

CHAPTER 19

BRAZE WELDING



Photograph courtesy of The Lincoln Electric Company

Reviewers

M. J. Lucas  
*General Electric Aviation*  
D. J. Kotecki  
*The Lincoln Electric Company*

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## CHAPTER 19

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# BRAZE WELDING

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## INTRODUCTION

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Braze welding (BW) is a joining process that uses a brazing filler metal having a liquidus above 840°F (450°C) and below the solidus temperature of the base metal. The base metal is not melted. Braze welding differs from brazing in that the brazing filler metal is distributed by deposition rather than by capillary action.

The welding processes utilized for braze welding include oxyfuel gas welding (OFW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW), plasma arc welding (PAW), carbon arc braze welding (CABW) and shielded metal arc welding (SMAW). In all cases, bonding between the deposited brazing filler metal and the hot, unmelted base metals occurs in the same manner as in conventional brazing.

Braze welding was originally developed for the repair of cracked or broken cast iron components. The fusion welding of gray cast iron required extensive preheating and slow cooling to minimize the development of cracks and the formation of hard cementite. With braze welding, the lower joining temperature reduces the preheating time, virtually eliminates the formation of the brittle white cementite, and reduces the likelihood of thermal cracks.

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## PROCESS FUNDAMENTALS

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To obtain a strong bond between the brazing filler metal and the unmelted base metal, the molten brazing filler metal must wet the hot base metal. The base metal is heated to the required temperature with an oxyfuel gas torch or an electric arc. With oxyfuel gas braze welding, flux is required to clean both the base metal and the previously deposited filler metal. Flux also aids in the process of wetting (precoating) the joint faces.

During braze welding, brazing filler metal is fed to the progressively heated joint surfaces in one or more

passes until the joint is completely filled to the desired size.

The joint to be braze welded must be properly aligned and fixtured in position. Braze welding flux, when required, is applied to preheated brazing filler rod (unless precoated) and spread on thick joints during heating with an oxyfuel gas torch. Next, the base metal is heated with the flame until the temperature is sufficient to promote the flow and wetting of the joint area as the brazing filler metal rod is melted.

The joint is filled with one or more passes using operating techniques similar to those for oxyfuel gas or arc welding. Braze welding requires a more diffused heat pattern than does fusion welding. The inner cone of an oxyfuel flame should not impinge on copper-zinc brazing filler metals or on iron or steel base metal. The techniques used with arc welding processes are similar to those described for oxyfuel braze welding, except that flux is not used.

Historically, braze welding was performed using the oxyfuel welding process with a copper-alloy brazing filler metal and a suitable flux. Recently, carbon arc braze welding process, gas tungsten arc welding, gas metal arc welding, and plasma arc welding have been used extensively for braze welding. These processes can be used in the manual, semi-automatic, or automatic modes, depending upon the process or the setup, or both, without a flux.

The gas tungsten arc, gas metal arc, and plasma arc welding processes normally employ inert shielding gases. Helium, argon, or a combination of these are suitable for braze welding with brazing filler metals that have relatively high melting temperatures. The carbon arc braze welding process does not utilize a shielding gas.

Brazing filler metal selection, the proper wetting of the base metal, and adequate shielding from the atmosphere are important considerations for effective use of these processes.