

A Comparison of **OXYGEN- VS. AIR-ACETYLENE TORCHES**

Find out the difference between the two setups

When it comes to brazing, there are two main equipment options to consider: oxygen/acetylene or air/acetylene torches — Figs. 1, 2.

Traditionally, oxygen/acetylene setups have been dominant in many air-conditioning brazing applications across the United States. However, air/acetylene torches present a viable alternative. Contractors who have

experimented with air/acetylene torches often appreciate their portability and lower operating costs, which can outweigh the slight trade-off of longer heating times.

Operation Capabilities

The primary difference between the two setups lies in how acetylene is combusted.

Oxygen/Acetylene and Air/Acetylene Systems

An oxygen/acetylene system requires both a compressed acetylene gas cylinder and a compressed high-purity oxygen cylinder. These gases are mixed to produce an intense flame temperature.

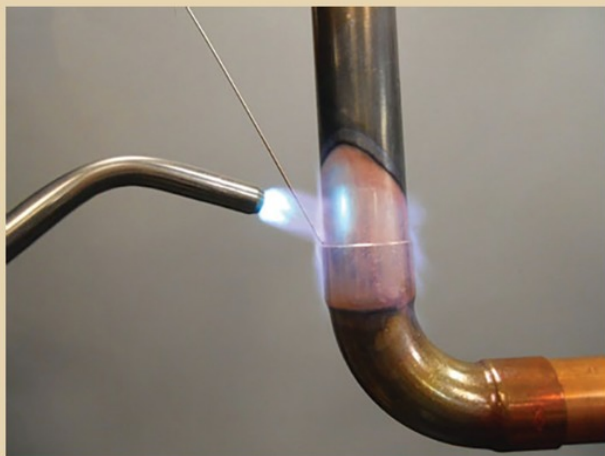


Fig. 1 — An air/acetylene torch melting a brazing alloy into an elbow joint.

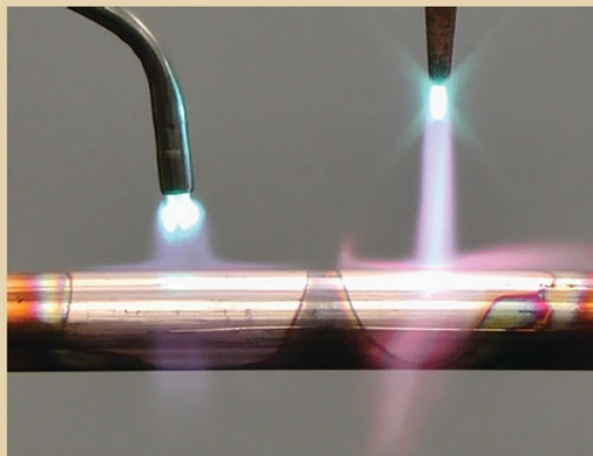


Fig. 2 — Heat spread patterns for air/acetylene (left) and oxygen/acetylene (right) setups.

On the other hand, an air/acetylene system utilizes only a single acetylene tank and draws oxygen from the surrounding atmosphere. This reliance on air presents a challenge because air contains only about 21% oxygen, making it difficult for older air/acetylene torches to reach the higher flame temperatures required for brazing. As a result, these torches have been more suitable for low-temperature soldering applications.

Modern Improvements

Modern advancements in torch design, such as the swirl combustion technology, have made air/acetylene systems viable for high-temperature brazing. In these torches, the acetylene gas passing through the tip expansion chamber creates a Venturi effect that draws in more air. The larger air volume mixes with acetylene at increased velocity, and a rotor or vane homogenizes the gases, resulting in a richer mixture that burns more efficiently. This unique tip design gives the flame its characteristic swirl pattern.

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Safety Considerations

Because an oxygen/acetylene system involves mixing two gases, there is a potential risk of flashback, which is the ignition of mixed gases. This safety concern is reduced with an air/acetylene torch because only a single gas is used. To view AWS Safety & Health Fact Sheets, including for fumes and gases, fluxes for arc welding and brazing, and many more, visit aws.org/standards/page/safety-health-fact-sheets.

Comparing Setups

In oxygen/acetylene setups commonly used in the heating, ventilation, air conditioning, and refrigeration industry, the gas cylinders are typically of the industry-standard MC size for

acetylene (10 ft³) and R size for oxygen (20 ft³). These cylinder sizes are compact and portable, but they do result in an uneven draw-off of gases due to their different volumes. As a result, contractors may find themselves making extra trips to the gas distributor or carrying backup cylinders to ensure an uninterrupted workflow.

To achieve the desired flame characteristics in oxygen/acetylene brazing, a neutral flame typically requires a close to 1.1:1 ratio of oxygen to acetylene. Achieving the right balance in the gas mixture is crucial for obtaining the ideal temperature and combustion efficiency during brazing. However, this means that gas consumption needs to be carefully monitored as imprecise adjustments may lead to an inefficient flame and waste of gas.

On the other hand, air/acetylene setups simplify the gas management aspect. With only a single MC- or B-size acetylene cylinder, there's no need to juggle multiple cylinders, reducing complexity and potential logistical challenges. Furthermore, air/acetylene torches provide greater flexibility in gas ratios because the oxygen is drawn from the surrounding atmosphere. The

The operator can adjust the air-to-acetylene ratio more easily to fine-tune the flame according to the specific brazing requirements.

Flame Characteristics and Brazing

Oxygen/acetylene flames typically measure around 5400°F at the end of the inner cone, while air/acetylene flames reach about 3000°F at a similar location, although temperatures can vary.

In welding or cutting, the concentrated heat of the oxygen/acetylene flame is necessary. However, brazing requires a different mechanism, known as capillary action, to pull melted brazing alloy between the parts being joined. To achieve uniform

capillary action, both parts must be evenly heated before adding the brazing rod. This broad preheat promotes heat conduction through the joint and brings both pieces to the correct brazing temperature.

Using oxygen/acetylene for brazing requires the torch to be kept in motion to evenly distribute heat because the highest temperature is focused at the end of the inner cone. It also needs to be located farther away from the part to avoid overheating, especially with brass or aluminum. In contrast, the air/acetylene flame is more forgiving. The inner cone can be placed closer to the part for a longer time without the risk of burning through the base metal. The broader flame wraps around the tube or fitting, providing wider heat distribution, making brazing easier, especially

for new technicians, according to many industry experts.

In the End

While oxygen/acetylene systems are popular due to their versatility in handling various applications, air/acetylene systems are preferred for soldering tasks and offer certain advantages, including ease of use and cost effectiveness, for specific brazing applications. **WJ**

NANCY JO LOEBKER is a national wholesale accounts manager at Harris Products Group, Mason, Ohio.



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