



A LINCOLN ELECTRIC COMPANY



USING ALTERNATE FUEL FOR HEATING APPLICATIONS

BY TIMOTHY READING



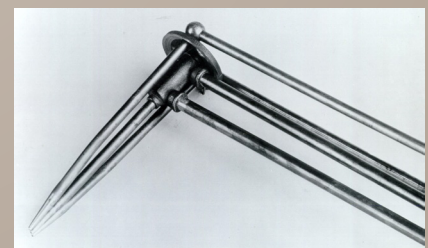
Oxy-fuel has been used in a variety of applications for cutting, brazing, welding, and heating for more than 100 years. In fact, John Harris invented the flame cutting torch in 1899, which led to the founding of Harris Calorific.

While much has been written about oxy-fuel as it relates to cutting, brazing, and welding, its significant role in preheating applications has not been as widely addressed, nor has the increasing role played by alternate fuels in this process.

THE PREHEATING PROCESS

Preheating or heating involves heating the base metal, either in its entirety or just the region surrounding the joint, to a specific desired temperature, called the preheat

temperature, before welding. Heating may be continued during welding, but frequently the heat from welding is sufficient to maintain the desired temperature without a continuation of the external heat source.



An early model of a Harris torch, circa 1903.

REASONS FOR IMPLEMENTATION

Typically, preheating is essential when there are larger, thicker pieces of material, such as in large-scale manufacturing, shipbuilding, or construction.

There are four primary reasons to utilize preheat, as detailed below.

- 1 *It lowers the cooling rate in the weld metal and base metal, producing a more ductile metallurgical structure with greater resistance to cracking;*
- 2 *The slower cooling rate provides an opportunity for any hydrogen that may be present to diffuse out harmlessly without causing cracking;*
- 3 *It reduces the shrinkage stresses in the weld and adjacent base metal, which is especially important in highly restrained joints; and*
- 4 *It raises some steels above the temperature at which brittle fracture would occur in fabrication.*

Additionally, preheat can be used to help ensure specific mechanical properties, such as notch toughness.

For optimal performance, efficiency, and safety in heating, it is important to have both the proper fuel gas along with equipment.

ALTERNATE FUEL HIGHLIGHTS

Using an alternate fuel, such as propane, propylene, natural gas, and proprietary gas blends, in heating can provide cost and performance benefits.



Acetylene can be used for heating applications, but there are many restrictions and safety concerns. **With acetylene, there is a limit to the amount of the gas that can be withdrawn from a cylinder; only one-seventh of the volume of the cylinder can be withdrawn at any one time.** Even the largest acetylene cylinders will not provide enough gas for the flow rates required by larger heating tips. Therefore, to properly and safely heat with acetylene, you have to use small heating tips and typically pigtail multiple cylinders together to allow for the needed withdrawal rates. In addition, acetylene cannot be used at pressures higher than 15 lb/in.², where the gas becomes unstable and can decompose explosively.

With alternate fuels, you are not limited to the one-seventh withdrawal rule or pressure restrictions, so larger tips can be used. In addition, fewer cylinders of gas are needed, so there are lower handling costs and rental charges, adding to the cost savings of alternate fuels.

Alternate fuels produce more BTU/ft.³ without extreme high pressures, allowing for better heating efficiency. By using alternate fuels in the oxy-fuel heating process, you will reach the targeted heating temperature faster than with acetylene.

THE IMPORTANCE OF PRESSURE SETTINGS, AVOIDING RESTRICTIONS

Two main issues need to be addressed in heating applications when compared to cutting applications. Both issues relate to the volume of gas used in heating processes. **One issue concerns having proper pressure settings at the regulators, and the other issue concerns avoiding restrictions in the torch, the tip, the hose, or even within the safety devices (flashback arrestors).**

For proper and safe heating, the gas must come out of the tip at the same rate or velocity as the flame burning back, so an equilibrium is created. That equilibrium should happen at the end of the tip. **With too much gas**

IDEAL EQUIPMENT

Different heating tips should be used depending on the heating application, as opposed to just decreasing or increasing the pressures for one tip size. But more must be done than merely changing tip sizes.

USE THE PROPER SIZE FLASHBACK ARRESTOR

A common heating problem seen with our customers concerns backfires or flames coming back into the torch. We often find they were using acetylene and had improper equipment, and this has resulted in injuries. They may try putting on additional flashback arrestors without realizing these devices can be making the problem worse.

*Flashback arrestors inherently cause about a **25% restriction of the flow of gas.** Flashback arrestors may be used between the regulators and the torch, but you must be sure to use the proper size.*

(pressure settings too high), the flame is not able to burn or propagate at a fast enough rate, and the flame can be blown off the tip. If there is not enough gas (pressure settings too low or restrictions in line) to equal the burning velocity of the flame, the flame will burn back into the equipment. These burn backs not only cause damage to the equipment (the tips can melt, closing some of the orifices and compounding the restrictions), they also put the operator at even greater risk of injury.

Flashback arrestors inherently cause about a 25% restriction of the flow of gas. This being said, flashback arrestors may be used between the regulators and the torch, but you must be sure to use the proper size. For example, a standard size flashback arrestor can be used for The Harris Products Group acetylene tips up to #4 and the company's alternate fuel tips up to #2. For tips larger than those, high-flow flashback arrestors must be installed. **Also, it is not recommended to use multiple sets of flashback arrestors (i.e., such as on both the regulators and the torch) in a single setup. A single set of flashback arrestors sized properly for either the torch or the regulators should be used.**

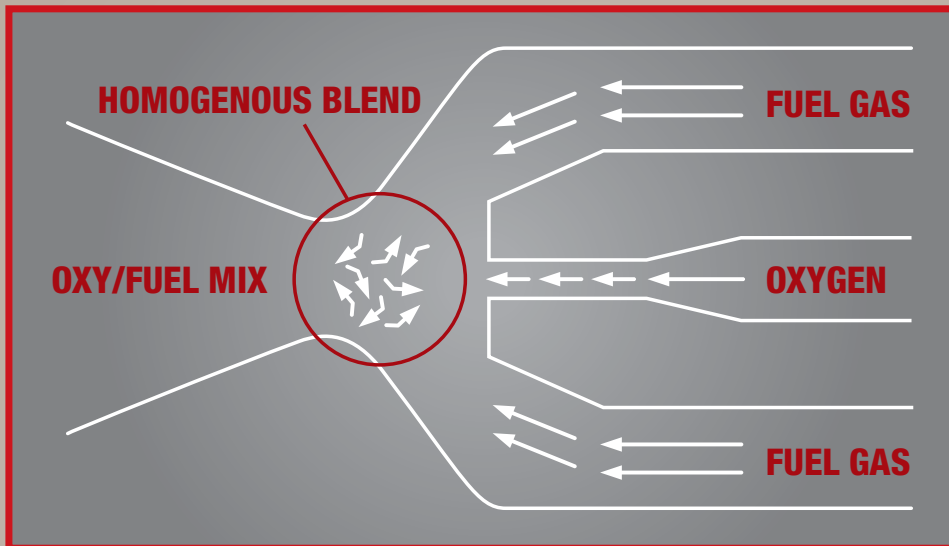


Fig. 1 Alternate fuel torches incorporate injector mixers designed to reduce pre-heat times and deliver more BTUs, which results in a greater combustion efficiency.

HANDLES AND MIXERS

For safe and proper heating, the operator should have a heavy-duty, high-flow capacity handle. These handles have larger tubes and valves to accommodate the increased volume of the gas flow needed. Along with the proper handle and tips, hose size is important. Just like with flashback arrestors, a 1/4-in. oxy-fuel hose can be used for Harris alternate fuel tip sizes #1 and #2. But for tip sizes #3 and above, a 3/8-in. hose is required to allow enough gas flow.

Manufacturers have developed special torches and tips to meet the exacting demands of heating. For example, Harris has designed heavy-duty handles and mixers that help to reduce heating times and provide optimal BTU efficiency — **Fig. 1**. In particular, the K-43 heating torch assembly features the Model 43-2 high-capacity torch handle to provide adequate gas flow for use with the largest heating tips — **Fig. 2**. In addition, the K-43 assembly includes the Model E3-43 mixer, which can be used with any size heating tip, and a 2393 stainless steel tip tube.

Recently, one of our structural manufacturing customers asked for help with their submerged arc welding application. They were trying to heat using multiple cylinders of acetylene and were not able to achieve the temperatures needed for the application. They also melted multiple heating tips in the process. **Following the advice of**



Fig. 2 The K-43 heating torch assembly by Harris contains the Model 43-2 high-capacity torch handle to provide adequate gas flow for use with the largest heating tips.

changing to alternate fuel and using the K-43 assembly, they were able to achieve the preheating that was essential for the project with one cylinder of fuel gas.



PARTING THOUGHTS

With alternate fuel and the proper equipment, a user can generate up to a million BTUs and handle any heavy-duty heating application. More information about the uses and benefits of alternate fuels can be found at harrisproductsgroup.com/alternatefuel.

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ABOUT THE HARRIS PRODUCTS GROUP

The Harris Products Group, a Lincoln Electric company with headquarters in the U.S., is a world leader in the design, development, and manufacture of cutting, welding, brazing, and soldering equipment, consumables and gas distribution systems. Products are sold and used in more than 90 countries.

For more information about The Harris Products Group and its products and services, please visit us at:

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