Experts at Brazing & Metal Treating Specialize in High Production Copper Brazing

Copper Brazing or Welding is Customer Choice?

Hi TecMetal Group provides both welding and brazing services. This is an advantage for you when working with a metal joiner. Our goal is to utilize the best fit, form and functionality design and manufacturing processes in order to produce the best product for the application.

When considering which metal joining process to choose for a particular assembly, several factors should be considered: strength and permanence, the physical characteristics of the parts, the shape of the joint, and the production level desired.

Welding and brazing are the best preferred methods of joining when strength and quality are primary considerations. In continuous exothermic furnace brazing a pure copper filler metal is usually used. Brazing is viewed as a more robust process than welding.

General Product & Process Information

EXAMPLES OF FURNACE BRAZED PARTS:

Market/Category	Product Description	Process	Temperature (°F)	Equipment
Filtration/Wire Mesh	**Figure 1 Filter Body**	Copper Braze	2050°F	Exothermic Continuous Belt Brazing Furnace
Valves & Regulators/Swimming Pool	**Figure 2 Regulator Cover**	Copper Braze	2050°F	Exothermic Continuous Belt Brazing Furnace
Hydraulics/Mobile	**Figure 3 Hydraulic Motor Face Plate**	Copper Brazed	2050°F	Exothermic Continuous Belt Brazing Furnace
Hydraulics/Aerospace	**Figure 4 Hydraulic Motor Manifold Plate**	Copper Brazed	2050°F	Exothermic Continuous Belt Brazing Furnace
Airbag/Automotive	**Figure 5 Airbag Component: Photograph of Spot Weld Fixture Required to Hold Parts In Position for Furnace Brazing**	Copper Brazed	2050°F	Exothermic Continuous Belt Brazing Furnace

Figure 1 Filter Body

Figure 2 Regulator Cover

Figure 5 Airbag Component: Photograph of Spot Weld Fixture Required to Hold Parts In Position for Furnace Brazing

Figure 3 Hydraulic Motor Face Plate

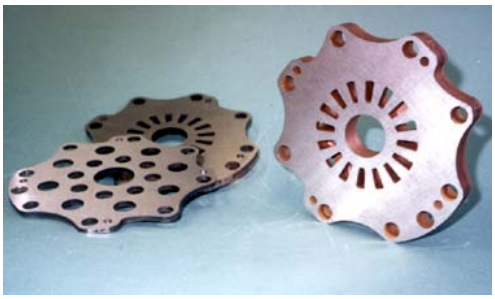


Figure 4 Hydraulic Motor Manifold Plates

Figure 5 Airbag Component: Photograph Brazed Airbag Detail

BRAZE, SOLDER OR WELD?

Although brazing, soldering and welding are defined as a joining process. Important factors and process differences to must be considered when depending on brazing, soldering and welding processes. Soldering is performed at lower temperatures than brazing. And, soldering does not produce as strong of a joint as brazing. Welding, a localized higher-temperature process in which the two metals to be joined are melted and fused together. Welding requires a great amount of heat energy to melt the filler metal and parent metals being welded. Both welded and brazed joints are usually at least as strong as the metals being joined. The welding process is ideal for applications which benefit from highly localized, pinpoint heating. But it is more difficult to apply to linear joining, not as easy to automate, and not easily adaptable for joining metals with different melting points.

It is also important to consider the physical characteristics of the parts and joint area. Because of its high temperature requirements, welding works best with thicker parts that can withstand the heat. which Brazing may be the best choice for thinner parts because metal warpage and distortion can be minimized. So for many metal joining procedures, furnace brazing becomes the most logical solution. The advantages and flexibility that brazing offers are most fully realized when braze process parameters are carefully considered at the assembly design stage.

Brazed parts, once conceptualized, can offer quality and cost reducing benefits over a constructed part made from one-piece [machined out of solid bar stock]. Copper brazed parts can be produced e quickly and economically. Our customers benefit by utilizing HTG brazing engineers and designers in order to best optimize the process, materials, component functionality, weight and economy. Expensive machining, casting and forging processes can be eliminated without compromising the integrity of the part. Lower cost raw materials such as sheet metal and screw machine components can be used. Metal stampings can also be utilized. The manufacturing process becomes faster, less costly and ultimately more profitable.

Exothermic atmosphere copper furnace brazing is particularly applicable for high-production fabrication in continuous conveyor-type furnaces. For medium-production work, batch-type furnaces can be used. In both types of furnaces utilized by Brazing& Metal Treating, heating is achieved by electrical resistance, although other types of fuel can be used. In order to achieve the best quality and lowest cost, the parts should be self-jigging or fixtured and assembled with filler metals preplaced near or in the joint. The preplaced filler metal may be in the form of wire, foil, powder, paste, slugs, or preformed shapes

Technical skill and knowledge of the fundamental principles of brazing, as well as, years of experience for the particular joining situation are needed in order to make high-quality brazed joints. In addition to typical joint inspection methods and braze filler metal quality control requirements, exothermic brazing also require internal performance in the area of the braze process development and monitoring of process procedures and practice.

Advantages and Limitations Of Copper Brazing

Brazing and Metal Treating is a specialist in the field of production copper brazing in an exothermic atmosphere. Our brazing services are most frequently used to produce brazed joints simple to complex metal parts. The basic advantages of our copper brazing process are:

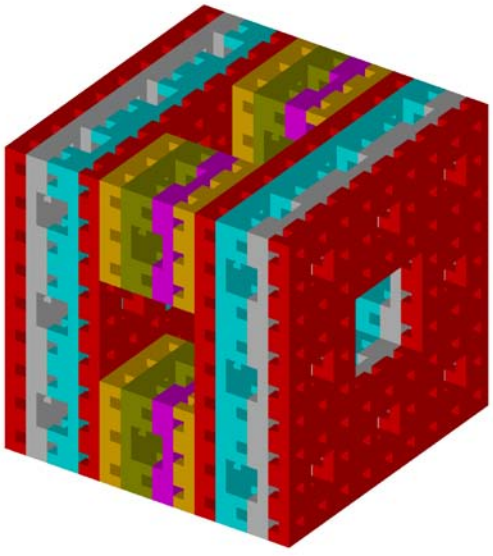
- ✓ RAPID CYCLE TIME
- ✓ CONTROLLED PRECISE CONTROL OF TIME, TEMERATURE AND ATMOSHPHERE
- ✓ LATEST EQUIPMENT
- ✓ HIGH QUALITY AND REPEATABILITY
- ✓ LESS EXPENSIVE THAN WELDING
- ✓ FULL PENETRATION OF THE BRAZE ALLOY THOUGHOUT THE BRAZE JOINTS.
- ✓

Some disadvantages of the process are:

- ✓ DIFFERING JOINT DESIGNS REQUIRE A ENGINEERED APPROACH TO BRAZE JOINT DESIGNS AND TOLERENCES
- ✓ EXPERIMENTATION PRIOR TO ACTUAL PRODUCTION IS DESIRED IN ORDER DELEVELOP THE BEST BRAZE RESULTS
- ✓ FILER METAL SELECTION IS LIMITED

How Else Would You Make This?

BRAZING IS THE MOST ECONOMICAL METHOD



ILLUSTRATED Example of Brazed Fabrication

Brazing Procedures

When performing exothermic copper brazing, the standard steps that are followed in any other brazing process apply, such as joint design, alloy selection, and surface preparation. However, additional parameters must be considered such as: pre-cleaning the components to be brazed, method of assembly, part size and configuration, joint design, control of tolerances, quality and cost considerations.

The filler metal is drawn into the joint by a pulling force known as capillary action during the heat cycle. It is particularly important to maintain right amount of gap [space] between the mating parts to allow the dynamics to occur. The strongest copper braze joints are made by maintaining a press fit with a tolerance of +/- .002". This will create the proper gap [space] for the filler metal to flow into the joint area and prevent braze voids or porosity to occur. Wider spacing will result in a weaker braze joint. Little clearances are preferred capillarity action to draw the braze filler metal throughout the joint area. Braze joint voids or shrinkage cavities may form as the pure copper filler metal solidifies. The optimum joints are those in which the entire joint area is wetted and filled by the filler metal. Again, it is best to avoid clearances that range from 0.001 to 0.003 in. Parts that maintain a line-to-line press fit with a tolerance of =/- .002" should be designed and controlled for the best capillary action and greatest joint strength.

It is also important to keep in mind that metals expand and contract at different rates when heated and cooled. Particularly when joining dissimilar metals, expansion/contraction rates must be allowed for when designing the part. Positioning the parts is best accomplished through self alignment or press fit operations and by utilizing the best type of braze joint configurations in the part design. [See American Welding Society Braze Manual for more detailed information.]

Selection of joint type is influenced by the configuration of the parts, as well as by joint strength and other service requirements, such as electrical conductivity, pressure tightness, and appearance. Also influential in the selection of joint type are fabrication techniques, production quantities, and methods of placing the filler metal at or near the joint to be brazed. Lap joints are generally preferred for furnace brazing processes. Lap joints should be at least as strong as the weaker material being brazed. For maximum strength, lap-joint length should equal three to four times the thickness of the thinner member.

Brazing Engineering

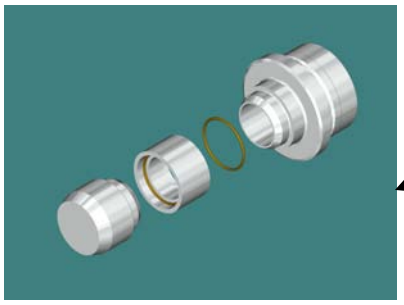
Brazing and soldering expertise
The use of brazing and soldering is becoming more widespread due to their practicality has a choice for manufacturers looking for creative ways to reduce manufacturing costs and/or join complex geometries that may have components made of different base metals.

Quality control and application engineering are very important factors to consider at the beginning of a design stage in order to ensure a competitive advantage and successful braze results. Contact HTG Engineering Group at the early stage of your product development in order to achieve the greatest impact from your brazing program and to ensure consistent quality results.

The benefits of Hi TecMetal Group experience
HTG metal joining engineers, technical staff and quality personnel will provide support to help your business produce high quality products:

- Evaluation of braze joint design, tolerances and manufacturability.
- Possible part redesign for cost reduction or quality improvement.
- Review of fit, form or functional characteristics to meet braze process requirements or reduce production costs.
- Provide input on both non conventional and conventional methods to produce a brazed part.
- Critique the product in order to eliminate the possibility of rejects due to leak issues.
- Evaluate braze joint strength properties and requirements.
- Provide suggestions in order to obtain optimal part preparation methodology.
- Assist with the selection of filler metal
- Develop procedures and qualification in accordance with Nadcap, AWS and ASME Codes
- Conduct in-house audits of brazing process.

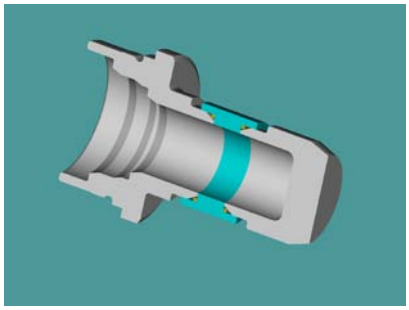
ILLUSTRATIONS



Consider all variables in the design and manufacturing steps required to produce a reliable brazed or welded part.

This cross section illustrates the braze joint design [lap joints] and the insertion of the braze rings prior to braze. This part requires a press assembly operation in order to main tolerances and concentricity.

Illustration: Hydraulic Solenoid Spool Assembly



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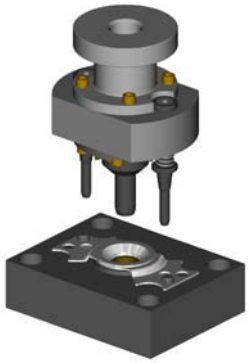
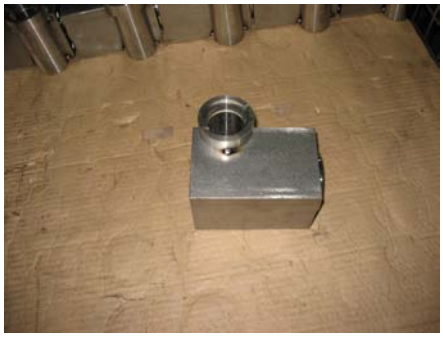


Illustration: Press Assembly Tool to Facilitate a "Press-Fit"



Hydraulic Valve Body Photograph of GTAW [Tig Weld] Required to Hold Parts
In Position for Furnace Brazing

Lever Photograph of Copper Braze Rind pre-placed
in Position for Furnace Brazing

The quality approvals and accreditations you need

HTG experts have hands-on experience with AWS, AMS, Nadcap and ASME Boiler and Pressure Vessel Codes, including the use of aluminum, copper, silver, gold, and nickel filler metals to braze both metallic and non-metallic materials using common heating methods such as furnace, torch, induction and resistance brazing.

Hi TecMetal Group knows how . . .

HTG is committed to a continuous improvement program based on Six Sigma and Lean business models. Want to learn more about our Braze and Weld Process Improvement or other services we offer?

Please send us your inquires for brazing, heat treating or welding services.

Send us your questions for a quick response.

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Click to question page or provide method for customer to send email to HTGquoteTeam@htg.cc