

THE BEGINNERS GUIDE TO OXY-ACETYLENE WELDING EQUIPMENT

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The purpose of this page is to introduce the beginning welder to the equipment used in the Oxy-Acetylene welding process. This will be done starting with the cylinders and ending with the torch tip.

BACKGROUND

The use of gas welding dates back to the middle 1800's where a mixture of Oxygen And Hydrogen were used to produce a hot flame that was used in the making of jewelry. It wasn't until the late 1890's when the gas Acetylene became available that gas welding developed into the process that we know today. Acetylene is a gas that is manufactured by mixing Calcium Carbide,(a byproduct of the electric furnace steel making process) with water. Acetylene when burned alone can produce a flame temperature of about 4000 deg. F. With the addition of Oxygen a flame temperature in excess of 6000 deg. F. can be achieved, making Acetylene ideal for welding and cutting. An Oxy-Acetylene outfit is portable, less expensive and more versatile than an electric welding set up. By using the proper tips, rods and fluxes, almost any metal can be welded, heated or cut using the Oxy-Acetylene process.

There are many components that make up the Oxy-Acetylene outfit such as cylinders, regulators, hoses etc. The following is a typical outfit listing each component with a brief description of each.

CYLINDERS

Oxygen and Acetylene are stored under pressure in steel cylinders. They are sized by the ft³ of either Oxygen or Acetylene that they hold.

Cylinders should be tested regularly with the date of the last test stamped on the top of the cylinder. Cylinders should always be secured and used in the upright position. When a cylinder is not being used, the valve cap should always be in place.

OXYGEN CYLINDERS

These cylinders are made of steel and are usually painted green. They range in size from less than 20 ft³. To over 300 ft³ and contain compressed Oxygen at pressures that can be as high as 2200 psig. All cylinders have valves and (except the small "R" tank) are fitted with a screw on steel cap that protects the cylinder valve when the cylinder is not in use. If Oxygen comes into contact with oil or grease, it will burst into flame. Never use oil or grease on Oxygen cylinder

valves or regulators. Make sure hands and gloves are free of oil and grease before handling cylinders. Crack open the cylinder valve then close it before installing the regulator to clear the valve of any dirt. With the regulator installed, always crack the cylinder valve open first, then open it fully. This will lessen the chance of recompression which is caused by high cylinder pressure entering the regulator, heating up and damaging the regulator.

ACETYLENE CYLINDERS

These cylinders contain Acetylene under pressure, are painted black, (small "B" and "MC" tanks can be gray, silver or red) made of steel and have cylinder valves. They range in size from 10 to almost 400 ft³ capacity. The cylinders contain a porous filler material which is wetted with acetone that allows the Acetylene to safely be contained in the cylinder at 250 psig. Always use an Acetylene cylinder in the upright position so you don't draw any of the acetone out of the tank. Only open the cylinder valve 1 to 1 1/2 turns, leaving the valve wrench on the valve in the event it has to be shut off quickly. Acetylene should never be used at a pressure that exceeds 15 psig as it becomes highly unstable which, depending on the condition, could cause it to decompose and explode. As with the Oxygen cylinder, make sure the cylinder valve is clean before installing the regulator.

REGULATORS



With the pressure in a full Acetylene cylinder at 250 psig and a full Oxygen cylinder at 2200 psig, a way is needed to lower these cylinder pressures to desired working pressures for use in the torch. This is accomplished by using an adjustable pressure reducing regulator. The regulator will also maintain a steady working pressure as the cylinder pressure drops from use.

Basically, regulators work by admitting the high cylinder pressure through a valve which is operated by a flexible diaphragm. Turning the regulator adjusting knob in or out causes a spring in the regulator to operate the diaphragm. That opens and closes a valve in the regulator. This in turn regulates the outlet pressure and flow. By turning the adjusting knob in you increase the flow and pressure, out decreases the flow and pressure. Most regulators have two gauges. One shows the inlet pressure from the cylinder (the high pressure gauge) and the other (low pressure gauge) shows the working pressure being supplied from the regulator. There are regulators that are made for heavy duty or rough service that are not equipped with gauges, (referred to as gauge-less) and have a scale in the regulator body that is used to make pressure adjustments.

There are two general types of regulators, single-stage and two-stage. Both perform the same function but the two stage regulator will supply a more constant pressure as the cylinder pressure falls by compensating for any drop in cylinder pressure better than will the single stage unit. Also, two stage regulators are usually more heavy duty in construction and will last longer in heavy duty use and require less maintenance than the single stage units. Two stage regulators can be identified by their second pressure chamber where single stage units have only one. Oxygen and Acetylene regulators connect differently to their cylinders so they cannot be mixed up. Oxygen regulators have right hand threads and regulators for Acetylene and other fuel gases have left hand threads. You will notice a groove around fuel connections which indicate a left handed thread. Finally all outlet (low pressure) gauges on Acetylene regulators have their gauge scales marked in red starting at 15 psig. This is to act as a reminder not to use Acetylene at pressures over 15 psig as explained in the section on Acetylene cylinders.

WELDING HOSES

The cylinder regulators and torch are usually connected together by double line rubber hoses. Double line hose is known as type VD. The Oxygen line is green; the fuel line red. Hoses are available in four sizes, 3/16, 1/4, 3/8 and 1/2 inch I.D. There are different grades of double line hose used for Acetylene. They are:

- Non-oil resisting rubber cover
- RM- carries both a non-oil and flame and oil resisting cover
- (For use with all fuel gases & Acetylene) flame and oil resisting cover.

Grades R & RM should be marked for Acetylene only. Grade T should be marked fuel gas. All hoses should be marked as to their service level (light, standard or heavy). Date of manufacture, maximum working pressure, (200 psig) nominal I.D size and if it meets RMA/CGA IP-90 (Rubber Manufacturers Association, Compressed Gas Association) specifications for rubber welding hose. The fittings on the hoses are marked as to right and left handed threads.

Single line hose come in three grades, L, light duty, S, standard duty and H, heavy duty. All are also limited to a working pressure of 200 psig.

CHECK VALVES



For combustion to occur, fuel and Oxygen have to mix. This should only happen in the torch mixer or the torch tip. Sometimes, due to improper operation, fuel and Oxygen could feed back into the hoses and cause combustion in the hoses or regulators. (Not good!) Check valves when installed between the hoses and torch prevent this back flow as they close if a reverse flow starts. Check valves should be used with all torches.

FLASH BACK ARRESTORS

A flashback, which is a rapid high pressure flame in the hose, can occur if there aren't any check valves or the check valves fail to operate due to improper installation. Once a flashback starts, check valves cannot stop it, but a flashback arrestor will! The arrestor connects the same as the check valves, in the hose at the torch or regulator and contains a trap that is spring loaded that cuts off the gas flow in the event of a flashback. Both check valves and flashback arrestors are like they say, cheap insurance and should be included on every Oxy-Acetylene outfit!

TORCHES



The torch assembly consists of the handle, oxygen and fuel gas valves and mixing chamber. Welding tips or a cutting attachment can be used with the handle allowing it to be used for welding, heating and cutting operations. Oxygen and fuel gas flow through tubes inside the handle which blend in the mixing chamber or tip. It is at the tip that the mixed gases are ignited. There are two basic mixer types, the equal or medium pressure type (also known as balance or positive pressure type) and the injector type. The equal pressure type is the most common and is used with fuel gas pressures that are above 1 psi. Oxygen and fuel gas enter the torch at almost equal pressures. The injector type is used when fuel gas pressures are less than 1 psi. In this type, Oxygen at high pressure pulls the fuel gas into the mixing chamber.

WELDING AND CUTTING TIPS



The welding tip is mounted on the end of the torch handle and through it the oxygen and fuel gas mixture feed the flame. Tips are available in a variety of shapes and sizes to fit most any welding job and are identified by number. The larger the number, the larger the hole in the tip and the

thicker the metal that can be welded or cut. Welding tips have one hole and cutting tips have a centrally located hole with a number of smaller holes located around it in a circular pattern. The cutting Oxygen comes from the center hole with the preheat flame coming from the holes around it. Many factors determine the size tip to use, but mainly the thickness of the metal to be welded or cut determines which tip size to use. The attachments at the end of this article will serve as a guide to tip selection.

ACETYLENE WELDING TIPS

Metal	Tip	Rod	Oxygen	Acetylene
Thickness	Size	Size	Pressure	Pressure
In.	No.	In.	PSI	PSI
1/64 - 1/32	000	1/16	3	3
1/32 - 3/64	00	1/16	3	3
1/32 - 5/64	0	3/32	3	3
3/64 - 3/32	1	1/8	3	3
1/16 - 1/8	2	5/32	4	4
1/8 - 3/16	3	3/16-1/4	4	4

CUTTING ATTACHMENTS



A cutting attachment connects to the end of the torch handle in place of the welding tip and allows for the cutting of metal up to 8 inches thick. For cutting metal over 8 inches, the use of a cutting torch instead of a cutting attachment should be used. The fuel gas valve on the torch handle is used to adjust the fuel. The Oxygen valve on the torch handle is opened full and the Oxygen flow for the preheat flame is adjusted using the Oxygen valve on the cutting attachment. The cutting Oxygen is controlled by the lever operated valve on the attachment.

CUTTING TORCH



The cutting torch is connected to the hoses in place of the welding handle and is used for cutting thicker metal than can be cut with the cutting attachment, or for heavy duty cutting work. The

cutting torch like the welding handle is equipped with Oxygen and fuel gas valves with a lever operated Oxygen valve that controls the flow of cutting Oxygen to the tip. (Center hole in the cutting tip) In the two tube model, Oxygen and fuel gas mix and flow to the tip in the larger bottom tube with the cutting Oxygen flowing to the tip in the top tube. In three tube models, Oxygen and fuel gas flow to the tip in the bottom tubes and cutting Oxygen flows to the tip in the top tube.

WELDING GOGGLES & GLOVES

Proper welding gloves and goggles must be worn to provide protection when using an Oxy-Acetylene outfit. Gloves should be made for welding use. Goggles (or face shield) must be worn to protect the eyes from sparks and hot metal, especially when cutting metal. If you ever try to weld or cut without using goggles or a face shield, try this first. Stand in front of the outfit, close your eyes tight and adjust the regulators. That is if you can find them! (point made I hope!!) The proper lens shade should be selected in order to provide the maximum amount of protection. The following chart lists the recommended shade of lens that should be used for various welding and cutting operations.

Application	Lens shade no.
Brazing	3 or 4
Light cutting (up to 1")	3 or 4
Medium cutting (1 to 6")	4 or 5
Heavy cutting (over 6")	5 or 6
Light welding (up to 1/8)	4 or 5
Medium welding (1/8 to 1/2)	5 or 6
Heavy welding (over 1/2)	6 or 8

SAFETY

The following is a list of some safety items that should be followed when using an Oxy-Acetylene outfit.

1. Never use Acetylene gas at a pressure over 15 psig.
2. Never use damaged equipment.
3. Never use oil or grease on or around Oxygen equipment.
4. Never use Oxygen or fuel gas to blow dirt or dust off clothing or equipment.
5. Never light a torch with matches or a lighter. Always use a striker.
6. When opening an Oxygen or fuel cylinder valve, always crack it open first.
7. Always make sure regulators have their adjusting screws released by turning them counter clockwise till free before opening cylinder valves. Stand to the side of a regulator, not in front of it when opening cylinder valves.
8. Always wear the proper welding goggles, gloves and clothing when operating Oxy-Acetylene equipment. Pants should not have cuffs.
9. Always have a fire extinguisher handy when operating Oxy-Acetylene equipment.
10. Always replace cylinder caps when finished using cylinders.
11. Do not rely on the color of the cylinder to identify its contents as some suppliers may use different color codes.
12. Always use the proper regulator for the gas in the cylinder.
13. Always use cylinders in the upright position only.
14. Never store cylinders in temperatures over 130deg. F.
15. Always keep the valve wrench on the Acetylene cylinder valve when in use. Only open valve a maximum of 1 1/2 turns.
16. Do not carry lighters, matches or other flammable objects in pockets when welding or cutting.
17. Always be aware of others around you when using a torch.
18. Be careful not to let welding hoses come into contact with torch flame or sparks from cutting.