

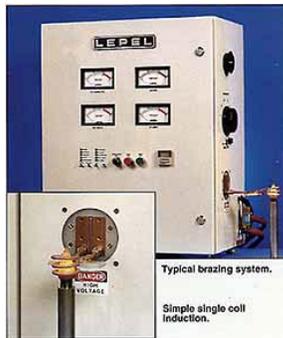
INDUCTION BRAZING SPECIALIST

Induction brazing is used in a wide variety of industries such as agricultural, aerospace, automotive, medical, electronics, hydraulics, stationary power, fuel cell, lawn and garden, medical and OE.

Induction brazing is a process that incorporates the use of a high frequency induction power source to create the heat necessary to melt the braze filler metal. The two or more materials are joined together by a filler metal that has a lower melting point than the base materials using induction heating. In induction heating, usually ferrous materials are heated rapidly from the electromagnetic field that is created by the alternating current from an induction coil.

Why Chose Induction Brazing:

- ✓ selective localized heating
- ✓ better braze joint quality
- ✓ reduced oxidation and post braze cleaning
- ✓ faster heating cycles
- ✓ consistent results
- ✓ Suitable for large volume production.



HTG Has Specialized Induction Brazing Knowledge

Induction brazing requires specialized knowledge supplied by HTG induction heating specialists. Achieving optimum quality and the best cost advantage requires HTG braze engineers to review the application and all of the details and specifications.

Many customers specify that their components be joined by induction brazing in order to fabricate the brazement. Prior to HTG quoting induction brazing prices, these steps are taken:

1. Braze engineering review of blueprints to verify design, blueprint dimensions, tolerances, joint design and tolerances will meet braze process and quality requirements.
2. Filler metal specifications will be reviewed if stated on the blueprint; in the absence of a filler metal call out, HTG braze engineers will determine and recommend a suitable braze filler metal.
3. Most induction braze applications involve fixturing to maintain the components to be joined in proper alignment and permit movement of the part in and out of the induction coil. HTG braze engineers will use their experience and follow good engineering principles to determine the correct coil design. All quotations may include engineering, coil and fixture costs.
4. HTG braze engineer's looks for the best means to use simplicity rather than complexity in developing the best cost effective methods to be used to fabricate the brazement.

Process Benefits & Considerations

Selective heating

Induction heating coils can be designed to provide the required heat to very small band width in order to focus the heat only on the area to be brazed. Induction brazing can meet tight blueprint tolerances. Only the area of the part within a close proximity to the braze joint is heated; the rest of the part is not affected.

Fixturing is generally required to hold the components to be brazed in position during the brazing and cooling cycle. Both fixturing and induction coil design are important with the brazing processes. With an engineered coil design, careful fixturing and consistent part placement, it is possible to simultaneously braze multiple joints at one time.

Better quality braze joints

Induction heating produces clean effective braze joints that are leak proof joints. The process will produce clean and high quality brazed joints. This is one of the reasons that induction brazing is being used extensively for high-precision, high-reliability applications.

Reduced oxidation and cleaning

Flame heating in an air atmosphere causes oxidation; scaling and carbon build up on the parts. To clean the parts, the parts require extensive post braze cleaning. Acid pickling baths have traditionally been required. Continuous, batch vacuum furnaces can solve oxidation problems, but have these limitations of their own.

- ✓ With furnace brazing the whole part must be heated
- ✓ Fixturing parts that do not self align requires higher cost expenditures than induction tooling.

Brazing with induction reduces both oxidation and costly cleaning requirements, especially when a rapid cool-down cycle is used.

Fast heating cycles

Induction heating cycles are short in comparison to flame brazing. The part comes to the required brazing temperature very fast; parts can be processed fast. An efficient induction brazing system will quickly deliver highly localized heating order to create a high quality braze joints. The process does minimize part warpage and distortion. HTG also offers brazing processes using either a controlled vacuum or in an inert protective atmosphere which can significantly improve overall part quality and eliminate costly part cleaning procedures.

Consistent results

Induction brazing is a very repeatable process because variables such as time, temperature, alloy, fixturing, and part positioning are controllable. The induction heating equipment used control cycle time, and temperature control. Both control and monitoring can be accomplished with pyrometers, visual temperature sensors or thermocouples.

For processes, which involve medium to high production runs of the same parts, an automated part handling system can be developed and utilized to further improve consistency and maximize productivity. The majority of the jobs induction brazed by HI TecMetal Group is brazed in air. For the most part, induction brazing and soldering is done in an open-air environment but it can also be done in a controlled atmosphere when necessary to keep the parts completely clean and free of oxidation. Below we will illustrate our approach to induction brazing in a pure dry hydrogen atmosphere at elevated temperature to 2150 ° F. Induction brazing generally works best with two pieces of similar metal. Dissimilar metals can also be joined by induction heating but they require special attention and techniques. This is due to differences in the materials' resistivity, relative magnetic permeability and coefficients of thermal expansion.

General temperatures and times

EXAMPLES OF INDUCTION BRAZED PARTS:

Induction Braze Process	Time	Temperature (°F)
Fig. 1 Brazed Refrigeration Air Condition Valve Body	20 seconds	1330°F
Fig. 2 Brazing a Friction Hub made of Stainless Steel	30 second	1250°F
Fig 3 Brazed Fuel Distribution Manifold	7 seconds	1325°F
Fig. 4 Brazed Solenoid Housing GE Aircraft Engine	2 minutes	1350°F
Fig. 5 Brazed Steam Distributor	45 seconds	1250°F
Fig 6 Silver Brazed Bracket for Agricultural Equipment	15 seconds	1325°F
Figure 7 Brass Ferrule to Stainless Tube	10 seconds	1400°F
Figure 8 Harley Davidson Front Brake Line Assembly	40 seconds	1350°F
Figure 9 Aircraft Engine Exciter Housing Silver Brazed	15 seconds	1250°F
Figure 10 Hydrogen Quartz Tube Nickel Brazed 2250° F	15 seconds	2250°F



Figure 1 Refrigeration/Air Conditioning Valve

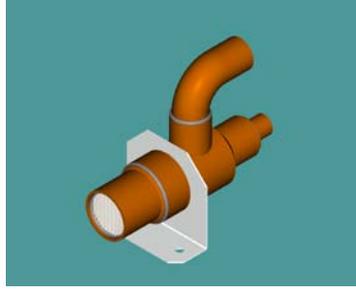


Figure 5 Brazed Steam Distributor

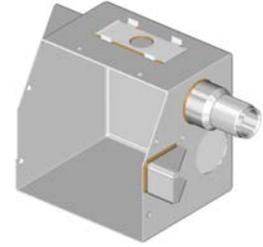


Figure 9 Aircraft Engine Exciter Housing Silver Brazed



Figure 2 Friction Hub



Figure 6 Silver Brazed Bracket for Agricultural Equipment



Figure 20 Hydrogen Quartz Tube Nickel Brazed 2250° F



Figure 3 Brazed Fuel Distribution Manifold



Figure 7 Brass Ferrule to Stainless Tube



Figure 4 Brazed Solenoid Housing GE Aircraft Engine



Figure 8 Harley Davidson Front Brake Line Assembly

INDUCTION BRAZE IN A HYDROGEN ATMOSPHERE

There are several benefits of performing high temperature nickel brazing process by localized heating under protective hydrogen atmosphere. The use of induction heating using 100% pure dry hydrogen [inert gas] is accomplished by placing the components to be brazed in a vessel that allows the transmission of the electromagnetic energy into the assembly. HTG has made significant advances in the field of controlled atmosphere brazing enabling us to braze stainless steels, titanium, super alloys and molybdenum in a controlled environment to avoid oxidation and volatilization. Also brazing in an inert atmosphere usually eliminates the use of flux in the assembly. The use of flux enhances the wettability of the braze filler metal; however, flux entrapment within the braze joint can open the possibility of porosity in the braze joint and flux removal is often difficult.

Hydrogen Atmosphere Induction Brazing Offers these Benefits:

- Heat required for melting the filler metal is applied in a narrow band, which can be controlled to within .050".
- The metallurgical characteristics of the parent metals will only change in the heat-affected zone. The other areas of the part will remain the same as before the brazing process. Softening [annealing] of the metal will not occur in the non-heated areas of the components.
- The braze process is much faster than furnace brazing.
- Much less energy and process gases are used.
- Tooling is generally inexpensive, as long as, the joint designs permits component part self-alignment.

HTH engineers have made rapid advancement in the technology of Hydrogen Atmosphere Induction brazing. Applications utilizing this process include automotive, aerospace, electronics and medical products. For special applications, several braze joints may be simultaneously brazed.

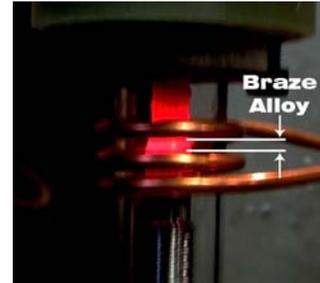
**QUARTZ TUBE
BRAZING 1**



**QUARTZ TUBE
BRAZING 1 INITIAL
HEAT UP**



**QUARTZ TUBE
BRAZING 2 AT BRAZE
TEMPERATURE**



**QUARTZ TUBE
BRAZING 3 COOLING &
SOLIDIFYING**

In brazing, the temperature of the components to be brazed, termed the assembly, is raised to point at which the filler metal molten and fills the joint clearance between the mating parts. The assembly is then cooled to solidify the brazing filler metal [BFM]. The process is illustrated in the pictures above.

HTG WILL PRODUCE PROPERLY ENGINEERED & PROCESSED INDUCTION BRAZED PARTS

HTG has the capacity to produce uniform, reliable induction braze joints with a high degree of quality and reliability. The process has the benefit of sustaining repeatability and producing, smooth braze fillets, high integrity braze joints and leak free parts.

If you have an application for induction brazing, please send us a request to quote your work. HTG will provide the best results and meet your specifications, quality, production and price needs.

HTG has the technical knowledge, 67 years of experience, equipment required. Our induction braze years of process knowledge covers brazing processes, specifications, applications, quality, production output and cost considerations.

Contact us at quoteteam@htg.cc

www.htg.cc

Or call: HTG Sales 216 426 6612