Electrode types, i.e., manganese, chromium, etc. See MSDS • Base metal coatings, galvanize, paint | <ul style="list-style-type: none"> • Use ventilation or exhaust to keep air breathing zone clear, comfortable. • Use helmet and positioning of head to minimize fume in breathing zone. • Read warnings on electrode container and material safety data sheet (MSDS) for electrode. • Provide additional ventilation/exhaust where special ventilation requirements exist. • Use special care when welding in a confined area. • Do not weld unless ventilation is adequate. |
| <p>Welding sparks can cause fire or explosion</p>  | <ul style="list-style-type: none"> • Containers which have held combustibles • Flammable materials | <ul style="list-style-type: none"> • Do not weld on containers which have held combustible materials (unless strict AWS F4.1 procedures are followed). Check before welding. • Remove flammable materials from welding area or shield from sparks, heat. • Keep a fire watch in area during and after welding. • Keep a fire extinguisher in the welding area. • Wear fire retardant clothing and hat. Use earplugs when welding overhead. |
| <p>Arc rays can burn eyes and skin</p>  | <ul style="list-style-type: none"> • Process: gas-shielded arc most severe | <ul style="list-style-type: none"> • Select a filter lens which is comfortable for you while welding. • Always use helmet when welding. • Provide non-flammable shielding to protect others. • Wear clothing which protects skin while welding. |
| <p>Confined space</p>  | <ul style="list-style-type: none"> • Metal enclosure • Wetness • Restricted entry • Heavier than air gas • Welder inside or on workpiece | <ul style="list-style-type: none"> • Carefully evaluate adequacy of ventilation especially where electrode requires special ventilation or where gas may displace breathing air. • If basic electric shock precautions cannot be followed to insulate welder from work and electrode, use semiautomatic, constant-voltage equipment with cold electrode or stick welder with voltage reducing device. • Provide welder helper and method of welder retrieval from outside enclosure. |
| <p>General work area hazards</p>    | <ul style="list-style-type: none"> • Cluttered area • Indirect work (welding ground) connection • Electrical equipment • Engine-driven equipment • Gas cylinders | <ul style="list-style-type: none"> • Keep cables, materials, tools neatly organized. • Connect work cable as close as possible to area where welding is being performed. Do <i>not</i> allow alternate circuits through scaffold cables, hoist chains, ground leads. • Use only double insulated or properly grounded equipment. • Always disconnect power to equipment before servicing. • Use in only open, well ventilated areas. • Keep enclosure complete and guards in place. • See Lincoln service shop if guards are missing. • Refuel with engine off. • If using auxiliary power, OSHA may require GFI protection or assured grounding program (or isolated windings if less than 5KW). • Never touch cylinder with the electrode. • Never lift a machine with cylinder attached. • Keep cylinder upright and chained to support. |

1-3. Additional Symbols For Installation, Operation, And Maintenance



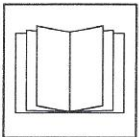
HOT PARTS can burn.

- Do not touch hot parts bare handed.
- Allow cooling period before working on equipment.
- To handle hot parts, use proper tools and/or wear heavy, insulated welding gloves and clothing to prevent burns.



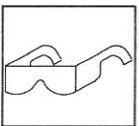
MOVING PARTS can injure.

- Keep away from moving parts such as fans.
- Keep all doors, panels, covers, and guards closed and securely in place.
- Have only qualified persons remove doors, panels, covers, or guards for maintenance and troubleshooting as necessary.
- Reinstall doors, panels, covers, or guards when maintenance is finished and before reconnecting input power.



READ INSTRUCTIONS.

- Read and follow all labels and the Owner's Manual carefully before installing, operating, or servicing unit. Read the safety information at the beginning of the manual and in each section.
- Use only genuine replacement parts from the manufacturer.
- Perform maintenance and service according to the Owner's Manuals, industry standards, and national, state, and local codes.



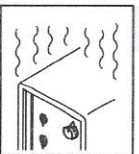
FLYING METAL or DIRT can injure eyes.

- Wear safety glasses with side shields or wear face shield.



ELECTRIC AND MAGNETIC FIELDS (EMF) can affect Implanted Medical Devices.

- Wearers of Pacemakers and other Implanted Medical Devices should keep away.
- Implanted Medical Device wearers should consult their doctor and the device manufacturer before going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations.



OVERUSE can cause OVERHEATING.

- Allow cooling period; follow rated duty cycle.
- Reduce amperage (thickness) or reduce duty cycle before starting to cut again.



EXPLODING HYDROGEN hazard.

- When cutting aluminum underwater or with the water touching the underside of the aluminum, free hydrogen gas may collect under the work-piece.
- See your cutting engineer and water table instructions for help.



BATTERY EXPLOSION can injure.

- Do not use plasma cutter to charge batteries or jump start vehicles unless it has a battery charging feature designed for this purpose.



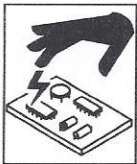
FALLING EQUIPMENT can injure.

- Use lifting eye to lift unit only, NOT running gear, gas cylinders, or any other accessories.
- Use equipment of adequate capacity to lift unit.
- If using lift forks to move unit, be sure forks are long enough to extend beyond opposite side of unit.
- Keep equipment (cables and cords) away from moving vehicles when working from an aerial location.
- Follow the guidelines in the Applications Manual for the Revised NIOSH Lifting Equation (Publication No. 94-110) when manually lifting heavy parts or equipment.



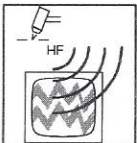
FIRE OR EXPLOSION hazard.

- Do not locate unit on, over, or near combustible surfaces.
- Do not install unit near flammables.
- Do not overload building wiring – be sure power supply system is properly sized, rated, and protected to handle this unit.



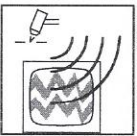
STATIC (ESD) can damage PC boards.

- Put on grounded wrist strap BEFORE handling boards or parts.
- Use proper static-proof bags and boxes to store, move, or ship PC boards.



H.F. RADIATION can cause interference.


- High frequency (H.F.) can interfere with radio navigation, safety services, computers, and communications equipment.
- Have only qualified persons familiar with electronic equipment perform this installation.
- The user is responsible for having a qualified electrician promptly correct any interference problem resulting from the installation.
- If notified by the FCC about interference, stop using the equipment at once.
- Have the installation regularly checked and maintained.
- Keep high-frequency source doors and panels tightly shut, keep spark gaps at correct setting, and use grounding and shielding to minimize the possibility of interference.




ARC CUTTING can cause interference.

- Electromagnetic energy can interfere with sensitive electronic equipment such as computers and computer-driven equipment such as robots.
- To reduce possible interference, keep cables as short as possible, close together, and down low, such as on the floor.
- Locate cutting operation 100 meters from any sensitive electronic equipment.
- Be sure this cutting power source is installed and grounded according to this manual.
- If interference still occurs, the user must take extra measures such as moving the machine, using shielded cables, using line filters, or shielding the work area.

1-4. California Proposition 65 Warnings

 Welding or cutting equipment produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Section 25249.5 et seq.)

 This product contains chemicals, including lead, known to the state of California to cause cancer, birth defects, or other reproductive harm. *Wash hands after use.*

1-5. Principal Safety Standards

Safety in Welding, Cutting, and Allied Processes, ANSI Standard Z49.1, is available as a free download from the American Welding Society at <http://www.aws.org> or purchased from Global Engineering Documents (phone: 1-877-413-5184, website: www.global.ihs.com).

Recommended Practices for Plasma Arc Cutting and Gouging, American Welding Society Standard AWS C5.2, from Global Engineering Documents (phone: 1-877-413-5184, website: www.global.ihs.com).

Safe Practices for the Preparation of Containers and Piping for Welding and Cutting, American Welding Society Standard AWS F4.1, from Global Engineering Documents (phone: 1-877-413-5184, website: www.global.ihs.com).

Safe Practices for Welding and Cutting Containers that have Held Compressibles, American Welding Society Standard AWS A6.0, from Global Engineering Documents (phone: 1-877-413-5184, website: www.global.ihs.com).

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Quincy, MA 02269 (phone: 1-800-344-3555, website: www.nfpa.org and www.sparky.org).

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151 (phone: 703-788-2700, website: www.cganet.com).

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 5060 Spectrum Way, Suite 100, Ontario, Canada L4W 5N5 (phone: 800-463-6727, website: www.csa-international.org).

Safe Practice For Occupational And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 25 West 43rd Street, New York, NY 10036 (phone: 212-642-4900, website: www.ansi.org).

Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, NFPA Standard 51B, from National Fire Protection Association, Quincy, MA 02269 (phone: 1-800-344-3555, website: www.nfpa.org).

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, from U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 (phone: 1-866-512-1800) (there are 10 OSHA Regional Offices—phone for Region 5, Chicago, is 312-353-2220, website: www.osha.gov).

Applications Manual for the Revised NIOSH Lifting Equation, The National Institute for Occupational Safety and Health (NIOSH), 1600 Clifton Rd, Atlanta, GA 30333 (phone: 1-800-232-4636, website: www.cdc.gov/NIOSH).

1-6. EMF Information

Electric current flowing through any conductor causes localized electric and magnetic fields (EMF). Welding current creates an EMF field around the welding circuit and welding equipment. EMF fields may interfere with some medical implants, e.g. pacemakers. Protective measures for persons wearing medical implants have to be taken. For example, restrict access for passers—by or conduct individual risk assessment for welders. All welders should use the following procedures in order to minimize exposure to EMF fields from the welding circuit:

1. Keep cables close together by twisting or taping them, or using a cable cover.
2. Do not place your body between welding cables. Arrange cables to one side and away from the operator.
3. Do not coil or drape cables around your body.

4. Keep head and trunk as far away from the equipment in the welding circuit as possible.
5. Connect work clamp to workpiece as close to the weld as possible.
6. Do not work next to, sit or lean on the welding power source.
7. Do not weld whilst carrying the welding power source or wire feeder.

About Implanted Medical Devices:

Implanted Medical Device wearers should consult their doctor and the device manufacturer before performing or going near arc welding, spot welding, gouging, plasma arc cutting, or induction heating operations. If cleared by your doctor, then following the above procedures is recommended.