Lesson 1: Safety and Maintenance Procedures for Oxyacetylene Welding

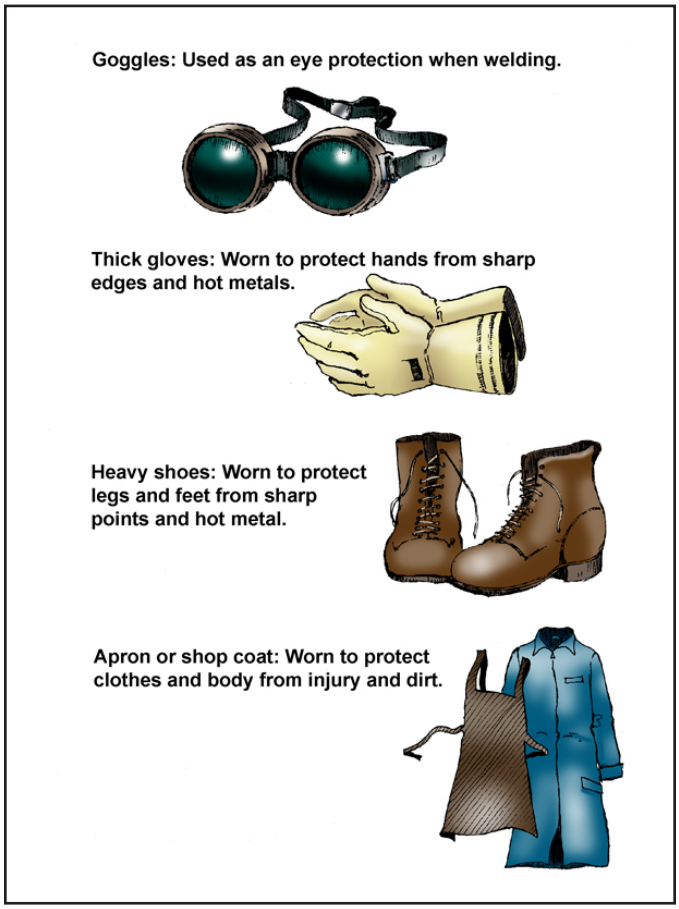
In oxyfuel processes, oxygen and a fuel gas (commonly acetylene) are combined to produce a high-temperature flame to heat, cut, or weld metal. These processes are commonly used in agricultural mechanics. Like arc welding, oxyacetylene welding can pose hazards but is safe when the operator is well trained and follows the safety precautions. This lesson discusses the hazards of oxyacetylene welding and the ways to avoid the hazards so that accidents can be prevented. It does not cover every possible risk; your instructor can provide other safety rules for the particular work setting or process.

Safety hazards of oxyacetylene welding include the volatility of the highly pressurized oxygen and acetylene cylinders, harmful fumes from gases and melting metal, burns from fire and sparks, and burns from light rays.

Protecting the Welder

- **Wear appropriate clothing and safety gear.** When using oxyacetylene, various clothing and gear are necessary to protect the body from sparks, burns, and harmful fumes. The eyes and other body parts must also be protected from harmful light rays. See Figure 1.1.
  - o Hands and feet: Leather gauntlet-style gloves and high-top leather shoes should be worn to protect the hands and feet.
  - o Body: Clothing should be wool or cotton. It should be dark and tightly woven, which helps block light rays. Shirts should be long sleeved and worn with the sleeves and top button at the collar buttoned. Pants should come down over the tops of the boots and be cuffless to avoid getting sparks caught in the cuffs. Other protective clothing, such as leather aprons and leather sleeves, are also available and should be worn as needed. Do not wear clothing with tears or frayed areas that can leave skin exposed or easily catch fire from the sparks. Do not wear synthetic materials, which can burn readily and give off poisonous gases. Do not carry items in pockets, such as matches or butane lighters, which could potentially catch fire or explode. Do not allow clothing to become saturated with fuel gas or oxygen, which would make the clothing highly flammable. If this happens, clothing must be aired out before it is safe to wear.
  - o Head and eyes: Welders should never look at the oxyacetylene flame with unprotected eyes; they should wear welding goggles with filter lenses appropriate for the work being done. Lenses with a 4 to 8 shade number are common for oxyacetylene welding. Consult the manufacturer's recommendations. Inspect the filter lenses for cracks and do not use them if they are damaged. Filter lenses are expensive and should be protected with clear cover plates. Wear safety glasses underneath the welding goggles to protect eyes from flying debris. Wear additional head and eye protection, such as a flameproof skullcap or face shield, as needed to avoid burns from sparks or hot metal spatter.

Figure 1.1 – Protective Gear for Oxyacetylene Welding

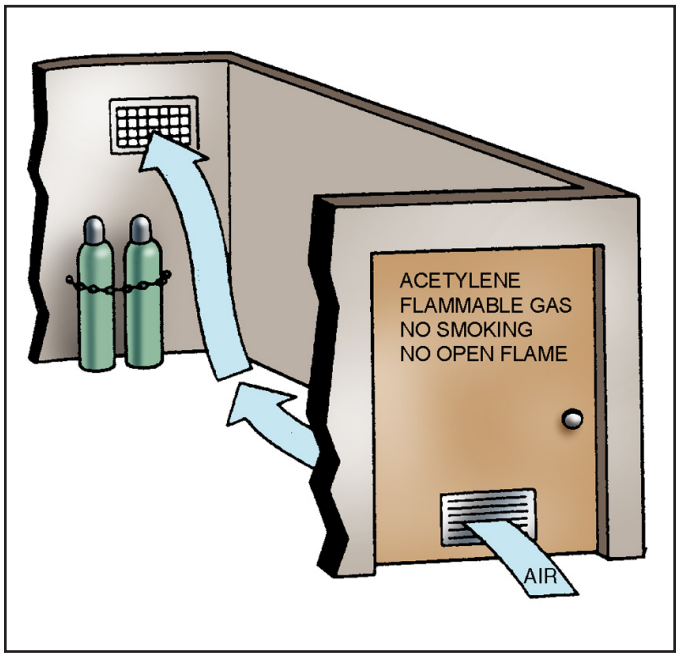


- Respiratory system: Some types of metals give off toxic fumes during the welding process. Metals that are covered with paint, grease, or other chemicals can also create a breathing hazard. In addition, acetylene fuel can displace oxygen in the air and cause respiratory problems. Working outdoors or in a large shop with high ceilings and natural ventilation is best. If this is not possible, use forced ventilation, such as hoods and exhaust fans. The ventilation system should be as close to the work as possible. Respirators also may be required depending on the size of the work area, ventilation available, and the metals being welded.

Protecting the Work Area

- **Make the work area as fire resistant as possible.** Oxyacetylene welding should only be done in fireproof surroundings, such as concrete floors and walls. Wooden floors or walls are combustible. The work area should be clean and free of trash, grease, oil, and other flammable materials. In case a person's clothes catch on fire, a fire blanket should be available to wrap around the person to smother the fire. An appropriately rated fire extinguisher, first-aid kit, and safety equipment should be kept within easy reach. Aisles and stairs should be kept free of obstacles for quick exit in case a fire occurs.
- **Work with adequate ventilation.** Besides eliminating breathing hazards, ventilation is required to protect the welder's clothing from becoming highly combustible due to saturation with oxygen or fuel gases. If possible, leave shop doors and windows open.
- **If natural ventilation is not sufficient, use forced ventilation.** A forced ventilation system can be hoods and exhaust fans and should be as close to the work as possible.
- **Store cylinders correctly**. The acetylene and oxygen cylinders used in oxyacetylene welding are highly pressurized and may explode if not handled properly. Acetylene is highly flammable and care must be taken to prevent fires. See Figure 1.2.

Figure 1.2 – Proper Storage of Acetylene Cylinders



- Acetylene and oxygen cylinders must be stored separately. If the cylinders are stored together and a fire starts, the fuel and oxygen might be released from the cylinders and cause a large explosion and/or blaze.
- Acetylene and oxygen cylinders should be chained upright or otherwise prevented from being knocked over. The valve may be damaged and cause a leak if the cylinder is knocked over. Use of a fuel cylinder that has been in a horizontal position can release acetone from the valve. This can adversely affect the cutting or welding process and damage equipment.
- The storage area should be locked and labeled with appropriate warning signs. These areas should only be accessible to authorized personnel and have signs posted warning people not to smoke or use fire near the area. Storage areas should be made of fire-resistant materials and located away from sources of heat and fire, such as furnaces and welding processes.
- Fuel storage should be adequately ventilated to eliminate buildup of fuel fumes if a leak occurs.

- Valve protection caps should be in place when the cylinder is not in use. Cylinder valves are fragile and can be damaged easily. Without the cap, the valve may break off a cylinder if it is knocked over or handled roughly. If the valve is broken off an oxygen cylinder, the cylinder may be propelled with great force. If the valve is broken off a fuel cylinder, a large flame may shoot out.
- A cylinder should be moved using a hand truck with a safety chain or by tilting it slightly and rolling it on its bottom edge with one hand on the valve protection cap. See Figure 1.3.

Figure 1.3 – Method of Moving a Cylinder

- If a cylinder is not properly labeled, do not use it. Return it to the supplier. If the cylinder does not have a label or if the label is illegible, it is impossible to be sure what type of gas is in the cylinder.

- **Do not attempt to heat, cut, or weld containers such as tanks, drums, and barrels.** These types of containers may have been used to store flammable substances, such as gasoline. The oxyacetylene process may cause an explosion and fire that can harm everyone in the area. Even though a container may look clean, it may still have fumes that can catch fire. Do not use oxygen to eliminate fumes in a container; this may cause an explosion and fire.

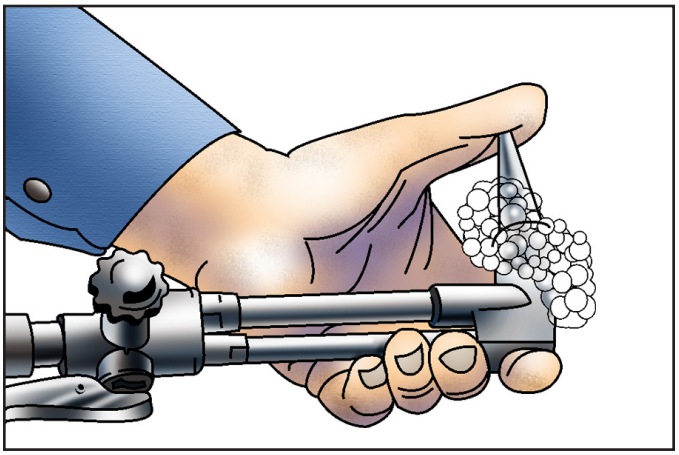
Safe Handling of the Oxyacetylene Outfit

Major parts of an oxyacetylene outfit include the following: acetylene and oxygen cylinders; a truck or other device to keep the cylinders upright; acetylene valve, regulator, gauges, hose, and fittings; oxygen valve, regulator, gauges, hose, and fittings; and a torch. Extreme care must be taken in handling the equipment.

- **Cylinders must be fastened to a wall, post, or approved cylinder truck so that they stay upright at all times.** The valve may be damaged and cause a leak if the cylinder is knocked over. Valve protection caps should be in place when the cylinders are not in use to prevent damage to the valves.
- **Follow the specific procedure for setting up the outfit that will be used and use only parts designed for that setup**. Parts, such as acetylene torch tips and cylinder regulators, can appear similar to those used with other fuel gases, but they cannot be used interchangeably without risk of explosion. For example, when a tip designed for acetylene is used with other fuels, the tip may explode or cause a backfire. When a backfire occurs, there is a loud snapping sound and the flame goes out.
- **Run hoses so that they will not be damaged or cause a tripping hazard.** Be sure that hoses are not exposed to sparks and molten metal and are not located where the welder or others must walk or stand. In temporary work sites, keep hoses covered to protect them from traffic.
- **Check all connections with a leak-detecting solution.** An important step in setting up oxyacetylene equipment is applying a leak-detection solution, such as soap and water, to all connections. Fittings

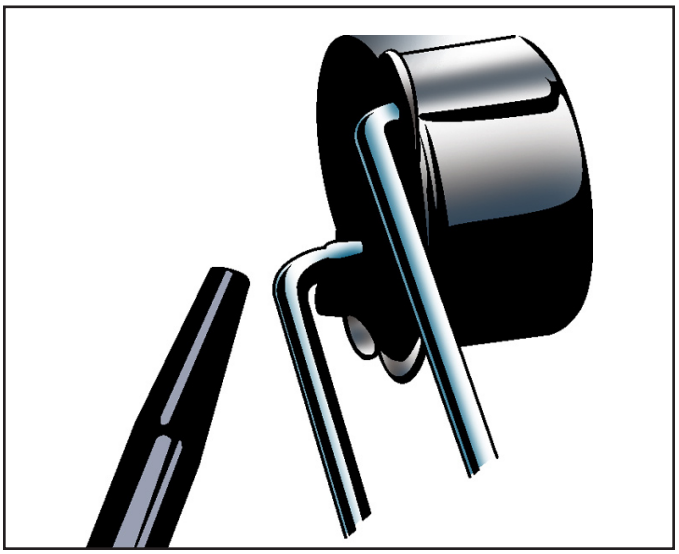
in areas that bubble should be tightened. See Figure 1.4. Note that leaking valve stems in cylinders should not be repaired or used. Turn off the valve, label the cylinder as "bad," and inform the supplier.

Figure 1.4 – Checking Connections for Leaks



- **Do not use petroleum-based solutions to check for leaks and do not use grease to lubricate parts.** These substances can cause a fire hazard in the presence of oxygen.
- **Use a spark lighter held at an angle to light the torch.** See Figure 1.5. Ensure the spark lighter is long enough to keep the operator from being burned by the flame. Do not use a match or butane lighter as this may cause a flare up that may harm the operator.

Figure 1.5 – Using a Spark Lighter to Light a Torch



Position the torch so that the tip is pointing away from the operator, other people in the area, and combustible objects.

- **Always be sure the flame is off before setting the torch down.** If work is suspended for some time, the outfit must be shut down.
- **Follow the correct shutdown procedure when finished.** Close all points where oxygen or fuel gas can escape and bleed lines of any remaining gas. This prevents any undetected leaks in the system from causing a fire or explosion.
- **If equipment catches fire, turn off the gas at the tanks immediately**. If the fire does not go out, leave the area and call for help.

Maintaining the Oxyacetylene Outfit

Maintaining the equipment in an oxyacetylene outfit also promotes safety. This section discusses additional maintenance recommendations for specific pieces of oxyacetylene equipment. Consult the manufacturer or your instructor for other maintenance concerns.

Hoses

Hoses should be inspected regularly and repaired or replaced if they show signs of damage. Using tape to fix a leaky or damaged hose is an unsafe and inadequate way to repair it. When not using the hoses, coil them and store them where they cannot be damaged or cause damage to other equipment. For example, hanging the hoses over cylinder regulators can break the regulators or cause a leak.

Regulators

When the oxyacetylene outfit is not in use, regulators should not be left under pressure. Leaving regulators under pressure can stretch their internal parts, which will make them less accurate and reduce their life expectancy. It is important to use the proper tool to attach and remove regulators so that the fittings are not damaged. Regulators are designed so that they do not require oiling. Oiling a regulator can cause a fire or explosion. Only a properly trained technician should perform repairs on regulators.

Torch Tips

Many torch tips are made of a soft metal and should be handled with care. Dropping them or subjecting them to other types of impact can damage the tips. Tips become dirty and clogged from use and should be inspected and cleaned frequently. Tip cleaners in various sizes are available to insert in the tip openings to remove dirt and spatter. It is important to use the correct size of tip cleaner. For example, if the tip cleaner fits too tightly, it may enlarge the tip openings. Damaged tips should be reconditioned or replaced as needed to ensure proper function.

Summary

Oxyacetylene welding is useful and safe when the welder follows the rules and is well trained. However, it has potential safety risks, such as explosions, burns, light ray burns, and breathing hazards. Welders must understand how to protect themselves by wearing protective clothing, ensuring the work area does not pose a fire hazard, and properly handling and maintaining oxyacetylene equipment.

Credits

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