INTRODUCTION TO THE BRAZING PROCESSES

Photograph courtesy of Expert Brazing & Heat Treating, Inc.

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CHAPTER 11

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INTRODUCTION

The phrase brazing process refers to any combination of heat source, shielding strategy (or atmosphere), and loading technique employed that favor the formation of a metallurgically sound brazed joint. Roughly a dozen distinct brazing processes are in widespread commercial use in the United States today.

This chapter elaborates on some of the issues that must be considered to reap the full benefits afforded by these technologies. This is accomplished by clarifying how brazing processes are classified, selected, developed, and maintained.

PROCESS CLASSIFICATION

Individuals who influence decisions impacting the quality of brazed products must understand the manner in which brazing processes are classified. The classification of brazing processes involves condensing into one or two words important technical information about the manner in which heat, mechanical loads, and atmosphere controls are applied to an assembly during brazing. Thus, by understanding this classification, engineers are able to communicate a great deal of valuable technical information concisely and accurately.

The science of classification is known as taxonomy. Both the physical and biological sciences depend heavily on taxonomic strategies for many of the same reasons that metallurgical joining has begun to rely on it—primarily because it allows a wealth of scientific and technical information to be more readily accessed and compared.

The taxonomic chart in Figure 11.1 shows the system of brazing and soldering process classification that has been in use in the United States during the last several decades. It is primarily intended to serve as a reference for engineers and technicians that rely heavily on brazing to fabricate products.

The chart serves two primary purposes. First, it summarizes the basic categories of options available to the brazing engineer for the application of heat and the shielding of the parts to be brazed from oxidizing conditions. Second, for any given brazing process represented by each circle on the far right of the chart, typically employed heating, loading, and shielding options are defined.

PROCESS SELECTION

Brazing process selection is one of four main engineering decisions that influence the success of a brazing operation. The identification of the product’s function, the selection of materials, and the definition of the product’s shape all interact with the brazing process chosen to influence the success of the joining operation. Figure 11.2 illustrates the relationship between these variables. Problems with brazing operations can be avoided or resolved by the manipulation of any of these four variables.

On the whole, most brazing applications can be supported by not one but several possible brazing processes. However, significant technical or economic reasons generally make one particular process distinctively superior for a particular application.

For example, the aluminum stator assembly shown in Figure 11.3 could conceivably be brazed by dip brazing, furnace brazing, induction brazing, infrared brazing, or torch brazing. In most cases, as in this one, the down selection to one process from a