

SOLDERING BASICS

A HANDOUT BY ESTONA METALSMITHING TUTORIALS

About soldering

Soldering is nothing more than connecting two metal parts together by adding a liquid. In this case silver solder. Together the soldered parts will form a new whole.

Safety

You are going to use an open flame and some toxic fumes will be released. Make sure you are working in a well-ventilated area. Wear protective clothing if you need to. Don't wear loosely fitted clothing (sleeves) and tie your hair together. And yes, this one comes from personal experience. Have a fire extinguisher near your bench. Get used to putting away your lighter as soon as you light up your torch. Don't keep it on your bench. And finally, when you are done with soldering, close up your gas flask. Every once in a while, check to see if the hoses that you use are still in good condition. Especially the thinner hoses can get porous and leak gas.

Preparation

Before you can solder, you have to make sure that the surfaces that you want to solder and the solder itself are perfectly clean. Dirt, oil from your hands and oxidation can prevent your solder from flowing and creating a decent soldering joint.

If you have milled or hammered the parts that you want to solder, anneal them before soldering. Make sure that there isn't any tension in your metal. If your piece has hardened instead of closing it up while soldering your piece can open or deform.

Lighting it up

And finally, it's time to get started. Flame control is half the job. First off, always check to see that you are touching your material with the hottest point of your flame. You can very easily spot this point by aiming your flame onto your soldering block. If a red / orange circle appears, you have found the hottest point.

When you are soldering silver and yellow gold it is important not to add too much oxygen to your flame. The oxygen will oxidize your metal and it will make it harder to solder together. You are better off using a reducing flame. This is a flame in which a bit of yellow is still visible at the outer tip. But every torch is different which makes this a hard one to explain. In my experience and with my torch (which I highly recommend) I like to sharpen my flame a bit and lose the yellow point all together. It is a trial and error way of learning. You will fail at soldering and melt a lot of pieces along the way. And that's okay, just pick up something to do differently at every fail. It's a great way to learn.

Distribute the heat evenly. If both pieces have the same size, heat them up in the same way. If you are combining a big piece with a smaller piece, the big piece will need more heating up. Let's say you want to add a jumpring as a bail on a pendant. First warm up the pendant and add some flux. Do the same for the jumpring. Slide both pieces together and keep most of the heat focused on the pendant. Just slide it over the jumpring every once in a while. Once the piece has reached the desired temperature, add the solder. And now the trick is not to overheat the pendant because then the solder will flow onto your pendant. But if you overheat the jumpring, this will melt. So very carefully keep moving the flame around between the pendant and the jumpring so they will both reach the same temperature and the solder will flow exactly in between the two parts. Remember that solder will flow to the hottest point.

The direction of your flame is very important as well. You can really use your flame to guide your solder to the point where you want it to flow. There is one big difference in working with silver or gold. When you are working with silver you will have to heat up your entire piece to get a decent soldering joint. With gold you can just focus on the parts you want to solder together. So, if you are working with silver, keep your flame moving around the entire piece and every once in a while, focus on the soldering seam. Let's say you have a very long pendant you want to solder. Keep the flame moving along the length of the pendant so you don't lose too much heat. When you are working with gold you should still keep the flame moving a bit, otherwise you can burn your material. But you can just move it around the soldering joint. If your solder is about to flow guide the flame in the direction where you want it to go.

To sum it up:

- Touch the material with the hottest point of your flame
- Use a reducing flame when you are working with silver or yellow gold
- Distribute the heat evenly
- Remember that you can use the direction of your flame to guide your solder

Flux

Your flux is used to create a barrier on the surface of your metal. This way you can block out the oxygen from contaminating your soldering joint and the solder can flow freely in between the two metals you want to solder together.

You can use flux to create a layer and prevent fire scale as well. Fire scales are very nasty stains that can appear on silver when you have overheated the metal. Due to overheating the copper alloy in the sterling silver can rise to the surface. It is very hard to get rid of these stains so preventing them is better. Coating your piece with flux* is only necessary with sterling silver. Keep in my mind that you can get fire scale even with coating your piece if you use too much heat. If you are going to solder yellow gold you don't need to coat your entire piece. You can only add flux to your soldering seam.

I am using boraxine* as a flux. This is a ready-made mixture made from borax. Normally borax is used as a cone, with which you can make your own paste by adding some water. Another way to use borax is by adding some denatured alcohol to boric acid. Not all materials can be found in every country so contact your local supplier if you have any questions about the fluxes that are available. Whatever you order, make sure it is of good quality.

The best part of using boraxine is that I can very easily tell when my pieces reach the right temperature to add the solder. You don't add the solder right away because it can oxidize which will prevent it from flowing. It will just curl up like a little ball that isn't going anywhere. The boraxine is very bubbly and white when I start heating up my piece. When the bubbles disappear and the boraxine is getting a more honey like structure I know that it has reached the right temperature needed for soldering.

Silver Solder

There are three types of solder we are going to be using: Hard, medium and soft (or easy) solder. All three of these solders are made of an alloy that consists of silver and tin. The tin is added to lower the melting temperature so the solder can flow.

There are different types of solder you can use, and they can have different melting temperatures. I am using wire solder. The hard one will melt at 740 degrees Celsius, the medium solder at 700 degrees Celsius and the soft or easy solder at 620 degrees Celsius.

You will want to use the hard solder as much as you can. This is the strongest soldering joint and because the solder alloy consists of the highest amount of silver you can't tell the difference between the silver that you are working with and the solder. The soldering seam will be invisible if soldered correctly. But let's say you are making a ring and you are adding prongs. You can make the basic ring with hard solder without any problems. The prong setting itself is made separately from the ring. If you can make an entire prong setting out of hard solder at this point of your career, I applaud you. It took me about four years to do so. But let's say that it worked out. If you want to add your prong setting to your ring and use hard solder again, it is very likely that everything will come undone while soldering. If you heat up your entire piece, which you have to do with sterling silver, all the solder will reach the same temperature at once and the solder will flow. This will cause your prongs to fall off and leave you in tears. That is why you use different kinds of solder. This way you can really build up your piece without having to fear everything will fall apart.

If you are going to add solder to your work, make sure it's clean. You can run over it with a very fine grit sanding paper to do so. I seal mine away in an airtight bag. Cut it into small pieces. Finding out how much solder to use is (again) a trial and error way of learning. If you use too little solder you will create a weak soldering joint. If you overuse your solder your piece is not going to look nice. Of course you can take away excess solder by filing or sanding, but this can be a lot of extra work.

This brings me to another point. Put your solder bits in places you can reach after soldering. If you have made a beautiful ring with texture on the outside, put your solder bits on the inside of the ring so you can clean the soldering seam up without ruining your design.

Tip

Remember that you can only solder if there is direct contact between the metal and your solder. The pieces should connect perfectly. If the pieces do connect very tightly, the solder is pulled in between the metal and this will make a perfect soldering joint. Finish your pieces as much as you can before soldering if you are going to have a hard time reaching them afterwards.

Quenching & Cleaning

If you still have some work to do after soldering, you can quench your silver piece in cold water. This will keep your silver soft so you can still work with your material. Think about a ring that still needs some shaping on a tribulet after soldering. Or if you want to give your piece a hammered finish. If you don't want to work your material after soldering, let it cool by air. The silver will harden this way.

But before you can finish up your jewelry, you will need to clean it up. Especially when working with borax or boraxine. This will leave a glass like layer on top of your jewelry that can really damage your tools. That is why you drop your pieces in a pickle solution after soldering. I am using vitrex myself but there are different types of solutions you can use. Important: don't drop steel in your pickle solution and use a copper pair of tweezers to take out your jewelry.

Troubleshooting

What if your solder doesn't melt? Check to see if your piece and solder are clean and if you have added flux. Maybe you have overheated your piece and burned the flux? Or haven't you used enough heat? Is your flame at the correct temperature? Is the entire piece up to temperature? Are you touching it with the hottest part of your flame? Asking yourself these questions will help you determine what the problem is.

Most important: give yourself time to learn. I can still remember my first couple of soldering attempts. Focusing on all those things together with a torch in one hand and a soldering pick in my other hand. Just trying to get that solder to melt. It felt so unnatural and I was absolutely sure I would never master it. But after a couple of attempts it got easier. The worst thing that can happen is melting your piece. But that is why we are just starting out with some practice pieces. Just try and see what happens. What does happen if you overheat a piece? Give it a go and find out. And take out another piece and try to see if you can see the signs just before your metal starts melting. If you can spot that exact moment, you have already learned a very important lesson. What happens if you don't add flux? What is the difference between the three different types of solder if you heat them with your torch? Just investigate, experiment and have fun with it.