TORCH BRAZING

Prepared by:
R. L. Hall
Copper Development Association
W. D. Rupert
Wolverine Joining Technologies

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Photograph courtesy of SK Brazing
CHAPTER 12

TORCH BRAZING

INTRODUCTION

Torch brazing (TB) is a joining process that utilizes a fuel gas such as acetylene, hydrogen, natural gas, or propane mixed with oxygen or air to produce a flame used to heat the components being joined. The heating process involves proper heat placement by the movement of the torch, assembly, or both to achieve optimum brazing filler metal flow. For best results, both surfaces to be joined should reach the brazing temperature uniformly. The torches used for this process can have a single head or multiple heads with a single tip or multiport tips. They can be either hand held or stationary.

PROCESS FUNDAMENTALS

Torch brazing is a widely used process that requires a relatively low initial investment for equipment, particularly in the case of manual operations. Operator skill is readily acquired. The equipment is portable and can be used in other operations that require flame heating. The same basic equipment that is used in oxyfuel gas welding can be utilized in brazing.

Torch brazing is a flexible process for which any degree of automation can be achieved. For small quantities of joints, a single operator with a hand-held torch is sufficient. When the labor cost in manual torch brazing becomes prohibitive in larger production quantities, semiautomated, fully automated, or robotic systems are available.

In addition to the safety equipment described in Chapter 10, “Safety and Health,” the equipment used in torch brazing performs several functions. It must be capable of supplying oxygen (or air) and fuel gas to the torch tip at the correct mixture and the correct rate of flow. These variables affect the flame temperature, the heating rate, and the nature of the flame atmosphere. In the case of automation, the equipment must allow the brazement to be fluxed, heated, and cooled in a manner that produces sound brazed joints.

The process lends itself to the use of low-melting-temperature brazing filler metals, which, because of their excellent flow characteristics, simplify brazer qualification. The available brazing filler metal selections range from the low-temperature silver-based filler metals to the high-temperature nickel- and copper-based brazing filler metals. A variety of brazing filler metal forms such as wire, preformed shapes, or paste are all acceptable choices in torch brazing, facilitating the selection of the optimum material for each application.

Torch brazing is performed in an uncontrolled atmosphere without the need for a shielding gas. It may or may not require the use of a flux. This decision is dependant upon the brazing filler metal selection and the composition of materials being joined. For example, when brazing phosphorus deoxidized copper assemblies using a copper phosphorus (BCuP) brazing filler metal, flux is not required because the phosphorus combines with the oxides present to create an oxide-free, wettable joint surface.

Should a different filler metal such as a silver (BAg) brazing filler metal be selected to join the same phosphorus deoxidized copper assembly, a suitable brazing flux is recommended. The uncontrolled oxidizing environment around the heat-affected zone of the brazement produces a heat scale. Brazements should undergo postbrazing cleaning operations to remove heat scale and flux residue if present.

ADVANTAGES

The advantages of torch brazing are numerous. These include the following:

1. Any volume of joints can be fabricated. Small quantities can be brazed manually, and large quantities can be brazed automatically;