Section 16E. Welding Safety

Both arc and gas welding processes are essential to the maintenance of equipment at the Tree Fruit Research and Extension Center. We recognize this vital process can also be hazardous and therefore submit the following safety procedures to prevent illness and/or accidents while performing these processes.

Protective Equipment Can Safeguard

Eye and face protection is as important to a welding process as the tools themselves. Welders are at risk for burns, heat radiation, and flying bits of hot molten metal. The proper protective equipment can limit these risks substantially.

OSHA requires gas welders to wear impact-resistant and heat-resistant goggles or other eye protection. Nonflammable welding helmets are recommended for many operations.

For arc welders, OSHA recommends wearing helmets and eye protection designed to resist heat, fire, impact, and electricity.

Since the flames and hot metal from both arc and gas welding give off infrared, or heat rays, workers need eye coverings that protect them from long-term exposure, which can lead to cataracts. Safety goggles are available in a wide range of different lens shades, each of which provides protection against the specific infrared hazards of different kinds of welding jobs. Manufacturer’s instructions detail which lens goes with which hazard.

Following is a guide to select proper shade numbers. Individual needs may vary.

Welding Operation ................................................................. Shade No.

Shielded metal-arc welding—1/16-, 3/32-, 1/8-, 5/32 inch electrodes ...... 10
Gas-shielded arc welding (nonferrous)—1/16-, 3/32-, 1/8-, 5/32-inch electrodes .................................................. 11
Gas-shielded arc welding (ferrous)—1/16-, 3/32-, 1/8-, 5/32-inch electrodes ................................................................................... 12
Shielded metal-arc welding: 3/16-, 7/32-, 1/4-inch electrodes ........................ 12
5/16-, 3/8-inch electrodes ........................................................................ 14
Atomic hydrogen welding ............................................................................ 10-14
Carbon arc welding ...................................................................................... 14
Soldering .......................................................... 2
Torch brazing ............................................................................................. 3 or 4
Light cutting, up to 1 inch ........................................................................ 3 or 4
Medium cutting, 1 inch to 6 inches .......................................................... 4 or 5
Heavy cutting, 6 inches and over ............................................................. 5 or 6
Gas welding (light) up to 1/8 inch ............................................................. 4 or 5
Gas welding (medium) 1/8 inch to 1/2 inch .............................................. 5 or 6
Gas welding (heavy) 1/2 inch and over .................................................... 6 or 8
Arc welding also creates ultraviolet rays that can burn eyes and skin—much like a very bad sunburn. Again, instructions from the manufacturer and your safety manager should be your guide to selecting the right safety goggles or glasses for the job. It is a good idea to wear a face shield over the glasses for extra protection.

**Body Protection**

Welders should also wear clothing that will protect them against burns from hot sparks or metal. Very hot work calls for protective leather aprons, leggings, and sleeves. Street clothes are acceptable for some welding jobs, if you follow these precautions:

- Wear long-sleeved shirts. Arc welders should wear clothing made of heavy materials to protect against ultraviolet rays.
- Keep collars and cuffs buttoned.
- Do not wear clothes with cuffs or open pockets that could catch sparks.
- Wear high shoes, and keep pant legs over them to keep sparks out.
- Wear flame-resistant head covers.
- Wear clean clothes—grease or oil spots could be flammable.
- Do not wear flammable hair preparations.
- Never carry flammable items, such as cigarette lighters, on your person when involved in any welding process.
- For arc welders, special dry welder’s gloves are a must to protect against shock to the hands or electrocution.

Some welding jobs also call for wearing respirators to protect against inhaling fumes and gases. There are special welding respirators available. Follow the instructions of the welding equipment manufacturers, material safety data sheets (MSDSs) for any gas or materials used in a welding operation, and your safety department in choosing the correct respirator. As with any respirator, it should be properly fit-tested for the individual wearer, and each employee must be trained in its use.

**Fire Hazards**

The flames and sparks created in the welding process make fire its greatest hazard. Welding sparks have been known to travel as much as 35 feet. And the spatter—hot metal created by the process—can bounce on the floor or fall through openings, so you need extra caution to keep fires from starting and spreading.

Whether you use arc or gas welders, always follow these precautions:

- Remove flammables from the area before beginning the job.
• Try to restrict welding operations to separate, special rooms with fire-resistant floors.

• Keep the welding area free of trash or debris that could catch fire.

• Keep fire extinguishers nearby. Check them regularly and make sure they’re in good working order and that workers know how to use them.

If using gas welders, take these additional steps to prevent fires:

• Keep cylinders away from sparks and spatter.
• Do not run over gas hoses.
• Do not use oxygen to blow away dust. It increases the likelihood of combustion if any ignition source—even static electricity—is present.
• Use proper lubricants, not grease or oil, on the connections of compressed-oxygen cylinders.
• Do not smoke!
• Never operate Oxy-Acetylene equipment without approved check valves in the oxygen and acetylene lines.

Keep in mind that the gases used for welding—acetylene, butane, natural gas, propane, propylene—are not only flammable, they are also potentially explosive. Before you start a job, check the MSDS for the gas you are using to make sure you are aware of all the hazards and safety precautions.

**Fumes and Gases**

Another welding hazard is fumes and gases. The fumes are actually microscopic metal particles that are suspended in the air. Fluxes, plating, dirt, oil, and other substances can also create fumes and gases when they’re heated by the welding process.

To avoid respiratory problems and lung damage from inhaling these airborne substances, follow instructions for selecting and using respiratory protection. In addition, keep these safety procedures in mind:

• Use local ventilation such as an exhaust system.
• Place fans to the side so fumes will blow away from you.

**WAC 296-306A-5001 5, What requirements apply to local exhaust hoods and booths?**

Mechanical local exhaust ventilation may be provided by either of the following:

1. Freely movable hoods intended to be placed by the welder as near as practical to the work being welded and provided with a rate of airflow sufficient to maintain a velocity in the direction of the hood of 100 linear feet per minute in the zone of welding when the hood is at its most remote distance from the point of welding. The rates of ventilation required to accomplish this control velocity using a 3-inch wide flanged suction opening are shown in the following table:
<table>
<thead>
<tr>
<th>Welding zone</th>
<th>Minimum air flow cubic feet minute</th>
<th>Duct diameter Inches²</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 6 inches from arc or torch</td>
<td>150</td>
<td>3</td>
</tr>
<tr>
<td>6 to 8 inches from arc or torch</td>
<td>275</td>
<td>3-1/2</td>
</tr>
<tr>
<td>8 to 10 inches from arc or torch</td>
<td>425</td>
<td>4-1/2</td>
</tr>
<tr>
<td>10 to 12 inches from arc or torch</td>
<td>600</td>
<td>5-1/2</td>
</tr>
</tbody>
</table>

¹When brazing with cadmium bearing materials or when cutting on such materials, increased rates of ventilation may be required.

²Nearest half-inch duct diameter based on 4,000 feet per minute velocity in pipe.

- Do not get too close to the arc on an arc welder. Welders with poor eyesight should use safety eyeglasses under their helmets or a magnifier in their helmets if they cannot see the job.
- Leave the area immediately and get medical attention if you feel sick or uncomfortable.

**Gas Cylinder Handling and Storage**

Cylinders of welding gas must be handled with extreme care. Since different gases require different procedures, the first step is to read the label. If a cylinder does not have a label, or the label is illegible, do not use it. Never handle a cylinder if you do not know exactly what is in it.

Here are some other precautions for handling and storing gas cylinders safely:

- Check equipment and hoses regularly for leaks.
- Open valves slowly-and keep them closed when cylinders are not in use or are empty.
- Turn off gas when you leave the area.
- Transport cylinders by strapping them securely to carts. Do not let them fall or bang into one another. If a valve is knocked off, the cylinder could explode.
- Never roll or drop a cylinder.
- Use cylinders only in areas with good ventilation.
- Light flames according to manufacturer’s instructions. Do it promptly, or the gas could build up in the area and explode when you light it.

**Instructions for lighting Oxy-Acetylene Torch**

- Blow out the cylinder valve before attaching the regulator, making sure the opening is facing away from you. Make sure no grease, oil, or debris is on the valve threads.
- Release all tension on the regulator adjusting screw before the cylinder valve is opened.
- Stand to one side when opening the cylinder valves.
- Open oxygen valve first- slowly
- Open Acetylene second- 1/4 to 1/2 turn.
- Never use Acetylene at pressures above 15 psi. Acetylene can spontaneously ignite above 15 psi.
- Light Acetylene first and adjust size of flame.
- Open oxygen valve and adjust for neutral flame.

When Oxy-Acetylene welding is finished:

- Turn off Oxygen and Acetylene valves at the torch.
- Turn off cylinder valves
• Release tension on oxygen and acetylene regulator adjusting screws.
• Purge oxygen and acetylene hoses separately (be sure one valve is closed while the other is open).

Store cylinders away from flammables or heat sources, on a level, fireproof floor, in a dry, ventilated area.

Store oxygen cylinders at minimum of 20 ft from fuel cylinders.

Always keep cylinders upright and properly secured.

Do not use a leaking cylinder.

Keep cylinders away from sparks, molten metal, etc.

**Arc Welder Handling and Storage**
Arc welders are electric, so you must also follow the rules of electrical safety to avoid shock or electrocution. Keep these precautions in mind:

• Turn off power before touching electric parts.
• Ground the object you are welding with a separate electrical connection. Use the correct cable size.
• Make sure cable insulation is not worn or frayed.
• Do not wear metal jewelry; it could become an electricity conductor.
• Do not weld in the rain. Moisture carries electricity.
• Use a flame retardant shield to prevent bystanders from exposure to welding arc and UV light.

**Tripping and Failing Hazards**
Yet another potential danger in welding operations is tripping and falling.

Welding helmets and goggles limit the wearer’s vision. So it’s a good idea to check the floor before a job to make sure there is nothing welders can trip over while they’re working. They will also have to keep track of the hoses (on gas welders) and cables (on arc welders) to avoid getting tangled up or tripping over them.

Reduce the risk of failing during aboveground welding operations by assigning a buddy to keep an eye out so as to alert the welder to any hazardous situations. A job that is on a scaffold or very high above the ground might also call for wearing a body harness.