Silver Soldering Tips

The Principles of Silver Soldering - **Capillary flow**

The key to successful silver soldering is to adhere to the basic principles of the brazing process. You are brazing - not welding with an expensive filler rod. Basically a welded joint relies on the strength of the filler and parent metals. The strength of a brazed joint, if made correctly, will be governed solely by the strength of the parent materials be they copper, brass, bronze or steel. They will fail before the joint fails.

The basic principle of brazing is that the alloy is made to flow into a joint by capillary action. This is what you see when dipping a sugar lump into your tea! The capillary forces are incredibly strong and will defy gravity.

We achieve this by considering four factors.
1) Fluxing
2) Joint gap
3) Heating technique
4) Application of alloy

Fluxing
The joints must be free of oil and grease.
The flux removes the oxides present before and formed during the heating process.

Mix the flux into a paste with water to the consistency of yoghurt. Add the water sparingly as it is very easy to "swamp" the flux. Add a couple of drops of detergent. This will help the flux to "wet" onto the components. Ensure that you have a good covering of flux paste before heating.
The flux used will depend on the parent materials, melting range of the silver solder and heating time. In essence there are two types of flux. The vast majority of joints will be made by a fluoride based flux. We refer to it as EF flux - "easy flowing flux". Use it with a low or medium melting point silver solder such as 842, 440 and 456 on copper, brass or mild steel.

If using a higher temperature alloy such as 424 or you are brazing stainless steel or have a long heating time use a borate based flux. We call this HT5 - "high temperature flux." If there is a problem getting the alloy to flow - it's probably a flux problem. Contact us.

It is essential that you cover, and keep covered, the joint areas with flux during the heating process. Use plenty to avoid the flux becoming "spent" and allowing oxidation to re-occur - a common fault that leads to poor joints. This also applies if the need to reflow the solder or add more solder arises.
Full details of the alloys can be found on the "Silver Solder" page.

Joint Gap
For all alloys there is an optimum joint gap. This ranges from 0.01mm .25mm. Alloys with a narrow melting range operate at the lower end of this band. To bridge wider gaps use an alloy with a wider melting range.

The strongest joints are achieved with narrow joint gaps. They are also the cheapest!

Heating Technique
Ensure that all the joint is at brazing temperature. Cold spots will freeze the alloy, preventing flow through the entire joint resulting in low strength and leaks. Heat the joint not the alloy. Where you heat the joint will affect where the alloy flows. Molten alloy will tend to flow towards the hottest point. Heat the joint in front of where you want to apply the alloy.
Avoid heating the rod directly. Let the alloy take its heat from the joint.
When brazing tube or pipe assemblies it is better to make a ring and put the alloy inside the tube and heat the joint from outside. The alloy will melt and flow to the hottest point ie flows though and fills the joint area producing a positive witness of alloy. This is very good confirmation of a sound joint.

Care should be taken when brazing copper of unknown quality. Use a more expensive "oxygen free" grade (C106) to avoid hydrogen embrittlement of the copper or ensure that you use an oxidizing flame. The flame can react with the oxygen to produce steam that causes embrittlement and internal porosity.

Alloy Application
There is little point in trying to apply alloy until the joint is hot enough. A good indication of joint temperature is the flux itself. During heating the flux bubbles and dries out. It becomes a clear colourless liquid at about 550 deg C. This is just below the melting point of your alloy.
Don't try to apply alloy until you see the flux melt. There can be a tendency to rush the process and apply the rod too early. You may be tempted to switch the heat to the rod. Don't!
Be a little patient. Watch the flux !
Apply your rod to the joint. The alloy will melt and flow into the joint. Once the joint is full remove the alloy. There is no advantage to be gained by building up a large fillet. It contributes nothing to the strength of a joint. Leave fillets to the welders!
Use the smallest diameter rod you can. It helps to keep the alloy usage and cost to a minimum.

SAFETY PRECAUTIONS

DO NOT OVERHEAT THE ALLOY It does not produce stronger joints. On the contrary, overheating is one of the main causes of poor joints and will exaggerate any potential problem of metal fume notably cadmium.
Once the alloy has flowed into the joint remove the heat.

Never brazed before ?
Experiment with our starter pack of alloy, flux and a few written words.

Remember

Braze in well ventilated areas.
Use protective goggles and gloves.
Wash your hands thoroughly after brazing.

If you notice anything unusual stop brazing and seek advice.

Want to make rings?

Wind your wire/rod around a former to get the correct size. Secure both ends of the "spring" on the former.
Using your brazing torch gently heat the spring. At about 300 deg C, you will see the wire relax as all the tension is removed. Remove your spring from the former and cut to make your rings. They will not spring open.

For any further information and advice please email us at cupalloys@googlemail.com or telephone 01246 566814.

Last piece of advice
Heat the joint not the rod!