



## Brazing

# Natural Gas Offers Advantages for Brazing

*What fuel gas are you using for your brazing applications? If you are seeking a potentially more cost effective process that yields superior quality brazes, you might want to try the natural approach.*

About twenty years ago, the use of natural gas as a torch fuel for brazing applications was virtually unheard of. Of course, back then there were no such things as cell phones, DVD players, or the Internet either. The point is, technology has come a long way and today innovative systems and equipment are available that enable safe, low cost natural gas to be used as a replacement for propane, acetylene, and other fuel gases used in brazing.

From air conditioning and refrigeration to automotive and aerospace applications, more and more companies are discovering the advantages of natural gas for brazing and enjoying the



*Natural gas has a higher BTU content in the secondary flame to heat the joint more evenly, reduce the chance of oxidation, and promote a better quality braze.*

resulting benefits. These include lower costs, more convenience, enhanced safety in the workplace, improved quality of the finished work, and less cleaning. Here we take a look at why natural gas is an excellent choice for brazing, including some examples of companies and organizations that

made the switch from other fuel gases. There's also an overview of the type of equipment and systems available for brazing with natural gas.

### Growing Consumption

Wayne Engeron is president of Engineered Alloys Systems and Supplies in

Atlanta, GA, a full service company of offering sales of brazing products, as well as training and consulting on equipment and techniques. With more than 40 years of experience — including his recent appointment as District 5 Director of the American Welding Society — Engeron has seen demand for natural gas grow as a fuel gas among his customers.

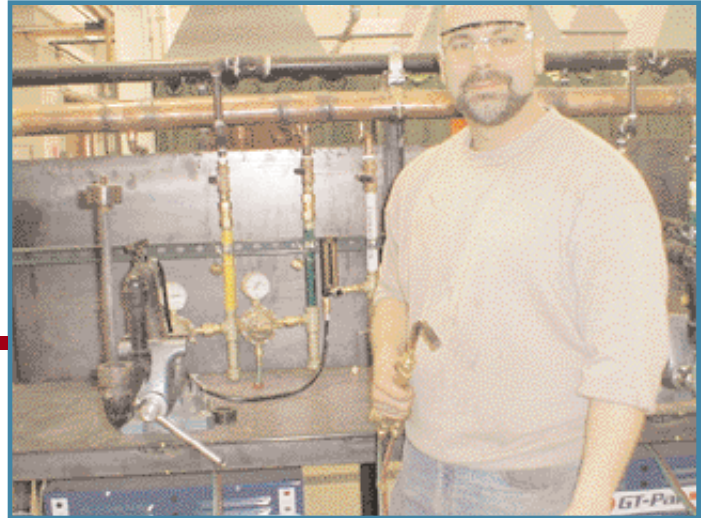
“Cost, cleanliness, and the flame profile provided by natural gas are the top three reasons my customers use it for their brazing operations,” he says. “Natural gas is less expensive, it burns cleaner with the lowest carbon possible, and it produces a more bulbous flame which enables a wide-spread, soaking type of heat that is more conducive to quality brazing.”

#### Lower Costs, More Convenience

The most significant benefit of using natural gas for brazing is its lower cost. Natural gas provides an average 15-to-1 price advantage over acetylene and a 3-to-1 advantage over propane. What’s more, with today’s equipment, there is no need to inventory a large number of cylinders; delivery and cylinder rental costs are eliminated.

Having a self-sufficient fuel gas supply is another major benefit of using natural gas. The local gas utility holds an endless gas inventory. Natural gas pressure booster systems operate on a simple connection to the standard low-pressure natural gas line, providing a continuous high

*Mike Lang says that apprentices are learning to make high quality brazes 25 percent sooner in their training with natural gas than they did when trained with acetylene.*



pressure gas stream. Companies do not need to waste productive time changing fuel gas cylinders.

#### Performance Advantages

Natural gas offers excellent performance and results in smoother, less porous brazes. Many brazers report that the rod flows better when heating with natural gas. Because natural gas has little carbon, no smoke is generated by torches and there is no carbon soot, resulting in cleaner work. “Fisheyes,” small bits of carbon formed by the combustion of the fuel gas that can mix with the braze alloy and contaminate the joint, are greatly reduced.

Additionally, the natural gas flame tends to wrap heat around the brazed fitting better than other fuels. Where an acetylene flame has a concentrated point of heat at the tip of the primary

flame, natural gas has most of its BTUs in the broader, bushier secondary flame. This makes it easier for the brazer to manipulate the torch, bringing the base metals to the right temperature to apply the rod, and hold the temperature over the entire joint while the braze is completed. When brazed joints are heated, allowed to cool slightly, then reheated, oxides form which destroy the integrity of the braze.

Melt-throughs are less common because the heat is broader and more evenly spread, compared to acetylene’s sharper, more concentrated heat.

#### Enhanced Safety

Improved safety is another inherent advantage of using natural gas for brazing. Natural gas is the safest of all commonly used torch fuels. It is lighter than air, so leaks quickly dissipate rather than accumulating in low areas like other heavier fuels. Natural gas can be used at pressures higher than 15 psi and it also has the highest ignition temperature and the narrowest band of combustibility of all competing fuel gases. Furthermore it is stable, non-shock sensitive and non-toxic.

#### Cases in Point

Manufacturers, brazing supply distributors, and the United Association of Plumbers and Pipefitters are just a few of the organizations singing the praises of natural gas for brazing. The following examples provide some insight on the advantages natural gas users experience.

*Mike Lang, CWI, demonstrates high quality brazing with natural gas at Plumbers and Pipefitters Local 501, Aurora, IL.*





Engeron cited diverse examples of customers using natural gas for brazing. An air conditioning and refrigeration equipment manufacturer uses natural gas to braze copper to copper in tubing assemblies, and copper to steel in assembling tubing to compressors. An automotive-components manufacturer uses natural gas for automated brazing systems that produce tube assemblies for air conditioning lines. A cutting tool company brazes carbide tips to tool steel with natural gas to produce drills, saws and router bits.

#### Switching to Natural Gas

The Condensing Unit Division of Copeland Corporation, Sidney, OH, is a leading manufacturer of condensing units for refrigeration and other equipment. Copeland operates approximately 20 brazing stations that use natural gas as a fuel gas to braze copper tubing sub-assemblies and on the assembly line to braze tube assemblies to condensing units.

Copeland had been using a methylacetylene-propadiene (C<sub>3</sub>H<sub>4</sub>) mixture as a fuel gas and evaluated natural gas as an alternative, starting with one system in their sub-assembly area. Before long the company purchased natural gas pressure booster systems from G-TEC Natural Gas Systems for all their tubing sub-assembly brazing lines, as well as a condensing unit assembly line. In manufacturing approximately 250,000 condensing units per year, Copeland's brazing applications include copper to copper, copper to steel, brass to copper, and monel to copper.

Norm Grell, manager of manufacturing services at Copeland, pointed to several benefits of using natural gas for their brazing applications. "We were initially attracted by the savings on the cost of fuel and the elimination of cylinder exchanges and the associated costs," he explained. "After using natural gas for a while, we found that the flame it produces provides better control of the finished product and that enhances quality."

Grell noted that the natural gas flame is not as hot as that of other fuel gases, which enables brazing personnel to keep the heat on for longer peri-

### Brazing vs. Welding

Brazing is suitable for many metal joining applications and often it offers advantages over welding. According to the AWS, brazing can be defined as a group of metal-joining processes involving two substrates in a surface bond, as opposed to the fusion bond of welding. In brazing, the metals being joined are heated but not melted. Instead a nonferrous filler metal melts and flows at temperatures above 800 degrees F. When the filler metal cools, it bonds to the base metal surface.

Brazing and soldering are similar processes, however, soldering is done below 800 degrees F while brazing is done below the melting point of the base metal, usually between 800 and 1,800 degrees F. With that in mind, advantages of brazing over welding include:

- Lower temperatures — Warpage and temperature-induced distortion in the base metal are less with brazing. Lower temperatures also allow brazing near other components, such as rubber, without damaging them.
- Easier field work — All that is needed for brazing is a torch, and with today's natural gas systems, cylinders are easily filled for portability.
- Versatility — Brazing allows the joining of dissimilar metals (i.e. steel tubing to cast iron), as well as components of different thicknesses. It even allows the joining of non-metallics such as ceramics to metal.
- Strength — A brazed joint is typically stronger than a soldered joint and in many instances is as strong as a welded joint. In fact, several brazing rods have a tensile strength of 80,000 psi.
- Better finished work—Brazing usually requires only minimal flux removal to enhance the final appearance of the brazed joint. That means less grinding, filing, or machining.

Of course, this is just a general comparison of brazing and welding. A particular application will dictate which method is best. It's important to keep in mind that one should never fusion bond a joint that was previously brazed. If an application requires both welding and brazing, the welding should be done first, then the brazing. Don't braze first. Otherwise, the higher temperature of the welding will melt away the braze filler.

ods of time for better flow of the alloy. Subsequently, the finished braze is smoother and requires less cleaning, which equates to less labor and costs.

The company was also able to eliminate their old fuel gas cylinders at each of their 20 stations, putting an end to the costs and inconveniences associated with the cylinders such as rental charges, storage, and exchanging empty cylinders. Now, with natural gas, Copeland has one central G-TEC system with a manifold to supply gas to each of the 20 brazing stations.

#### Training for Plumbers and Pipefitters

The United Association of Plumbers and Pipefitters Local 501, Aurora, IL, teaches refrigeration and medical gas brazing to 500 apprentices each year. Switching from acetylene to natural gas helped improve brazing training, cut costs, and make training safer. Lo-

cal 501 realized these benefits and more when they installed a G-TEC natural gas pressure booster system in their new training facility.

Michael Lang, CWI, is welding director at the training facility. He says that Local 501 is realizing several key benefits from using natural gas. "Apprentices are making high-quality med-gas brazes 25% faster when they are trained with natural gas compared to when they were trained with acetylene," he said. "The torch is easier to manipulate to heat the work properly and there are fewer melt-throughs. When learning high standards demanded by med-gas brazing, apprentices are able to produce top-quality work earlier in the training so they have more time to practice doing it the right way."

The local saves \$2,000 per month by using natural gas compared to the cost of acetylene. These savings come

from the lower cost of natural gas and eliminating cylinder rental charges. All the gas they need comes right from the utility line. They also saved \$10,000 on installation costs by installing natural gas units at their brazing stations, rather than having to manifold a large acetylene system.

Before the natural gas system was installed instructors took 20-25 minutes checking acetylene cylinders prior to class to make sure they were full and everything was ready. Now, with the natural gas system replacing acetylene cylinders, they come in, turn on the equipment, and they are ready to teach in less than five minutes.

As a bonus, Local 501's insurance premiums went down when they replaced acetylene with natural gas due to the inherent safety of natural gas.

After several months experience with the natural gas pressure booster systems, Mike Lang says, "This is the finest oxy fuel system I have ever used."

The System

G-TEC Natural Gas Systems, Buffalo, NY, develops and manufactures systems that make high pressure natural gas practical and portable for any-sized business. Dave Reichard, G-TEC's president, notes, "Many smaller and mid-sized companies are unable to get high pressure natural gas service from their local utility. Others may already have high-pressure service but want to use natural gas in portable applications. Our systems bring the benefits of high-pressure natural gas to anyone who has basic gas service, wherever they want to use it."

The company's GT-Pak Torch Booster systems elevate the pressure of utility natural gas service to levels required for brazing—as high as 500 ft.<sup>3</sup>/hr at 45 psi. The company also produces refuelers that allow refilling of portable natural gas cylinders for hand truck and off-site use.

In addition to Copeland and UA

Local 501, G-TEC has customers using its systems for brazing musical instruments, tool and die equipment, refrigerators, electric motor windings, auto and truck radiators, heat transfer systems, jewelry, and more.

G-TEC Natural Gas Pressure Boosters are certified in the United States and Canada as natural gas appliances. They can be installed in any building in the U.S. and Canada without special environmental conditions, such as ventilation interlocks. A G-TEC System will easily pass inspection by building inspectors or the Fire Marshal. Many G-TEC customers originally ordered their systems because they were not allowed to store other fuel gases in their facilities. ☺

*This story was edited from information supplied by Gas Technology Energy Concepts, Buffalo, NY.*

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