

BRAZING WITH PROPANE AND OXYGEN (OXY-PROPANE)

SUMMARY

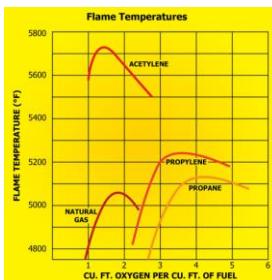
Most refrigeration piping is installed with joints assembled by flame brazing. A common brazing filler material is BCuP-5 (15% Ag, 5% P, remainder Cu). This is a self-fluxing brazing filler for copper to copper with a melting point of approximately 1190°F. Most installers use acetylene and oxygen (Oxy-Acetylene) torches to produce the temperature and heat required to braze copper tubing. While it may be possible to braze smaller tube sizes with an Alternate Fuel-Air (Air-Fuel) torch, the use of Fuel and Oxygen (Oxy-Fuel) is preferred. The use of propane and oxygen (Oxy-Propane) is a very good, if not preferred alternative to Oxy-Acetylene.

OXY-PROPANE VS OXY-ACETYLENE

Fifteen percent (15%) silver brazing filler melts at approximately 1,190°F and copper melts at approximately 1,984°F. To melt the brazing filler and to prevent melting the copper tube, a brazing temperature of approximately 1,500°F is recommended.

Oxy-Acetylene produces a neutral flame temperature of approximately 5,700°F at the tip of the inner cone. The temperature at the end of the outer envelope of the flame drops to approximately 2,300°F. This allows the operator to control the brazing temperature by varying the distance from the flame core to the copper tube. An Oxy-Acetylene flame has a heating value of 1,483 BTU/cubic foot. A neutral to slightly reducing (carburizing) flame should be used for brazing.

Oxy-Propane produces a neutral flame temperature of approximately 5,100°F in front of the inner cone. A large percentage of the heat in an Oxy-Propane flame is in the outer cone. This is a disadvantage for welding, but is an advantage for heating and brazing. An Oxy-Propane flame has a heating value of 2,600 BTU/cubic foot (175% of acetylene). With a higher heating value and slightly lower temperature, Oxy-Propane can heat copper tube faster than Oxy-Acetylene with less chance of melting the copper. As with Oxy-Acetylene, an Oxy-Propane flame should be neutral to slightly reducing (carburizing). Do **NOT** use an oxidizing flame for brazing copper.



By becoming familiar with the flame characteristics and brazing techniques of Oxy-Propane, brazing copper tube can be easier, faster and safer with propane compared to acetylene. Propane is more stable and does not have the handling and storage precautions of acetylene. However, propane is heavier than air and leaking fittings or discharge of propane can result in pooling or puddling of propane gas in low areas. This is a dangerous condition and **must** be avoided. Acetylene is lighter than air and leaks tend to dissipate more easily than propane, but may collect in high areas. In either case carefully check all equipment and hoses for leaks and do not allow propane or acetylene to leak into the surrounding atmosphere.

OXY-PROPANE BRAZING EQUIPMENT

The following equipment illustrates a possible combination of components for a complete Oxy-Propane brazing setup. There are other brand names and different quality levels available that will also work. This list is not intended as a recommendation, but as a possible combination of high quality components. Always check with a brazing supply specialist to determine the best options for your application.

Oxygen and Propane Cylinders: The oxygen cylinder should have a CGA-540 connection and the propane cylinder should have a CGA-510 connection (left hand thread).

Propane Regulator: Compressed propane does not have identical pressure as Acetylene. A "full" propane tank will indicate about 145 psi at 70°F. If the tank is in the sun and reaches 130°F, the pressure will increase to about 315 psi. The regulator shown below is a Harris model 425-50-510P. This regulator has a pressure gage on the inlet that reads from 0 psi to 400 psi. The pressure gage on the outlet reads from 0 psi to 60 psi, with a maximum rated delivery pressure of 50 psi. This is a "heavy duty" single stage regulator. Do **NOT** use a regulator previously used for acetylene for propane.



Harris Model 425-50-510P Propane Regulator

Oxygen Regulator: Commercially available compressed oxygen will indicate a nominal pressure of 2,200 psi at 70°F. The pressure will increase approximately 4% for each 20°F rise in temperature. The regulator shown below is a Harris model 425-50-540. This regulator has a pressure gage on the inlet that reads from 0 psi to 4,000 psi. The pressure gage on the outlet reads from 0 psi to 60 psi, with a maximum rated delivery pressure of 50 psi. This is a "heavy duty" single stage regulator.



Harris Model 425-50-540 Oxygen Regulator

Flashback Arrestors: Regulator mounted flashback arrestors are installed to prevent backflow of gases or flame into the regulator or storage tank. Flashback Arrestors should always be installed. These arrestors will not prevent back-fires or sustained back-fires within the torch. Proper flame adjustment is required to prevent back-fires or fuel burning in the tip or handle.



Harris Model 88-5FBR(L&R) Flashback Arrestors

Fuel Gas-Oxygen Hose: Propane or any fuel gas other than acetylene requires the use of T-Grade hoses. Shown is a $\frac{1}{4}$ " Twin, T-Grade hose with "B-B" fitting type (9/16"-18 RH&LH).



$\frac{1}{4}$ " Twin T-Grade Hose, B-B connection

Welding Handle: A welding handle is required to combine the propane and oxygen and allow for flame adjustment. This handle must have built-in check valves to help prevent backflow of gases into the hose. The handle shown below is a Harris model 19-6 w/CV. The Inlet connections are fitting type "B-B" 9/16"-18 (RH&LH). This is a "medium" duty handle.



Harris Model 19-6 Welding Handle with Check Valves

Mixer: To thoroughly mix the oxygen and fuel gas, Harris "E" style mixer designs rely on positive pressure control of both oxygen and fuel gas. Both gases enter the mixing chamber at controlled pressures. "E" mixers allow the end-user greater control of the oxy/fuel ratio. Also, because of their higher potential flow rates, "E" mixers are required for high flow heating applications.



Harris Model H-16-E Positive Pressure Mixer

Tip Tube: A tip tube attaches to the mixer and allows for the use of interchangeable brazing tips. The tip tube shown below is a Harris Model D-50-C Single Tip Tube for Medium Duty Welding, Brazing & Heating Tips.



Harris Model D-50-C Single Tip Tube

Brazing Tip: The use of propane as a fuel gas for brazing requires a different tip design than acetylene. The end of the tip is recessed. For the above D-50-C tip tube, the Harris 1390 series tips work well. Show below is a Harris 1390-5N. This is a tip designed for use with propane. This tip should work for 1/4" O.D. copper tube through 1-5/8" O.D. copper tube. These tips are easily changed for different tip size or replacement.



Harris Model 1390-5N Brazing Tip

Complete Assemblies: Shown below are regulators and flashback arrestors assembled and installed on tanks. Also shown is a completed torch assembly with handle, mixer, tip tube and brazing tip.



Completed Assemblies

SAFETY NOTICE

You should be familiar with "Safety in Welding and Cutting" - ANSI Z49.1, which is published by the American Welding Society. Material Safety Data Sheets (MSDS's) on various products, such as welding rods, wires and fluxes, also provide helpful safety and health information. Read the manufacturers' operating instructions for the apparatus you use. You should be familiar with the proper operation of all equipment before you start to work. **ALWAYS READ AND UNDERSTAND THE MANUFACTURER'S OPERATING INSTRUCTIONS AND YOUR EMPLOYER'S SAFETY PRACTICES BEFORE OPERATING AND MAINTAINING GAS WELDING, BRAZING AND CUTTING EQUIPMENT.**

VIDEO

Below is a link to Harris Products Group video discussing changing from Oxy-Acetylene to Oxy-Propane.

https://www.youtube.com/watch?v=c_njf9oD7Os&t=88s