



OXYGEN/ACETYLENE WALK THROUGH

This guide briefly highlights equipment and protocol covered in Metal 2 and Metal Foundations. Oxy/Acetylene rig users must first be certified by Open Works staff. Misuse may lead to lethal injury and destruction of our makerspace. Ask a technician for assistance if you have any hesitation using the equipment.

KNOW THE BASICS

This versatile system consists of two tanks, **oxygen** and **acetylene**. Acetylene is a HIGHLY volatile gas, used as a fuel to combine with oxygen to burn at roughly 6300 °F. Oxygen is added to produce a greater heat, and oxidizes the metal. This facilitates welding, cutting, forging, heating, and bending processes, which require different torches to manipulate the flame: a **welding torch**, a **cutting torch**, and a **Rosebud torch** for heating. These torches come in different sizes, which typically determine the pressure settings for the gases, but at Open Works each only comes in one size. The torches and attachments are kept in a drawer in the red cart of the main metal shop work area. You will need to use a **striker** to ignite the acetylene, the same as you would use with a bunsen burner in a lab. Sometimes the **flint** wears out and must be replaced. **Tip files** should be used before working, to clean out any blockages of debris or soot from the holes of the torch.

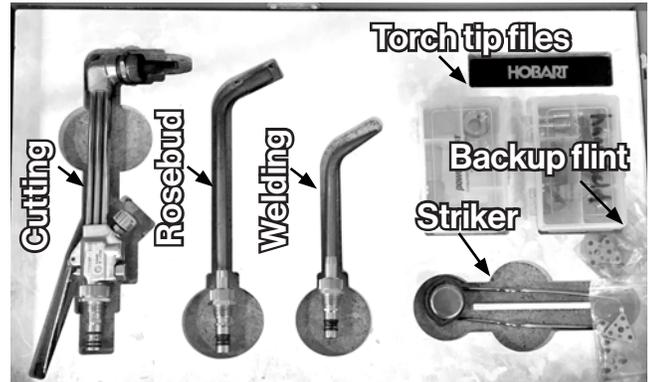


FLASHBACK SAFETY

Utmost caution and awareness must be exercised to use the oxy/acetylene rig. The most dangerous hazard is **Flashback**, which results when a backfire takes place in the mixing chamber of the torch. Unless you shut off the oxygen valve, the flame burning in the torch head could ignite gases in the hoses and result in an explosion that will progress through the torch, hoses, regulators, and into the cylinders. Consequences can range from a burst hose to a lethal explosion of the regulator and cylinders.

Causes of flashback include

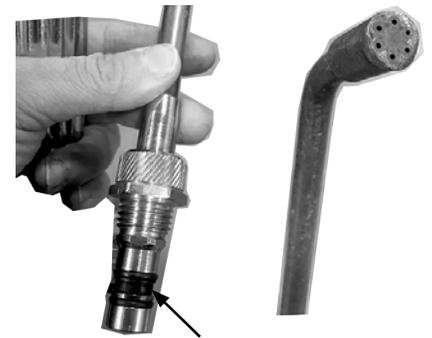
- Improper gas pressure
- A clog in the torch
- Improper or loosely fitted parts
- Lighting the torch with both gases flowing/without bleeding the lines
- Letting the torch tip touch the workpiece



THE WELDING TORCH

The welding torch is the most approachable to get used to handling the rig. However, welding with oxy/acetylene requires a lot of practice and patience. With this torch, you can weld, braze, and even solder metals such as mild steel, copper, and brass. The welding tip can also be used to heat small parts, and for localized bends in thin metal.

- Recommended ratio is **1 part acetylene: 1 part oxygen**, ranging from 3 psi to 10 psi, depending on the thickness and type of material.



Check the O-Rings for cracks and charring.

Use the tip file to clear the holes of the torch.

THE CUTTING TORCH

The cutting torch cuts mild steel, from thin sheet, beam or plate up to 5/8" thick. It has an oxygen "blast" lever and three pipes. One for acetylene, one for oxygen, and another for the oxygen "blow out". The metal is heated by the flame of combined oxy/acetylene, until it turns cherry red. Once this temperature is attained, the "oxygen-blast lever" is pressed to release more oxygen.

The oxidization of metal produces the needed heat to continue the cutting process.

As the metal becomes molten iron oxide, it flows away from the cutting zone. What's left over forms a "slag" on the workpiece, which can be removed by gentle tapping and/or grinding.

- Recommended ratios are **1 part acetylene: 5 parts oxygen**, ranging from 5 to 10 psi (Acetylene), depending on the thickness of material.

THE ROSEBUD TORCH

A rosebud torch is used to heat metals for forging, bending, and even annealing. **A higher acetylene pressure is needed to safely use the rosebud**, and it consumes more fuel than the other processes. As such, be conservative when using it and monitor acetylene levels before and after use.

- Recommended ratios are **1 part acetylene: 4 parts oxygen**, ranging from 10 psi (Acetylene), OR **1 part acetylene: 1 Part oxygen**, as high as 15 PSI (Acetylene).



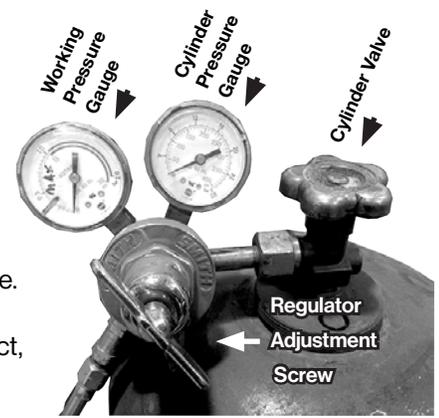
The torch body controls the gas output and connects the torch to the hoses. Always hold the torch body so that the torch valves are facing towards you, with the "Fuel" (acetylene) valve to your left and oxygen valve to the right.



GETTING STARTED

The following instructions apply to use any of the torches.

1. Ask a tech to retrieve the oxy/acetylene rig keys for you to unlock the tanks. The tanks are heavy, so find help moving the oxy/acetylene cart around the metal shop. (Knocking over a cylinder can result in an explosion.)
2. Inspect the torch: Use the tip files to clean any old clog. Look for cracks in the O Rings. If there are cracks, give the torch to a tech for replacement.
3. Check the hoses for any cracks or holes. Do NOT use a damaged hose.
4. Clear your work area of combustible materials, and clean your workpiece of oil, paint, or grease.
5. Connect the tip to the torch body. The valves should be facing up, towards you, and the tip should be connected so that it will be facing away from the valves, towards the floor. To connect, push the end of the torch in far enough for the locking nut to slip onto the threads of the torch body connection. Tighten the locking nut by hand.



OPENING THE TANKS

Wear eye protection when using the oxy/acetylene. Shade 5 is recommended for best visibility with oxy/acetylene to properly observe the flame. Thin leather gloves and a welding jacket should also be worn, and ideally leather shoes and natural fiber clothing. Remove any lighters or matches from pockets.

1. Never stand in front or behind a regulator when opening the cylinder valve. Stand to the side.
2. Always open the Acetylene valve first. **SLOWLY**, open the Acetylene tank **NO MORE than a 1/2 turn**.
3. Check the **cylinder pressure gauge**, and make sure that there is plenty of acetylene in the tank. Notify a technician if the contents are low. Using a near-empty cylinder can also cause flashback.
4. Turn the **regulator adjustment screw** to set the flow rate. Watch the **working pressure gauge**. To increase pressure, turn screw clockwise. To relieve pressure, open the torch valve to bleed the gas, and turn screw counter-clockwise. Only make slight adjustments.

Do not set the acetylene pressure higher than 13 PSI. Working with acetylene at a flowrate above 15 PSI will release the acetone that stabilizes the Acetylene, and will damage the regulators.

5. **SLOWLY** open the oxygen cylinder valve. This should be fully opened. Set the desired flow rate.



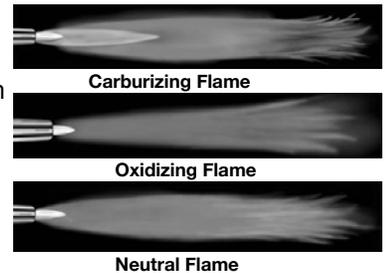
LIGHTING UP

1. Take the striker and hold it about 6" away from the tip. Strike it while pulling your hand away.
2. From here, you will need to regulate the acetylene burning in the atmosphere.

If the acetylene is flowing too high, there will be a gap between the torch tip and the flame. If the acetylene is too low, it will produce black soot. Slowly adjust the fuel valve until the soot clears from the flame, and the flame is connected to the torch tip.

3. Now slowly open the oxygen valve. The flame will turn blue, with a cone at the tip. Watch the cone while adjusting the flame. There are three different flames that will form while adjusting the gas:

- **Carburizing flame:** Contains excess acetylene, has three distinct zones
An outer envelope of a soft blue flame, which contains the other two zones
The acetylene feather, which is a narrow long, darker blue cone
The inner cone, which is short and light
- **Oxidizing flame:** Contains excess oxygen; The inner cone sharpens more, and the acetylene feather disappears. The outer envelope will narrow. Accompanied by a loud hissing sound.
- **Neutral flame:** The neutral flame is most common for cutting and welding, and is an even blend. To adjust a neutral flame, open the oxygen valve until the acetylene feather disappears and the outer cone remains wide and soft. The inner cone will become sharp, and the flame is quiet.



SHUTTING DOWN

1. Shut the oxygen torch valve first. Shutting the fuel first will cause backfire and make a loud pop.
2. Slowly close the fuel torch valve.
3. Close the Oxygen Cylinder Valve and purge the oxygen from the hose by reopening the oxygen torch valve. Watch the working pressure gauge to drop to 0. Shut the torch valve again.
4. Backout the oxygen regulator adjustment screw counter-clockwise until loose. Close torch valve.
5. Inspect the acetylene cylinder pressure and ask a tech to record the gas level. Follow the same steps as oxygen to shut down the acetylene.
6. Watch to make sure pressure doesn't build up into the line again, put the torch away and lock up cylinders.

If using the cutting torch, preheat the metal at the beginning edge of the cut with the neutral flame. Once the molten metal turns bright cherry, press down the **oxygen blast lever** and hold it through the cut.

- Double check work area to insure that no slag, or workpiece will fall directly onto the hoses.
- Do not cut directly on concrete. This may result in the concrete exploding.