Hi temp sliver brazing/soldering By Hammered

As requested on my HP O/400 build, I've put together some information that I've learned about using high temperature silver solder, or "brazing" as it's sometimes referred to.

The following is based on what I have found works for me using products that I have experience with. It's not meant to be the be all end all guide on the subject. I'll begin by showing the process from start to finish on a sample joint then show various fixtures used to hold the parts for the soldering process. I show these because holding everything in correct alignment is an extremely important, and often times overlooked part of a successful solder job. The fixtures don't have to be elaborate, just able to hold the parts correctly and withstand the heat involved. I tend to use MDF because I have plenty of scraps laying around and the tools to fabricate it. You can usually design the fixture to keep the flames off of the wood, but I use heat tape or other materials, like aluminum or steel, to shield it when necessary. Some of the basic material and tools used:

Soldering torch with Mapp gas. For years I used just a torch head that screwed onto the top of the can. That works fine, but a detached torch with a hose makes it easier to maneuver the flame exactly where you want it. This one has an adjustable flame that is nice also.



Next, the solder. The one shown is an alloy of 30% Copper, 25% Zinc, and 45% Silver. You can get alloys with lower or higher content of Silver, but this one works well and is available in several diameters. I use 1/16" for general soldering of tubes, pipes, and plates that are of average size for the items we tend to solder. The smaller diameter works well for intricate parts that need very little filler material. Look here for more information:

<u>https://www.harrisproductsgroup.com/en/Products/Alloys/Brazi ng/High-</u> <u>Silver/Safety-Silv-45.aspx</u>



This is the heat tape I referred to earlier.



I use die grinders, both straight and angled for shaping and cleaning parts. Carbide grinding burrs make quick work of cutting fish mouth joints and general shaping. Scotchbrite wheels clean the parts before and after soldering.



The following shows me prepping and soldering two tubes together using a fish mouth joint. The process is similar for most jobs though.

The holding blocks are two pieces of MDF taped together and then drilled slightly smaller than the tube O.D.. The tube can be then clamped between them for a secure hold while shaping and soldering.









The parts shaped and then cleaned with Scotcbrite.





An additional MDF block attached to the previous one, with thick C.A., to hold the tubes. This is where you need to get creative. The parts need to be held in alignment but the fixture should allow for some expansion of the metal. If you try to lock it in too securely, it may warp out of shape when the heat is applied. How much is too much will be different each time and you may need to revise your fixture to make it work. The tubes here are clamped in fairly tight, you can't push them around, but they can slide and expand if necessary. To tell you the truth, holding fixture design was the hardest obstacle to getting good joints for me. Initially, I clamped everything as tight as I could, restricting any movement at all. Clamps, Vice Grips, screws, you name it. That actually caused the parts to warp and twist out of alignment. *You can't fight the expansion of the metal. It will happen.* You have to account for it.



The joint is rather close to the wood, so I used the heat tape here.



The paste flux applied and we're ready to solder.



All the prep now leads to the big moment. It's actually the fastest step in the whole process, and not at all difficult if you've taken proper care up to now. Fire up the torch and apply heat to the joint. Move the torch around some to cover all sides but don't remove the heat from the flux. If it cools down it will be useless. The first thing that will happen is the flux will turn to liquid. Keep the heat on it. Then the flux will appear to "dry up". It's still there though. Keep the heat on. Once the parts are *all* cherry red, touch the end of the solder to the joint. Don't apply the solder in the middle of the flame, or it will burn off before it can get into the joint. Instead, apply the heat from one side and the solder from the other. You don't need to follow the joint around with the solder. If the entire joint is heated up properly, the solder will flow into the joint all by itself into the nooks and crannies and chase the heat around to the flame.



And now you have a solder joint. This one is pretty typical. You can see the solder along with some discoloration of the metal and the flux will look like glass, coating some areas. There is a small fillet of solder between the tubes. You don't need globs of solder piled on top of it.



Soak it in some Baking Soda for several minutes and scrub it with a wire brush to clean off the flux. If it fights you, try some Citric Acid first to remove the flux and then Baking soda again.



After the Baking Soda and scrubbing.



Cleaned with the a Scotchbrite wheel on a die grinder.



You can also use a bead, soda, or sand blaster to clean the joint. I have a small, airbrush sized sandblaster that I picked up at Harbor Freight. It works well for getting into tight areas the grinder can't reach. It also gives the metal a nice tooth for the primer to stick to. I then coat it with a self etching primer. It's now ready for further fabrication or final painting.



The following are random images of fixtures or holding schemes that I've used.





































Quote: Sparky

Great tips.....

after the brazing, do allow the parts to cool to touch before putting them in the baking powder water mix?

Is there a problem with the water getting inside the tube and corrosion starting later? Where do you source the tubing?

Where do you source the flux and does it depend on the material being brazed? Where do you source the fishmouth grinder?

Sparky

Thank you, everyone.

To answer your questions, Sparky:

after the brazing, do allow the parts to cool to touch before putting them in the baking powder water mix? No, I leave it in the fixture until it cools down. Thin parts like this may warp if left on their own or tossed into the cold too fast.

Is there a problem with the water getting inside the tube and corrosion starting later? If the tube is open, I blow it out well immediately. If it's sealed up, there's not much you can do unless you want to drill some holes and run oil or treatment inside, as some full size do. I don't think that's really necessary for our models, but I live in the desert and rust isn't much of an issue here.

Where do you source the tubing? I get most of mine thru McMaster-Carr. Every size and type imaginable. <u>https://www.mcmaster.com/</u>

Where do you source the flux and does it depend on the material being brazed? McMaster-Carr sells it or you can find it at a welding supply store locally. Probably Amazon also. The website I showed with the solder in the original post (Harris)has a lot of information regarding alloys and fluxes. I use the same flux and solder for mild or stainless steel. They do make a flux that is supposed to be better for stainless but i haven't had any issues.

Where do you source the fishmouth grinder? I don't remember where I got that particular grinding burr. Any good industrial tool supplier will have them though. Find one that caters to the building or machining trades.