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Arc Welding Safety[1]

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INTRODUCTION

The electric arc welder remains one of our most useful and timesaving pieces of shop equipment. Almost every farm, ranch, and Vocational Agriculture shop is equipped with one or more welders which are used for fabrication, repair, and/or educational programs. Most of these welders are typically AC/DC, 240 volt transformer types using electricity as the energy source. Portable welders are of the diesel/gasoline engine powered type. Properly installed and used the arc welder is very safe, but if used improperly the operator can be exposed to a number of hazards including toxic fumes, dusts, burns, fires, explosions, electric shock, radiation, noise, and heat stress. Any of these hazards can cause injury or death. By following suggestions and guidelines in this pamphlet the risks can be greatly minimized.

SELECTING THE ARC WELDER

When purchasing an arc welder you can be assured of design safety if the unit complies with National Electric Manufacturers Association (NEMA) standards or the safety standards for arc welders as determined by the Underwriters Laboratories (UL). Be sure that the welder you purchase carries the seal of approval of one of these organizations.

INSTALLING THE ARC WELDER

Prior to installing the arc welder you should determine if your present electrical system is adequate to handle the increased load re- quired by the welder. Your local power supplier or a qualified elec- trician can assist you in determining this. It is very important for your safety to install the welder in compliance with State of Arizona, Occupational Safety and Health Administration (AOSHA) regulations and the National Electric Code (NEC) by a qualified electrician. Failure to do so could cause fire, a ground fault, or equipment failure. The following rules are not a complete list but are especially important guidelineswhich should be adhered to:

The frame or case of the welder shall be properly grounded.

A safety-type disconnecting switch or controller shall be located near the machine (See Figure 1). The welder or welders shall be protected by a properly sized fuse or circuit breaker on an independent circuit.

VENTILATION

The welder should be located in an area with adequate ventilation. In general, when welding is being done on metals not considered hazardous, a ventilation system that will move a minimum of 2000 cubic feet per minute (CFM) of air per welder is satisfactory. However, many materials are considered very hazardous and should be welded only in adequately ventilated areas to prevent the accumulation of toxic materials or to eliminate possible oxygen deficiency not only to the operator but to others in the immediate vicinity. Such

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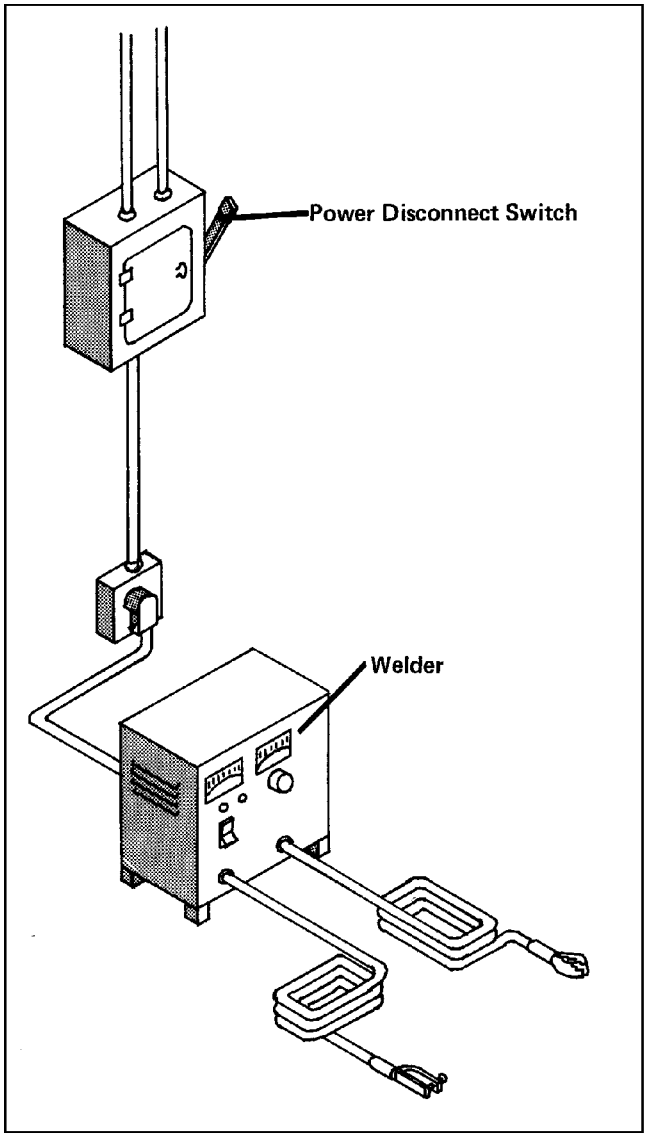

Figure 1. The power disconnect switch should be located convenient to the operator.

ventilation should be supplied by an exhaust system located as close to the work as possible (See Figure 2). When welding or cutting metals with hazardous coatings such as galvanized metal the operator should use a supplied-air type respirator or a respirator specially designed to filter the specific metal fume. Materials included in the very hazardous category are welding rod fluxes, coverings, or other materials containing fluorine compounds, zinc, lead, beryllium, cadmium, and mercury. Some cleaning and degreasing compounds as well as the metals they were cleaned with are also hazardous. Always follow the manufacturers precautions before welding or cutting in the presence of these materials.

FIRE PREVENTION

The arc welder is capable of producing temperatures in excess of 10,000 degrees F.,therefore it is important that the workplace be made firesafe. This can be accomplished by using metal sheets or fire resistant curtains as fire barriers. The floor should be concrete or another fire resistant material. Cracks in the floor should be filled to prevent sparks and hot metal from entering. When work cannot be moved to a firesafe area then the area should be made safe by removing or protecting combustibles from ignition sources. In certain welding situations it may be necessary to ask someone to watch for fires that could go undetected until the welder has finished the job.

Suitable fire extinguishing equipment such as buckets of sand or a dry chemical extinguisher of the ABC type should be readily available. The extinguisher should be large enough for the situation with a 10# size adequate for most farm and school shops.

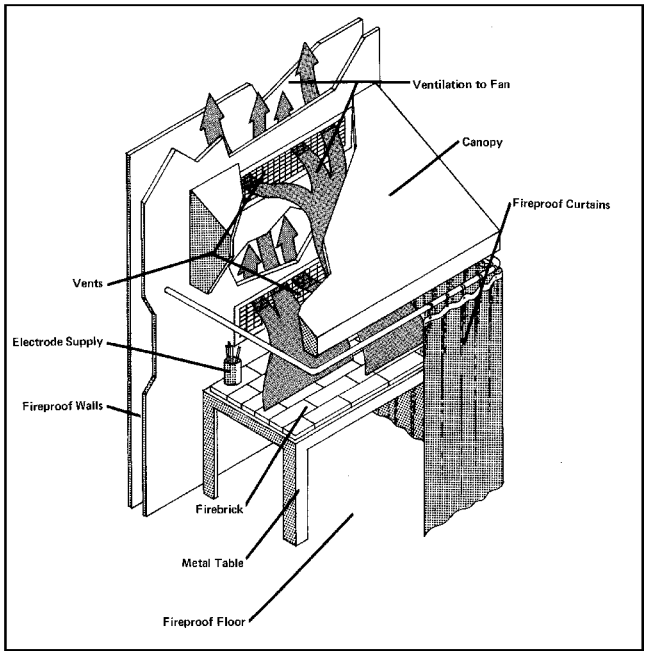

Figure 2. Typical welding area showing proper ventilation and screening.

PERSONAL PROTECTION

It is essential that the operator and helpers be properly clothed and protected because of the heat, ultraviolet rays, and sparks, produced by the arc welder (See Figure 3). For body protection a pair of fire retardant long sleeved coveralls without cuffs is a good choice. Always avoid clothing with tears, snags, rips, or worn spots as these are easily ignited by sparks. The sleeves and collars should be kept buttoned. The hands should

be protected with leather gauntlet gloves. A pair of high top leather shoes, preferably safety shoes, is good protection for the feet. If low shoes are worn the ankles should be protected by fire resistant leggings. Eyes should be protected by transparent goggles if the person wears prescription glasses or safety glasses if not. A welding helmet or hand shield with filter plate and cover plate is mandatory for eye protection from the harmful rays of the arc. The filter plate should be at least shade #10 for general welding up to 200 amps. However, certain operations such as carbon-arc welding and higher current welding operations require darker shades. Never use a helmet if the filter plate or cover lens is cracked or broken. A flame-proof skull cap to protect the hair and head as well as hearing protection in noisy situations is recommended.

Plastic disposable cigarette lighters are very dangerous around heat and flame. It is very important that they not be carried in the pockets while welding. Always provide protection to bystanders or other workers by welding inside a properly screened area, if possible. If unable to work inside a screened area then protection to others should be provided by a portable screen or shield, or by their wearing anti-flash goggles.

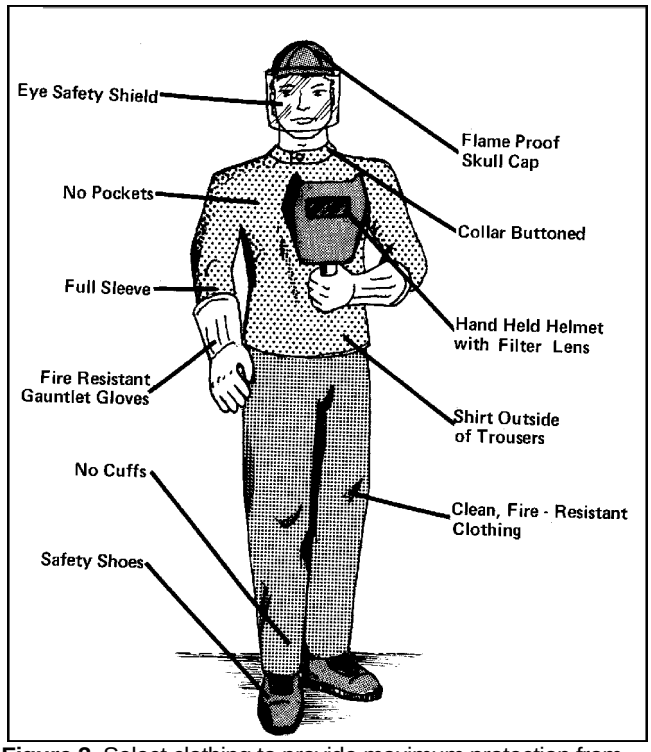

Figure 3. Select clothing to provide maximum protection from sparks and hot metals.

SAFE OPERATION OF THE WELDER

It is important that anyone operating an arc welder be instructed on its safe use by a qualified teacher or welder.

Because of their potentially explosive nature, we strongly recommend that no welding, cutting, or hot work be attempted on used drums, barrels, tanks, or other containers under any circumstances.

If possible, work to be welded should be placed on a firebrick surface at a comfortable height. Welding should never be done directly on a concrete floor. Heat from the arc can cause steam to build-up in the floor which could cause an explosion. The welder cables should be positioned so that sparks and molten metal will not fall on them. They should also be kept free of grease and oil and located where they will not be driven over.

Electric welders can kill by electric shock. If the welding operation must be done on steel or other conductive material an insulating mat must be used under the operator. If the welding area is wet or damp or the operator is actively perspiring then he/she should wear rubber gloves under the welding gloves.

It is easier and safer to establish an arc on a clean surface than a dirty or rusty one. Therefore, metal should always be thoroughly cleaned by wire brushing or other method prior to welding. When chipping slag or wire brushing the finished bead the operator should always be sure to protect his eyes and body from flying slag and chips. Unused electrodes and electrode stubs should not be left on the floor as they create a slipping hazard. Hot metal should be handled with metal tongs or pliers. When quenching hot metal in water it should be done carefully to prevent painful burns from the escaping steam. Any metal left to cool should be carefully marked "HOT" with a soapstone. When welding is finished for the day or suspended for any length of time electrodes should be removed from the holder. The holder should be placed where no accidental contact could occur, and the welder should be disconnectedfrom the power source.

SAFETY PRECAUTIONS FOR ENGINE POWERED WELDERS

Always operate in an open well-ventilated area or vent the engine exhaust directly outdoors. Never fuel the engine while running or in the presence of an open flame.

Wipe up spilled fuel immediately and wait for fumes to disperse before starting the engine. *Never remove the radiator pressure cap from liquid cooled engines while they are hot to prevent scalding yourself.
Stop the engine before performing any maintenance or trouble shooting. The ignition system should be disabled to prevent accidental start of the engine. Keep all guards and shields in place. Keep hands, hair, and clothing away from moving parts.

FIRST AID

The welding area should always be equipped with a fire blanket and a well stocked first aid kit. It is desirable that one person be trained in first aid to treat the minor injuries that may occur. All injuries, no matter how minor they may seem can become more serious if not properly treated by trained medical personnel.

KEY POINTS TO REMEMBER

Be sure the welder is properly installed and grounded.
Never weld without adequate ventilation.
Take proper precautions to prevent fires.
Protect your entire body with fire retardant clothing, shoes, and gloves.
Wear eye protection at all times.
Weld only in a firesafe area.
Never do any welding, cutting, or hot work on used drums, barrels, tanks, or other containers. Mark metal "HOT" with a soapstone. Keep a well stocked first aid kit handy.