

# Oxy-Acetylene Safety and Procedures

## Basic Background Knowledge

The greatest use for the oxyacetylene equipment is as a heating and metal cutting device. With instruction and practice it can also be used to weld and braze steel and cast iron, which can sometimes be too difficult with other welding processes. The equipment can be kept in the shop, or if properly secured, can be taken out to the field. It does not require any electrical power and can be used on a variety of thickness of materials.

As a welding torch, the basic operation of an oxyacetylene unit is blending two gases, oxygen and acetylene, together in the right proportion to create a proper size flame. The flame is used to melt two



pieces of metal to the point that they reach a liquid type state and flow together. This is called fusion and in most cases a filler metal rod is also heated and added to the liquid puddle. If done properly, the cooled weld can be very strong and have the same characteristics as the original part.

As a cutting torch, the operation also introduces a stream of pure “higher pressured” oxygen to the heated metal. This stream cuts (burns) a path through the metal and allows us to separate sections of base material. This flame will reach a temperature of 4400°F to 6000°F (2400°C to 3300°C), depending on the fuel gas used as well as the ratio of oxygen to fuel gas.

As a heating tool, the torch can be helpful for bending metal, getting bent parts back to where they belong, or for freeing rusted bolts.



## Equipment

**Oxygen Cylinders** – These tanks are made of steel and come in many sizes. Cylinders are under a lot of pressure so be careful when handling them. They have a high-pressure valve on them with a safety nut that will burst and let the oxygen out safely if the pressure in the cylinder becomes too great. Never move cylinders around without the safety cap on, unless attached to an approved oxyacetylene mobile cart. Oxygen from these cylinders is not a substitute for compressed air. This oxygen can be 99% pure and makes things burn really fast.



**Acetylene Cylinders** – These cylinders have lower amounts of pressure in them, but can be quite dangerous because acetylene is a fuel and can easily ignite. As a safety measure, acetylene should never be released or used at a rate above 15 pounds per square inch (p.s.i.). Raw acetylene gas has a very strong odour (worse than propane) when released. It is a bad smell, but if it is leaking you know it right away.

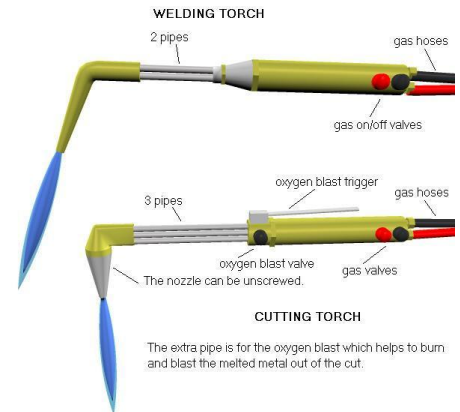
**Regulators** – A regulator is a device used to control pressure from the tanks by reducing pressure and regulating flow rate. Regulators for oxygen and acetylene are different. Acetylene regulators have a male fitting with a left hand thread and oxygen regulators have a female fitting with a right hand thread. Normally, both types will have two gauges on them. One will indicate the amount of pressure left in the cylinder and the other will indicate the amount of pressure that has been set by the operator to go to the torch. There is an adjusting screw in the centre of the regulator that is used to adjust the flow of gas.



**Hoses** – As with regulators, the fittings on oxyacetylene hoses are different than the oxygen ones. The acetylene (fuel) hose has left hand threads and the oxygen hoses have standard threads. The acetylene hoses are usually red and the oxygen hoses are green. You must be careful to keep the hoses protected from damage as they are made of a flexible rubber.

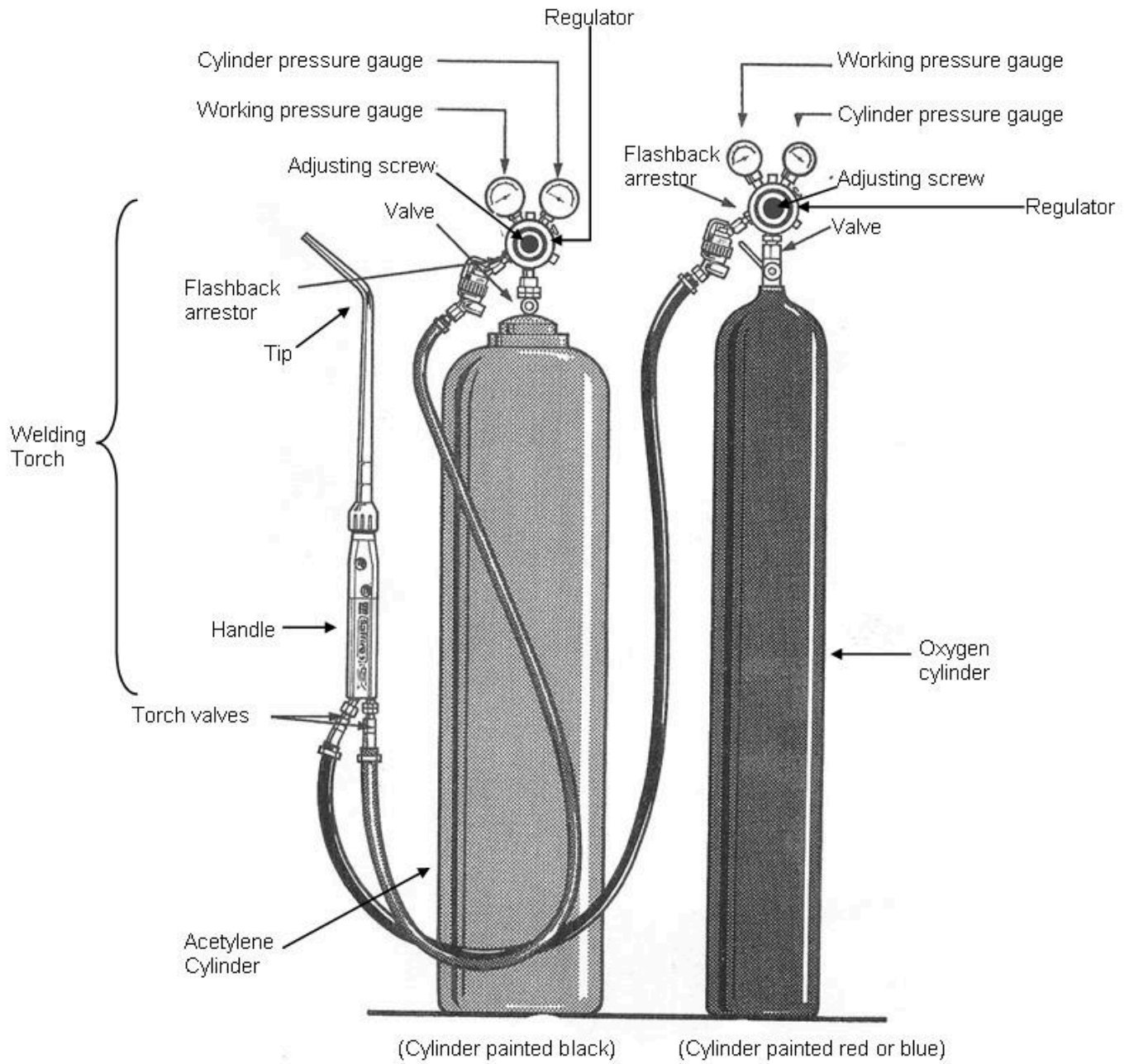
**Flashback Arrestors** – This is to stop the travel of a spark up a hose and into a cylinder; which may result in an explosion.

**Torches** – The torch (blowpipe) is the part that the welder holds and manipulates to make the weld. The most common torch for general versatility is a “combination torch”. This allows the operator to install welding tips (various sizes), heating tips (also called a rose bud), and cutting attachments to the body (handle) of the torch.



**Goggles** – Welding/cutting goggles should be worn at all times when welding, brazing, cutting, or when a lot of heating is required. They should have a number 4, 5, or 6 shade filter lens in them and be C.S.A. approved. They are made to protect your eyes from sparks, dust, and damaging light rays that can be produced. At **all times** in a shop where there are potential sparks or fragments, safety glasses with a side shield should be worn.





## Backfire and flashback

A **backfire** (a single cracking or 'popping' sound) is when the flame has ignited the gases inside the nozzle and extinguished itself. This may happen when the torch is held too near the workpiece.

A **flashback** (a shrill hissing sound) when the flame is burning inside the torch, is more severe. The flame may pass back through the torch mixing chamber to the hose. The most likely cause is incorrect gas pressures giving too low a gas velocity. Alternatively, a situation may be created by a higher pressure gas (acetylene) feeding up a lower pressure gas (oxygen) stream. This could occur if the oxygen cylinder is almost empty but other potential causes would be hose leaks, loose connections, or failure to adequately purge the hoses.

Non-return valves fitted to the hoses will detect and stop reverse gas flow preventing an inflammable oxygen and acetylene mixture from forming in the hose. The flashback arrestor is an automatic flame trap device designed not only to quench the flame but also to prevent the flame from reaching the regulator.

## Backfire or flashback procedure

After an unsustained backfire (single "popping" sound) in which the flame is extinguished:

- close the torch control valves (acetylene gas first)
- check the nozzle is tight
- check the pressures on regulators
- re-light the torch using the recommended procedure

If the flame continues to burn:

- close the oxygen valve at the torch (to prevent internal burning)
- close the acetylene valve at the torch
- close cylinder valves or gas supply point isolation valves for both oxygen and acetylene
- close outlets of adjustable pressure regulators by **winding out** the pressure-adjusting screws
- open both torch valves to vent the pressure in the equipment
- close torch valves
- check nozzle tightness and pressures on regulators
- re-light the torch using the recommended procedure

When a backfire has been investigated and the fault rectified, the torch may be re-lit. After a flashback, because the flame has extended to the regulator it is essential not only to examine the torch, but the hoses and components must be checked and, if necessary, replaced. The flashback arrestor should also be checked according to manufacturer's instructions and, with some designs, it may be necessary to replace it.

# Safety

**Safety is a full-time responsibility.** Accidents don't need to happen. Always follow these basic safety rules when working with oxy-fuel equipment:

1. Chain cylinders to prevent their falling over. An oxygen cylinder with over 2,000 psi in it becomes a lethal projectile if it falls over and its cylinder valve is sheared.
2. Vent the oxygen regulator valve before attaching the regulator to the cylinder. This blows any dust or dirt (which may be combustible) off the cylinder valve. Dust and dirt in the regulator inlet provides the fuel that can be ignited by the heat of recompression in an oxygen atmosphere. Inspect the filter in the regulator inlet, if so equipped, to ensure it is in place and it is clean.
3. Open the oxygen cylinder valve slowly, and always stand to one side while doing this. This prevents the sudden pressure surge which is accompanied by substantial heat, and also prevents unnecessary strain on the regulator.
4. Purge the system by bleeding off each hose independently. If REVERSE FLOW has occurred, this precaution safely bleeds off the mixed gases.
5. When using Oxy-Acetylene, **always light the acetylene first**, when using alternate fuel gases with oxygen, it is permissible to light the torch with both gases flowing. Always check with the manufacturer or other authorities first before attempting to operate oxy-fuel equipment.
6. Use the correct tip size and pressure. Each tip is designed to operate at a specific pressure. If too much pressure is used, the system can be back-pressured and REVERSE FLOW occurs. If too little pressure is used, the tip will sputter and pop and perhaps encourage backfire or flashback.
7. Keep heat and flames away from combustibles. Obviously, if torch flames and sparks are around combustible materials, they can be ignited easily.
8. Do not use oxygen as a substitute for air. If clothing is blown off with oxygen, the clothing will absorb the oxygen. Then if a spark or other source of ignition touches the clothing, the three necessary ingredients for a fire are present. Combustible material burns more vigorously in an oxygen enriched atmosphere than in air. Serious injury may result.

9. The expression, "use no oil" is printed on every regulator gauge. Oil is a combustible material with an extremely low flash point. An oxygen regulator frequently has two of the three necessary ingredients for a fire. If the cylinder valve is opened quickly, the heat of recompression creates an ignition temperature. Oxygen is present, and if oil is also in the area, a combustion triangle is complete and a dangerous explosion can occur.
10. Never cut or weld on an enclosed container that may have contained flammable material. This includes oils, tars, waxes and fuel. Even if the container has been cleaned out, residual amounts of the flammable material may remain and can cause a violent explosion of the container.
11. Use only friction lighters or strikers to light the torch. Butane in lighters could ignite upon getting too close to a flame.



# Operation Procedures

## How to Properly Light, Adjust and Shut Down



Lighting, adjusting and shutting down an oxygen-acetylene torch is easy – especially when following the proper procedures. In addition to these easy to follow instructions, you must always be sure to follow the torch manufacturer's operating procedures.

### **First - before you attempt to light the torch follow these checks:**

1. Make sure regulator pressure adjustment screws are **backed out!**
2. Make sure torch valves are closed!
3. Stand away from front of regulator
4. Separately and slowly open the oxygen and acetylene cylinder valves
5. Adjust regulator pressure adjust screws to tip pressure settings

(10 psi for acetylene (max 15psi) and 40 psi for oxygen)

6. Open/close torch valves separately and fine tune pressure settings on regulators
7. Depress cutting lever and adjust pressure if necessary

### Lighting and adjusting the torch

1. Separately purge (let gas flow) both oxygen and fuel gas lines
2. Open fuel gas valve about 1/4 – 1/2 turn – not opening enough will produce black soot floaters
3. Ignite flame with striker
4. Increase fuel gas flow until flame leaves end of tip and no smoke is present
5. Decrease until flame goes back to tip
6. Open oxygen valve and adjust to neutral flame

Depress oxygen lever and make necessary adjustments



### Shutting down the torch

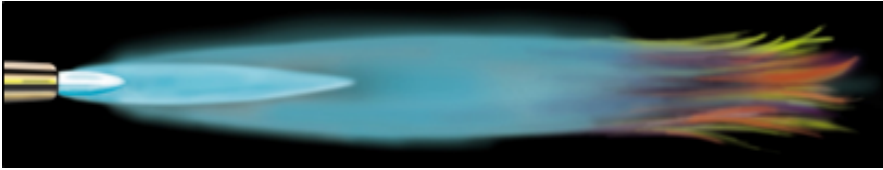
1. Close oxygen torch valve
2. Close fuel gas torch valve

If the torch/regulators and gases are not being used for a while, follow these procedures:

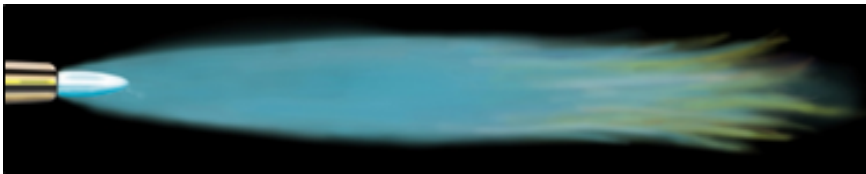
1. Close oxygen and fuel gas cylinder valves
2. Separately purge oxygen and fuel gas lines
3. Make sure all regulator gauges read **0 (zero)**
4. **Back out** regulator pressure adjustment screws!
5. If you are using in a commercial environment, report any damage, etc. to your supervisor

# TYPES OF CUTTING FLAMES...we want a neutral one...

Carburizing Flame ( too much fuel)



Neutral Flame



Oxidizing Flame (too much oxygen)

