



Arc Welding Safety 115

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Objectives

- Explain the importance of arc welding safety.
- Identify the dangers of arc radiation.
- Describe common procedures for preventing arc radiation.
- Describe characteristics of the welding shield.
- Identify possible risks of burns and fire.
- Describe common procedures for preventing burns.
- Explain the importance of ear protection.
- Describe common procedures used to prevent fire.
- Identify possible risks of electrical shock.
- Describe common procedures for preventing electrical shock.
- Identify possible risks of harmful fume inhalation.
- Describe common procedures for preventing harmful fume inhalation.
- Identify possible risks of explosion.
- Describe common procedures for preventing explosion.



Figure 1. A properly dressed welder.

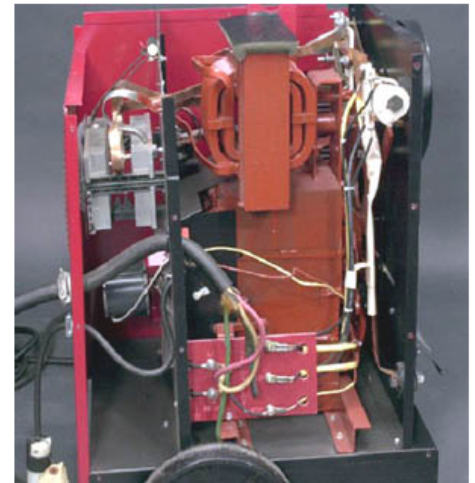


Figure 2. Only trained technicians should work with leads inside the welder.

Lesson: 2/16

Safety and Arc Welding

Safety is one of the most important concerns in **arc welding**. Arc welding, which is shown in Figure 1, uses an electric current, generates intense heat, and emits an intense light. All of these factors demand a thorough knowledge of safety requirements.

During arc welding, welders must be aware of their actions and surroundings at all times. There are many potential dangers, which is why safety is one of the most important concerns in arc welding. Observing safety precautions results in a safe, efficient arc welding process. However, when safety practices are ignored or only carelessly observed, the results may be fatal for both the welder and any nearby employees.

Before welding, you must know the risks associated with arc welding and the proper safety precautions. As you can see in Figure 2, welding equipment has warning labels. Always read all warning labels for all of the components you will be using. Regardless of the situation, if you are ever in doubt about a safety issue, ask your supervisor for guidance. This class will teach you about the importance of arc welding safety. You will learn about the risks involved with arc welding and how to prevent accidents.



Figure 1. Safe arc welding requires several safety precautions.



Figure 2. Always read all warning labels on all arc welding components.

Risk of Arc Radiation

Arc welding generates an intense electric **arc**, as shown in Figure 1. This arc emits intense bright light and harmful **infrared rays** and **ultraviolet rays** that can damage the eyes. You can usually tell if you have been exposed to damaging bright light because it hurts to look at light that is too bright. Infrared rays are invisible, but you can feel them as heat.

However, ultraviolet rays, or more simply UV rays, are invisible and cannot be seen or felt. If you have ever spent a day at the beach without wearing sunscreen, chances are you have known the effects of UV rays by getting sunburn. Likewise, your skin and eyes can burn the same way from arc welding. Even brief exposure to the arc's UV rays with the naked eye can cause a condition known as **arc flash**.

Arc flash is often described as sunburn on the eye. However, it does not usually become apparent until hours after exposure to the arc. Arc flash causes extreme discomfort and may produce temporary blindness, as well as cause the eyes to swell and leak fluid. Usually this is a temporary condition, but repeated exposure can lead to permanent injury.



Figure 1. The arc gives off an intense bright light.

Preventing Arc Radiation

You can protect yourself from the arc's harmful rays by choosing the proper clothes for welding. As you can see in Figure 1, dark-colored, wool clothing is preferable. Dark colors minimize arc rays from being reflected under the **welding helmet**. As a general rule, you should not leave any skin exposed, but if skin is exposed, wear a sun block lotion of SPF 30 or higher to prevent burn from occurring.

A welding helmet, or **welding shield**, protects the welder's eyes and face from the arc's harmful rays and its intense bright light. Welders must wear helmets during most welding processes. **Submerged arc welding (SAW)** and **oxyfuel welding** do not require the use of helmets.

Welders must also be sure that any possible onlookers are protected, either with a **welding screen** or a hand-held **face shield**, depending on their proximity. Figure 2 shows a face shield that is appropriate for onlookers.

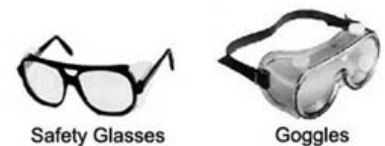
Even when the weld is complete, the welder and any bystanders must wear eye protection with side shields, like those shown in Figure 3. In a welding area, there is always the risk of flying debris, especially while chipping **slag** from a workpiece.



Figure 1. Wearing dark clothing during a weld will protect you from the arc's harmful rays.



Figure 2. Hand-held face shields are commonly used by onlookers during a weld.



Safety Glasses

Goggles

Figure 3. Even after welding, eye protection is required in a work area.

The Welding Shield

The **welding shield** or **welding helmet**, shown in Figure 1, protects the welder's eyes and face from the arc's harmful rays and intense light. Most welding shields are attached to helmet-type headgear and can be raised from the face when not in use. Some welding shields are hand-held, but these are typically used only for lighter jobs or onlookers.

With any helmet or shield, the welder views the arc through a window that contains a **filter plate** that removes damaging rays and light. The filter plate is expensive and must be handled carefully. It is protected from **spatter** and debris by a clear lens made of plastic or glass, as shown in Figure 2. Filter plates come in various shades that range from 7-14. The higher the shade's number, the more shading or darkness it provides.

The **American Welding Society** sets the standards for the amount of shading needed for a given welding process. The shade you use is specific to the welding process, the amount of **amperage**, and the size of **electrode** you use. Figure 3 illustrates the appropriate shading for arc welding processes. You should start out with the darkest shade recommended for a given process, and then move up one shade until you find the one that is most comfortable for you while still adhering to the standard. **Auto-darkening welding shields** are also available. These welding shields can adjust their shading automatically without having to change the filter lens.



Figure 1. The welding shield protects the welder from the arc's bright light and harmful rays.



Figure 2. These clear lenses protect the filter plate.

| Guide for Shade Numbers | | | | |
|--|---------------------------------|-----------------|--------------------------|-------------------------------|
| Operation | Electrode Size 1/32 in. (mm) | Arc Current (A) | Minimum Protective Shade | Suggested Shade No. (Comfort) |
| Shielded metal arc welding | < 3 (2.5) | < 60 | 7 | — |
| | 3-5 (2.5-4) | 60-160 | 8 | 10 |
| | 5-8 (4-6.4) | 160-250 | 10 | 12 |
| | > 8 (6.4) | 250-500 | 11 | 14 |
| Gas metal arc welding and flux cored arc welding | | < 60 | 7 | — |
| | | 60-160 | 10 | 11 |
| | | 160-250 | 10 | 12 |
| Gas tungsten arc welding | | 250-500 | 10 | 14 |
| | | < 50 | 8 | 10 |
| | | 50-150 | 8 | 12 |
| | 150-500 | 10 | 14 | |

Figure 3. Proper filter lens shading for arc welding processes.

Lesson: 6/16

Risk of Burns and Fire

The electric arc is extremely hot. Its temperature can reach 10,000°F (5500°C) or higher. Exposure to this intense heat poses a risk of burning the welder. Such extreme heat could also suddenly start a fire. The heat from the arc also produces **spatter**, which is a serious fire and burn hazard. Spatter, which is shown in Figure 1, can spray up to 35 feet (10.7 meters) from the work area. These sparks can quickly start a fire if they come into contact with **flammable material**. Even small particles of dust in the work area could suddenly **oxidize** upon coming into contact with spatter and cause a flash fire or explosion.

To avoid fires and burn hazards when welding, remove combustible materials a minimum of 35 feet from the work area, or move the work location well away from combustible materials. If relocation of the work area is not possible, protect combustibles with covers made of fire-resistant material.

Additionally, welders must be conscious of the types of fabric that they wear. Clothing and shoes made from man-made fabrics like **polyester** and **rayon** can melt from the arc's extreme heat and cause severe burns.



Figure 1. Spatter can quickly cause a fire if it contacts flammable or combustible material.

Preventing Burns

Wearing the proper clothing will prevent most welding-related burns. It is best to wear **wool** clothing, but **cotton** is also suitable. For added protection, you should wear **leather** shirts, trousers, aprons, sleeves, or bibs over your clothes, such as the items shown in Figure 1. Additionally, you should always wear a welding safety helmet, shown in Figure 2. When you are welding in a small space or from an awkward position, you are at an increased risk of getting burned by spatter. For these welding applications, you should always have leather covering. Figure 3 shows a welder with the proper leather covering in an overhead position.

During arc welding, never roll up your sleeves or cuff your pants. All clothing should be buttoned up and free of frays and tatters. If you wear a shirt with pockets, be sure that they are closed so that sparks cannot fall in them. Wear a cap to protect your head, and always wear flame-resistant gloves like the ones shown in Figure 4. Leather is usually the best choice for welding gloves. Keep in mind that welding gloves are not intended for handling hot metal.

Sparks can easily fall into low-top shoes. Instead, wear work boots, preferably made of leather with steel toes. Figure 5 shows a welder with the proper foot protection. Always wear pants outside your work boots so that sparks cannot fall into your boots. Remember, any skin that is left exposed during welding may get burned from stray spatter.



Figure 1. Protective leather clothing for welding.

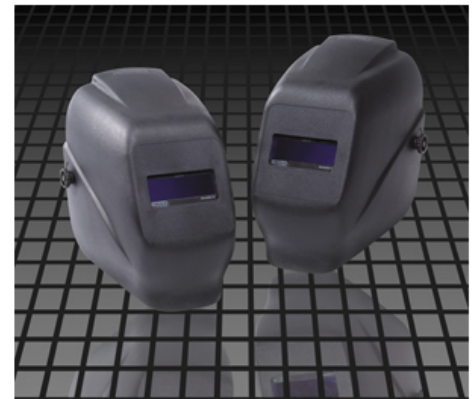


Figure 2. Welders must wear welding helmets for safety.



Figure 3. This welder wears leather sleeves for

Figure 3. This welder wears leather sleeves for added protection during an overhead weld.



Figure 4. Leather welding gloves protect the hands during welding.



Figure 5. Leather high-top boots will protect your ankles and feet.

Protecting the Ears

Other important safety considerations during arc welding are hearing loss and ear protection. Some arc welding processes are loud. In addition, chipping slag from a workpiece can be loud, especially in small spaces. When welding, wear ear protection to avoid hearing loss. Hearing loss is something that happens gradually. Repeated exposure to loud noises increases hearing damage over time.

Ear protection serves two purposes: it protects your hearing, and it also prevents spatter from entering your ears. Two types of hearing protection are pictured in Figure 1. **Earmuffs** provide the most protection from hearing loss and spatter. However, these are not commonly worn because they can be bulky and cumbersome. **Earplugs** are worn more frequently. However, keep in mind that earplugs do not protect flying sparks from hitting the outer ear.



Earmuffs

Earplugs

Figure 1. These devices protect hearing.

Preventing Fire

When welding, always be conscious of fire prevention. Welders must have a **fire extinguisher** on hand, and be aware of the location of fire alarms and evacuation routes. Figure 1 shows an extinguisher that is properly located. Make sure that you have access to fire hoses, sand buckets, fire-resistant blankets, or other fire-fighting equipment.

A spark can start a fire very quickly if it contacts the right materials. Since sparks or spatter can travel anywhere within 35 feet of the work space, a welder must thoroughly inspect the work area before beginning a weld. The welder must be aware of others present in the welding area and make sure they maintain a proper distance from the arc and have adequate protection.

Make sure that your workpiece is free of **combustible material** and **flammable material**. This includes materials like gas, oil, and grease. Also, make sure that your clothing and work area are free from combustibles or flammables. Inspect for clutter in your area. Commonly ignited substances include trash, wood, textiles, boxes, papers, rags, plastics, and chemicals. If for any reason you must weld in an area that is questionable, place **fire shields** around the welding area, as shown in Figure 2. Also, have a **fire watcher** keep watch over the work area. Continue inspecting for fire 30 minutes after performing the weld.



Figure 1. Fire extinguishers should be conveniently located.



Figure 2. If you must weld in a cluttered or high-traffic area, use fire shields.

Lesson: 10/16

Risk of Electrical Shock

One of the most serious risks to the welder is **electrical shock**. Any electrical shock over 30 volts can be fatal to a person. Arc welding presents the risk of both **primary voltage shock** and **secondary voltage shock**. Primary voltage shock occurs when the power is on and someone simultaneously touches a **lead** inside the welder and either the welder case or other grounded metal. The shock can be anywhere from 120-480 volts. Always remember that even though the welder is switched "off," a charge still exists inside the machine. This makes the interior leads, which are shown in Figure 1, extremely dangerous.

Secondary voltage shock occurs when you touch the electrode while another part of your body touches the workpiece. If you touch both of these components at the same time, you will receive an electrical shock ranging from 60-100 volts. The higher the voltage in an electrical circuit, the more serious the electrical shock. Figure 2 shows the international warning symbol for electric shock. Additionally, if the **work clamp** is attached to the building framework or somewhere away from the weld, there is a chance that current can flow through other circuits in the work area. This also presents a risk of electrical shock.

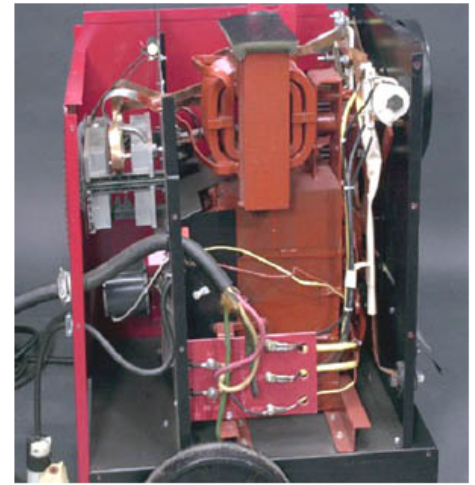


Figure 1. Only trained technicians should work with leads inside the welder.



Figure 2. This symbol warns you about watching for electric shock when working.

Preventing Electrical Shock

Always remember that electricity easily flows through water. Therefore, when you are arc welding, you must stay dry. Never weld with wet gloves. Even wetness from perspiration is dangerous. You must wear proper welding clothing to maintain **insulation** between yourself and your work. Do not wear jewelry, since these metals are good conductors. If you must work in damp or wet areas, always insulate yourself by standing on a dry plank of wood or a rubber mat.

Before you weld, make sure that the work area is clean and dry. Inspect the welding equipment, and make sure that the cables, electrode, and **electrode holder** are dry and in good condition. Figure 1 shows a shielded metal arc welding electrode holder that passes visual inspection. If necessary, replace any damaged components. Also, check to make sure that all connections are tight and properly installed, as shown in Figure 2.

Remember that the **work cable** and work clamp, which are shown in Figure 3, must stay as close to the work area as possible. Also, make sure that no part of the electrode circuit touches the workpiece or ground. This can cause the circuit to overheat. Finally, never touch the electrode or metal parts of the electrode holder with skin or wet clothing.



Figure 1. Like all arc welding components, the electrode holder must be dry and in good condition.



Figure 2. Make sure that all cables are installed in the welder properly.



Figure 3. The work cable and work clamp must remain close to the weld area.

Risk of Harmful Fume Inhalation

The welding process can emit dangerous **fumes** that collect in an area known as the **fume plume**. As you can see in Figure 1, the fume plume is a smoke-like cloud that rises from the molten metal. It contains metallic vapors that have condensed into tiny particles of solid metal. These particles are suspended in the air and can settle on the walls and floor of the workspace if they are not removed. Immediate human exposure to the fume plume usually results in temporary side effects that include eye burning, skin irritation, and dizziness. Long-term and short-term exposure to the fume plume may lead to severe respiratory and skin problems.

Of all the welding materials and equipment, the electrode usually emits the most dangerous fumes, while the base metal gives off fewer fumes. Most shielding gases are **nontoxic**. In other words, they will not emit hazardous fumes. However, shielding gases may remove the oxygen from the air. Without proper ventilation, this could cause a person to **asphyxiate**. When UV radiation hits the air, it causes **ozone** and **nitrogen oxides** to form. These can cause chest pains, headaches, and eye and throat irritation. Some metals and gases give off more dangerous fumes than others. Always know the dangers associated with the metals, electrodes, and gases you use.

Hexavalent chromium, a grayish metal that contains the element **chromium** and oxygen, is sometimes added to electrodes used in arc welding. When released into the air in high enough levels, chromium causes nausea, headaches, dizziness, and respiratory irritation. To prevent overexposure to hexavalent chromium, **OSHA** recently lowered the permissible hexavalent chromium intake to .005 mg per cubic m.



Figure 1. The fume plume is a safety risk.

Preventing Harmful Fume Inhalation

All welding areas must have good **ventilation**, with at least 10,000 cubic feet of area per welder. There must be positive air circulation without barriers like dividing walls or equipment. Regardless of the type of ventilation, always keep your head away from the fume plume. It is best to use both natural and man-made ventilation systems.

There are two forms of **exhaust**: Low-vacuum high-volume systems and high-vacuum low-volume systems. **Low-vacuum high-volume systems** are widely used in industry. Most shops use **welding hoods**, a form of low-vacuum high-volume exhaust. As you can see in Figure 1, this type of ventilation is stationary and remains positioned above the work area. It does not have to be directly above the arc because it removes fumes from the surrounding area. It sucks up harmful fumes into the hood and can be positioned within 6-15 in. of the weld area so that fumes do not pass through the welder's breathing zone.

A **High-vacuum low-volume system** is shown in Figure 2. Many high-vacuum low-volume systems are **source capture systems**. This means that the fumes are sucked up inches from the arc. There are also low-vacuum high-volume source capture systems, as shown in Figure 3.

Often, you can tell whether or not your ventilation system is adequate. If you are comfortable and can breath easily during a weld, then you probably have adequate ventilation. However, if you feel faint or nauseous, turn off your welder, seek fresh air immediately, and notify your supervisor.



Figure 1. These welding hoods are used to exhaust a large area.



Figure 2. A high-vacuum low-volume source capture system.



Figure 3. A low-vacuum high-volume source capture system.

Risk of Explosion

The shielding gases used in arc welding are commonly **inert** or only slightly reactive. However, the cylinders that contain these gases are under intense pressure. Figure 1 shows the cylinder that must be present during welding. If the cylinder tip and valve were to break off, the cylinder would become a potential "rocket" because of the force of the thrust from the pressure.

The use of electricity near gas cylinders presents an additional risk. If current flows through certain gases, it can cause a chemical reaction. If the gas is held under pressure, this can cause an explosion. For this reason, an electrically "hot" electrode must never touch a gas cylinder. Always remember that when the welder is turned on, the electrode is capable of conducting current, even if you do not have a complete circuit.



Figure 1. When using shielding gas, welders must observe the appropriate safety precautions.

Preventing Explosion

Since gas cylinders are welding components that can potentially explode, you must inspect them regularly. Make sure that the gas cylinder and its hoses are not damaged to prevent leaks and avoid an accident. The cylinder must always be secured and upright, as shown in Figure 1. It must also be kept away from walkways, flying spatter, fuels, or combustible materials. Make sure that the **valve cap** is hand-tight and in place until the gas is needed.

Figure 2 shows a gas cylinder with a **regulator**. Before attaching a regulator, only open the valve slightly to prevent dirt from getting into it. Open the valve when standing to the side of the cylinder, away from the weld area or other sources of ignition.

Above all, it is important to learn about the materials you are welding and to know the risks involved when working with these materials. Make sure that you have the correct base metals, electrode, and shielding gas for a process. Never weld near flammable or combustible materials, and notify your supervisor immediately if you detect any damage to your welding equipment.



Figure 1. Gas cylinders must be secured to prevent explosion.



Figure 2. Welders must exercise caution when attaching a regulator to the shielding gas.

Lesson: 16/16

Summary

Every arc welding process has potential risks. The arc emits harmful UV and infrared rays, as well as intensely bright light. UV rays can cause arc flash and burning of the skin. Appropriate welding attire, such as dark colored wool or cotton clothing, protects the welder from UV rays. Additionally, the welding helmet contains a filter plate that protects the eyes and face from UV rays.

Spatter is extremely hot and can spray up to 35 feet from the welding area, which poses a burn and fire risk. Proper clothing protects the welder from spatter, and leather covering provides extra protection. Earplugs or earmuffs protect hearing and shield the ears from flying spatter. Maintaining a clutter-free workspace can help to prevent fire. If welding must take place in a questionable area, fire shields should be used.

One of the most serious risks to the welder is electric shock. Both primary voltage shock and secondary voltage shock can be fatal. Staying dry and maintaining insulation from the work area is crucial to preventing electrical shock.

Some arc welding processes emit harmful fumes, which can cause dizziness and eye and skin irritation. Proper ventilation prevents fume inhalation. Many shops use welding hoods to ventilate large areas. Although shielding gases are inert, they are held under pressure in the gas cylinders and can cause an explosion. Before welding, always inspect your shielding gas cylinder.



Figure 1. The welding shield protects the welder from the arc's bright light and harmful rays.



Figure 2. Protective leather clothing protects the welder from burns.



Figure 3. Appropriate ventilation protects the welder from harmful fumes.

Class Vocabulary

| | |
|--------------------------------------|--|
| American Welding Society | The non-profit society that regulates the industrial standards for welding. |
| Amperage | A unit of measurement that indicates the amount of current flowing in a circuit. The required amount of shading for a welding helmet's filter lens increases when more amperage is used for a weld. |
| Arc | The area in which electricity jumps from the electrode to the workpiece. The heat generated by the arc melts the base metals. |
| Arc Flash | An extremely painful condition that can result from exposure to UV rays. Arc flash can feel like sunburn on the eye; it is usually a temporary condition. |
| Arc Welding | A fusion welding process that uses electricity to generate the heat needed to melt the base metals. |
| Asphyxiate | To cause death by obstructing the breathing with inadequate oxygen or fume inhalation. |
| Auto-Darkening Welding Shield | A type of welding shield that automatically adjusts to the proper amount of shading for any process. |
| Chromium | A grayish metal that improves corrosion resistance. Hexavalent chromium is sometimes added to electrodes used in arc welding. |
| Combustible Material | An object that can quickly catch fire if it comes in contact with sparks or fire. Combustibles must never be present in a weld area. |
| Cotton | A fabric made from the fiber of various plants. For welding, cotton clothing is a good choice. |
| Earmuffs | Ear wear that protects hearing. Earmuffs also prevent flying spatter from entering the ear. |
| Earplugs | Ear wear that protects hearing. Earplugs do not protect the outer ear. |
| Electrical Shock | The flow of electricity through the human body. Electrical shock can be fatal. |
| Electrode | A device that conducts electricity. The required amount of shading for a welding helmet's filter lens increases when larger electrodes are used. Electrodes can also emit harmful fumes. |
| Electrode Holder | The insulated handle that clamps onto the electrode. The electrode holder must be dry and in good condition. |
| Exhaust | Any of various devices used to suck up harmful fumes in welding. |
| Face Shield | A hand-held welding shield, often used for bystanders to view the arc safely or for lighter welding jobs. |
| Filter Plate | The shaded protective lens inside the welder's helmet that filters out harmful rays and intense bright light. The amount of shading required depends on the welding process, electrode size, and amount of current used. |
| Fire Extinguisher | A portable device that uses a rapid spray of chemicals to put out small fires. |
| Fire Shield | A large, flame-resistant screen. Fire shields are placed around the area of welding to protect bystanders from spatter, the arc's harmful rays, and bright light. |
| Fire Watcher | A person other than the welder who keeps watch over the weld area. The fire watcher must be able to quickly respond should there be a fire or other emergency. |
| Flammable Material | An object that can quickly catch fire if it comes in contact with sparks or fire. Flammable materials can catch fire at lower temperatures than combustible materials. Flammables must never be present in a weld area. |
| Fume | Metallic vapor that is emitted during the weld process. The metallic vapor solidifies to form tiny particles of metal. |
| Fume Plume | A cloud-like area where welding fume collects. |

| | |
|--------------------------------------|--|
| Hexavalent Chromium | A grayish metal that contains the element chromium and oxygen. Hexavalent chromium is sometimes added to electrodes used in arc welding. |
| High-Vacuum Low-Volume System | A ventilation system that is meant to exhaust a smaller area. |
| Inert | A type of gas that is inactive and is not chemically reactive. Many shielding gases are inert. |
| Infrared Rays | Invisible rays emitted during the welding process. Infrared rays can damage vision. |
| Insulation | Material that does not allow for the easy flow of electricity. Proper insulation is mandatory to prevent electrical shock. |
| Lead | A conductor that provides an easy path for electricity to flow. Leads inside the welder must be repaired by trained technicians only. |
| Leather | A fabric made from the hide or skin of an animal. For welding, leather covering provides the welder with extra protection. |
| Low-Vacuum High-Volume System | A ventilation system commonly used in industry that is meant to exhaust a large area. |
| Nitrogen Oxide | A toxic gas that is created when UV radiation hits the air. Nitrogen oxide can cause symptoms including headaches, chest pains, and itchiness of the eyes. |
| Nontoxic | A substance that is not harmful. |
| OSHA | The Occupational Safety and Health Administration. A government agency under the U.S. Dept. of Labor that helps employers reduce injuries, illnesses, and deaths in the workplace. |
| Oxidize | To combine chemically and react with oxygen. |
| Oxyfuel Welding | A fusion welding process that uses a flame produced by gas containing oxygen and a gas fuel. |
| Ozone | A toxic gas that is created when UV radiation hits the air. Ozone can cause symptoms including headaches, chest pains, and itchiness of the eyes. |
| Polyester | A fabric made of man-made materials that can melt in the presence of the arc's extreme heat. Jerseys are sometimes made of polyester. |
| Primary Voltage Shock | An electrical shock from 120-480 volts that occurs in arc welding from touching a lead inside a switched-on welder and then touching the welder case or other grounded metal at the same time. |
| Rayon | A fabric made of man-made materials that can melt in the presence of the arc's extreme heat. Button-down shirts are sometimes made of rayon. |
| Regulator | The device used to control the amount of gas that flows from a cylinder during a weld. |
| Secondary Voltage Shock | An electrical shock from 60-100 volts that occurs in arc welding from touching the electrode while another part of the body touches the workpiece. |
| Slag | Cooled flux that forms on top of the weld bead. Slag protects cooling metal and is then chipped off. |
| Source Capture System | A moveable ventilation device that sucks up harmful fumes inches away from the arc. |
| Spatter | Liquid metal droplets expelled from the welding process. Spatter can spray up to 35 feet from the work area. |
| Submerged Arc Welding | SAW. An arc welding process that uses a consumable wire electrode, which deposits a layer of flux over the weld to prevent spatter. |
| Ultraviolet Rays | Harmful invisible rays emitted by the arc during welding. UV rays can damage a welder's vision and burn skin. |
| Valve Cap | A device used to prevent the flow of gas from a cylinder while not in use. |
| Ventilation | A means of providing fresh air. For the safety of the welder, welding requires proper ventilation. |
| Welding Helmet | A protective eye and face device worn during welding. Welding helmets protect the welder from the arc's harmful rays and intense bright light. |
| Welding Hood | A stationary ventilation device installed above the weld area. The welding hood sucks up harmful |

- fumes in its surrounding area.
- Welding Screen** A large fire-resistant screen placed around a weld area. Welding screens are commonly used to protect bystanders and to block stray spatter.
- Welding Shield** Another name given for eye and face protection worn during welding. Welding shields protect the welder from the arc's harmful rays and intense bright light.
- Wool** A fabric made from the soft covering of a sheep. For welding, wool clothing is the best choice.
- Work Cable** The path used in welding to conduct electricity from the welder to the workpiece. To prevent injury, the work cables must be in good condition and correctly installed.
- Work Clamp** The component that, along with the electrode, comes in direct contact with the workpiece during welding. The work clamp is connected to the work cable.