Jewelry Making DAILY

Jewelry Soldering Basics

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BY LEXI ERICKSON

SOMETIMES SOLDERING IS SIMPLER. Although learning how to solder jewelry is a big step, it's one that can save you time and effort — even money. Connections that don't involve silver solder or a torch might be easier to make in some cases, but for some designs a solder join really makes the most sense.

Soldering is the "gateway" jewelry making technique that will let you take your jewelry designs to a whole new level. Soldering lets you do the seemingly impossible: take two pieces of metal and create one single piece of metal with them.

In this introductory eBook about soldering silver jewelry (copper, too!), you'll learn essential basic information you will use again and again throughout your jewelry-making lifetime. You'll learn what solder is and how it works. You'll find out what types of jewelry solder are available, what forms they come in, and when to use each one, with convenient reference charts that will make it easy to figure out exactly what you need. You'll discover what flux is for and how to use it to make your jewelry soldering more successful. You'll have access to expert advice on setting up an area in your workspace that is dedicated to soldering so you can feel confident about working with hot metal, an open flame, and fuel for your torch. You'll get a glossary of all the specialized terms you'll encounter about the basic jewelry soldering supplies, tools, and pieces of equipment you'll be using in your new soldering station.

And whether you've been soldering for a while or are just firing up your torch for the first time, you'll get step-by-step instructions for a great little ring that makes the perfect soldering practice project: a silver band with one solder seam. Make one and you've created soldered jewelry; make that band again and again and you'll have a fashionable set of stackable rings!

Merle White

Merle White
Editorial Director, Interweave Jewelry Group

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solder

What it is, how to use it

BY LEXI ERICKSON

If you have been creating unsoldered jewelry, either with beading, wire wrapping, or cold connections, you have probably come across occasions when things would have been simpler for you if you'd just known how to solder. Soldering is a big step to take because it is the "gateway" technique that will let you take your jewelry making to a whole new level. Soldering lets you do what seems impossible: make jewelry that is held together with a deliciously thin line of molten silver or gold. When you join two pieces of metal with solder, you create a new, single piece of metal.

In this exclusive soldering series, you'll find basic information for beginners, and tips and shortcuts for everyone. If you already know how to solder, you might find something here that disagrees with what you were taught. That's okay. I have always told my students to study with another teacher when given the chance. We all have our certain ways in which we do something, and it doesn't mean one is right and one is wrong. There are numerous ways and techniques to accomplish the same outcome.

Through simple experiments and experience, you will determine what is the best and easiest for you. As a teacher with ah – shall we say, a few decades of experience – I have found what works best for me and what seems to make the most sense to my students. These are the techniques I'm sharing here. Please: take this and run with it, and make it your own.

JEWELRY SOLDERING

If you're new to jewelry making, you might think that if you know how to use an electric soldering

All temperatures in Fahrenheit

SOLDERING SETUP

EQUIPMENT

- Single gas torch, either acetylene or propane
- An acetylene "B" tank or a small propane canister
- Chain or bungee cords
- Fire extinguisher
- Small sturdy table dedicated to use as your soldering station
- Fireproof surface for soldering, either ceramic tiles or a metal soldering station
- White kiln bricks, purchased from a jewelry supply or ceramic supply store, 2.25" x 4.5" x 9"
- Charcoal blocks (optional)
- Small crock pot, preferably new, or commercial pickle pot
- Glass or ceramic bowl, for quenching hot metal
- Goggles or safety glasses
- Particulate paper mask

TOOLS

- 2 or 3 solder picks
- Paintbrushes, for flux
- Copper tongs
- Old extra long chain nose "burn 'em up" pliers
- Small, fine point steel tweezers
- Small solder cutting snips or scissors

MATERIALS

- Easy, medium, hard silver solder, either sheet or wire
- Flux
- Pickling compound such as Rio Pickle or PH Down (available from swimming pool suppliers)
- Fine sandpaper or green kitchen Scrubbie

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iron, or have experience soldering circuit boards or stained glass works, you could just jump right into jewelry soldering. Not true.

There are similarities, but also important differences. The similarities are that in all these cases, we're joining metals using solder (more on that in a moment). In jewelry soldering, though, we're usually joining different metals than in those other operations. These different jewelry metals have different properties that require different types of solder, different sources of heat, and different techniques for using them.

For this series, we'll be focusing on learning how to solder traditional sterling silver, copper, brass, and bronze, plus we'll touch on how to solder gold. It's also important to understand that the traditional jewelry soldering techniques we'll learn do not work for the newer sterling silver alloy marketed as Argentium Sterling Silver®. Argentium, as it's commonly called among jewelry people, uses its own silvers, solder, and techniques.

Jewelry soldering involves specific tools and materials and a special vocabulary that is standard among jewelers. Using the correct terminology will help when you order supplies and discuss soldering techniques and problems with other jewelers. Most of these words will be explained as we go along and are included in the glossary as well.

Beginning any new project is intimidating, especially when it involves using potentially dangerous materials and comes with unpleasant urban myths of blown-up houses or exploding tanks. Putting together a soldering setup in your home is safe as long as you are diligent and follow common sense safety measures.

WHAT IS SOLDER?

Solder is an ***alloy,*** a mixture of two or more metals, usually silver and zinc. The more zinc, the lower the melting temperature, and the easier the mixture will flow in between two joins.

How soldering joins metals is an interesting but highly technical topic we won't get into here. What you need to know is that we use a solder for joining jewelry metals because it's more difficult and in some cases impossible to join them without solder, and we use a solder with a lower melting point than the metals we want to join . . . because it works.

The temperatures given as general "melting points" are not standard from manufacturer to manufacturer, and may differ as much as 50 degrees; also, the "melting" point can be from 85-120 degrees lower than the "flow" point. If you want to be really picky, find out the exact melting and flow points of your solder from your supplier. Most of these are available on the websites of the ***mill***, the company that alloys your metal.

Just remember that while it is the general melting point for easy solder, it may be difficult to judge just when 1240 degrees is reached. Your ability to know when you're there will come with experience, and because you will get used to the timing for a specific solder, it makes sense to order all your solder from the same supplier.

Silver, copper, bronze, and brass (NuGold and DixGold) are almost always soldered with silver solder. When done correctly, the silver solder is undetectable. Bronze and brass solder is difficult to use, oxidizes quickly, and can be brittle.

Gold solders are made to match the actual karat gold you are using. They come in similar temperature ranges, but you must also consider the color of gold and karat you are using. If you are unsure about the gold solder to purchase, discuss your project with the supplier of your gold and he will advise you best. The specifics are too numerous to discuss here.

HOW IS SOLDER SOLD?

There are many variations in solder – not only temperature differences, but also the forms that it's sold in. It comes in wire or sheet, or in powdered form in a paste flux with a hypodermic syringe. You can buy it in precut ***pallions*** (chips), which are sold in quarter ounces or smaller amounts. Some people find using premade flux and powered solder works well, especially for delicate operations such as soldering gold prongs, chain repair, or even closing jump rings. I find this to be expensive, messy, and unreliable for general soldering, but it's a matter of whatever you get used to.

glossary

Alloy a mixture of two or more metals. Solder is an alloy of fine silver and zinc. Fine silver is too soft to be used by itself, so it is alloyed. Sterling silver is 925 parts per 1000 silver, with the remaining 75 parts usually copper. Both brass and bronze are alloys, mixtures of copper and other metals. Copper is often used unalloyed.

Flow point the temperature at which solder will follow a join by capillary action. This temperature is between 85-120 degrees hotter than the melting point.

Melting point the temperature at which solder will ball up.

Mill the manufacturing site of your metal. The manufacturer alloys and rolls your metal into sheet or other milled products such as wire, bezel wire, and so on.

Pallions small chips of solder cut from a sheet or flattened wire. They are usually 1mm or smaller in size.

Pickle Why is it called pickle? According to Charles Lewton-Brain, possibly because German jewelers used an alum solution in which to clean their soldered work, and alum was used to make pickles, too. It might have started as a simple jeweler's inside joke! Pickle is a sodium bisulfate, and is a white granular powder. It is mixed at about ¾ cup of pickle to a gallon of water. Citric acid may be used as a pickle, but I use PH-Down, found as a ph balancer for swimming pools, because it's much cheaper and available at the local pool supply store.

Pickle pot an electric pot, which may be a commercial pickle pot, a crock pot, or even a coffee cup set on a coffee warmer pad, which holds the liquid pickling solution and keeps it warm. Pickle works best when it is slightly warm, not boiling.

Solder ghosts places where your solder has flowed outside of the seam.

Solder station where you do your soldering. This area must be fireproof and stay free of any combustible materials such as paper towels. You may use large ceramic tiles and lay firebricks, charcoal on top, as a soldering station, or you may use a metal soldering station. Whatever you use, keep it clean.

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Most jewelers use wire or sheet solder. Since the wire solder all looks alike, you should color-code your solders by marking them with colored Sharpies, which you can sand to clean at the time you use them. A bonus to this routine is that the Sharpie will cleanly burn off at 1100 degrees, thus acting as a temperature indicator.

I prefer wire solder, and I am diligent about keeping all my solders separate. Most suppliers will sell wire solder by the foot and sell standard size small sheets. Solder is not expensive, and I usually buy 10 feet at a time. That will last a good long time. If you order one ounce of solder, it may seem like a small amount, but you will then have solder for years to come!

ID SOLDER TEMPERATURES

Through the years I have learned to mark *everything.* The idea that "I will remember that this is Easy wire solder because I put it in this special box" has long been disproven. *Whatever system you use, be consistent.*

Decide on what works best for keeping your wire solder identifiable, anything from tying one, two, or three knots into the ends of your solder to having as many bends in it. If you buy sheet, be sure to scribe your mark into the metal with a sharp instrument, not just write with a marker, as this can rub off as you handle it. Mark your sheet with a large EZ (easy), MED (medium), and H (hard). If you have a set of metal letter stamps, you can emboss EZ, M, and H all over your sheet – EZ (and not E) because if you just mark them E and M, sometimes those look alike, and it can confuse you down the line.

I use old Altoids tins for holding my solder. Wire solder is easy to keep rolled in the colorful round tin. And because the tins are colorful, I use the Lemon (yellow) for easy solder, the Tangerine (orange) for medium solder, and the Apple (red) for hard solder. This will work for wire or sheet. In my classes, students are always offering each other Altoids in order to have the empty tins.

If you do get them confused, take the samples of the solders in question, lay them side by side on a piece of scrap copper, and heat them evenly. The one that melts first will be the lower temperature solder. While not foolproof, this is something that will help. You may also add a "control," a piece of easy solder, and judge melting temperatures from that.

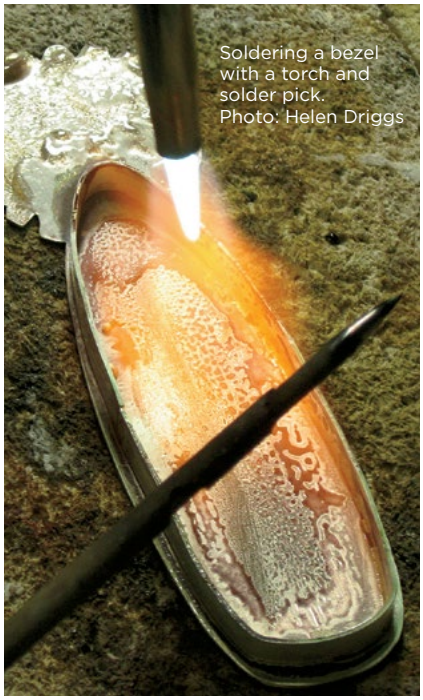
Keep your wire solder away from your sterling or fine silver wire. Nothing is so disheartening as to cut and file 25 jump rings for a chain, only to find them melt as you put the flame on them! After a while you will be able to discern the difference in wire and solder.

WORKING WITH SOLDER

Because many beginners use too much solder, I recommend rolling your solder, both sheet and wire, through a rolling mill. This will thin your solder out, so that while you may cut off the same size piece in area, there is actually less solder volume, reducing the amount of overflow and cleanup for you. You'll be surprised at how much this will stretch your solder out. If you don't own a rolling mill, you may hammer your solder thinner.

After rolling or hammering your solder, be sure to sand the solder with sandpaper or a green Scrubbie because this will remove any oils or contaminants that may have been transferred from the rolling mill or hammer. Always remember to sand or Scrubbie your solder before using it to remove any oxidation as well.

One of the potential solder problems that beginners often create for themselves comes from cutting small *pallions* (chips) of solder and putting them into a container so they'll have a nice supply of ready-made solder chips. Works great in theory, except these tiny chips of solder will oxidize, thus making your soldering job much more difficult. Solder must be clean to flow, and it's really hard to pick out those tiny bits of solder from a pickle pot or sand them. So keep your solder in a solid sheet or wire until ready for use.



Soldering a bezel with a torch and solder pick. Photo: Helen Driggs

WHAT THE TEMPERATURES ARE FOR

Different (melting/flowing) temperatures of solder are needed for specific tasks. Sometimes, when multiple soldering is to be done on a piece, a higher temperature solder is used first. If you use only low temperature solder and are doing several solders, the reheated zinc in the solder may decompose, or burn out and leave pits in the easy solder. These pits are unsightly and also compromise the solder join.

Also, because the addition of zinc lowers the melting temperature, easy solder may leave a yellowish-gray line on the silver. That's why all ***solder ghosts***, or blobs of melted solder outside the join, must be cleaned. And don't think that oxidizing with liver of sulfur will cover it up, either. It just makes it more noticeable.

Hard solder is used when you are "building" pieces, especially when the piece may collapse when high heat is applied. Each subsequent solder

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needs to flow at a lower temperature to prevent the already soldered joints from letting go.

For example, when you solder a bezel closed, it must be soldered with hard solder. By using a solder with a flow temperature of 1450, you know it will not flow again at 1360, thus allowing the bezel to remain closed during the next soldering procedure. That is not saying that the bezel won't "pop" open, but if you carefully solder the bezel down and have done your homework (the bezel is flat against the back plate, the piece is clean, and you keep the flame off the bezel join), the solder will flow around the bezel in a bright silver line, and your bezel will be secure.

Hard or medium is also used for closing rings, otherwise you will see a yellowish-gray line on the silver as the ring oxidizes. Always use the highest temperature solder you can. See the temperature charts (below) and keep them handy. These will help you remember the melt/flow points for solders and the melting temperatures of the metals you may be using.

Paste solder is handy for workshops and classes because the flux is already mixed in. Photo: Jim Lawson

melt and flow temperatures

	Melt	Flow
Easy solder	1240	1325
Medium solder	1275	1360
Hard solder	1365	1450
IT solder	1340	1460

(IT = Intense Temperature, used for enameling)
Source: Hauser & Miller

alloy melting temperatures

Sterling	1640
Fine silver	1760
14K yellow gold	1615
18K yellow gold	1700
Copper	1983
Red brass	1880
Bronze	1825
Nickel	2030
Pewter	440
Platinum	3223
Aluminum	1220

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flux

Help when solder flows

BY LEXI ERICKSON

A selection of fluxes and specialty fluxes available for today's studio jeweler. Have several on hand in the studio to conquer any soldering scenario.

We've discusssed solder itself: what it is, what types there are, and the importance of their melting temperatures. Now we're going to look at what happens to your metal when you get your solder hot enough to flow, and how flux can help you predict when that will be as well as protect your metal from some unwanted side effects of that heat. Sometimes even experienced jewelers don't relate the simple act of fluxing the metal to understanding when the solder will flow.

WHY DO YOU NEED FLUX?

Anytime you heat sterling to a high enough temperature for the silver solder to flow (approximately 1350˚), the copper in the sterling reacts with the ambient air and creates a "skin" of **cupric oxide**. This will soak off in a warm pickle solution, because it's only on the surface.

At the same time, though, deeper in the sterling, another oxide is forming, called **cuprous oxide**. This is called %&#@!, or **firescale**, the bane of metalsmiths. Flux forms a "glass" coating on metal which helps prevent firescale.

Firescale appears as a grayish-purple stain that lies underneath the top layer of silver. Unfortunately, it will show up when you are finishing your piece by polishing or buffing. Flux solution will usually but not totally eliminate firescale, and help protect metal from additional firescale formation. Flux also acts as a temperature indicator: it shows me just when my solder is getting ready to flow. I find this information vital to successful soldering.

Please remember that all fluxes are potentially toxic. The handling and breathing of the fluxes should be kept to a minimum. It's best to use a chemical mask and 3M's #6006 cartridges to protect against fluorides. Absolutely do not ingest any flux.

Fresh flux and solder pallions prepped for sweat soldering.

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Flux is traditionally made up of borax and alcohol, and some fluxes contain boric acid. Historically, jewelers used a borax cone, which they would grind into powder and add to denatured alcohol in about a 50-50 solution. They would then dip the entire piece into the mixture, remove it, and then light it with a flame, which would burn and coat the entire piece in a white borax powder. There are several variations available on this recipe, but nowadays, most of us use a premixed flux.

FLUXES FOR COPPER

I used a regular paste flux for years for soldering mixed metals, usually silver with copper. Copper and its alloys, though I love working with them, seem to be a particularly nasty group of metals when heated because they oxidize rapidly. When the oxides form, they quickly create a nasty black skin, which keeps the solder from flowing and the pieces from joining. This creates major frustration with many a beginning jeweler.

However, when I discovered Prip's Flux, a spray liquid, my copper soldering became much easier. And for some reason, it seems to be a deep, dark secret. Prip's is not carried by a lot of jewelry supply stores, so I have a recipe for you to use. It can be used as an everyday flux, but I tend to keep it only for using with copper, bronze, and brass soldering.

PASTE FLUXES

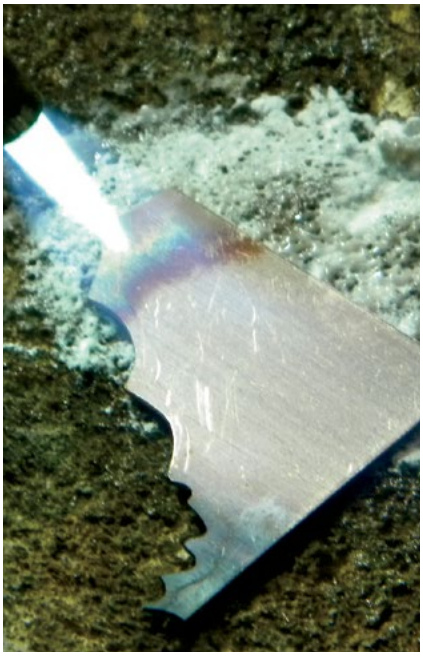
For many of us who solder sterling silver, white paste flux is our choice. These fluxes come under several brand names such as Grifflux #1, Handy-Flux, Superior #6, and Ultraflux. While there are pros and cons to all fluxes, white paste flux seems to be what is used at most schools, and most of us seem to stick with what we learned.

Paste flux has a narrower temperature range, from 1100-1500° F, but it seems to have a longer staying power than liquid flux. Also, paste fluxes are most useful as a temperature indicator : they go on with the consistency of Elmer's Glue, get fluffy white at 400-600° F, and turn clear at 1100° F. To those critics of paste flux who say you can't see the join well, it turns clear right before easy solder melts, and you can see the join just fine then.

I especially like to use paste flux for sweat soldering, or tinning (soldering the top overlay piece on the back before attaching it to a back plate). If there is delicate soldering to be done, cut your pallions of solder, put them on the piece, flux the back of the piece, and allow the flux to dry. When the heat is added, there will be a little popping or spattering of solder as the water in the paste flux boils and causes the popping and hopping around of solder pallions.

Handy Flux seems to be rather grainy, which I don't like, and Ultra Flux is much smoother. Superior #6 is rather difficult to find. Handy Flux and Ultra Flux contain potassium hydrogen fluorides, KHF_2, which are toxic and should not be inhaled and should be used with ventilation. Grifflux #1 contains potassium tetraborate and no free flourides. Flux with fluorides flows smoother and easier, but is more of a health hazard. PDFs of the MSDS (material safety data sheets) can be downloaded and should be kept in all jewelry studios. Find the flux you like the best, but always protect your health.

I've been using Ultra Flux for almost a quarter of a century, and though it's harder to find, you can purchase it through Indian Jewelers Supply in Gallup, New Mexico (ijsinc.com).



Do your brick a favor: don't brush flux on it. You'll only end up having a glassy brick, and your piece will stick to the flux as is cools.

spray flux recipe

1 gal bottled water

4.9 oz powdered borax

4.9 oz trisodium phosphate (available at Home Depot)

7.4 oz boric acid (available at Walgreens or most pharmacies)

Bring water to a boil and add ingredients. Stir until all particles dissolve. Put in a spray bottle. Even though the particles are in suspension, I shake before using.

flux colors as temperature indicators

Temperature	Flux Color
Room temperature	Milky white
400-600°	Fluffy cloud white
1100°	Clear
Overheated	Red

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LIQUID FLUXES

Liquid fluxes do not change color and are not useful as a temperature indicator, but they have a loyal following. I'm going out on a limb here and saying that most jewelers working with gold will use a liquid flux, most prevalently the well-known greenish yellow Battern's Self Pickling Flux. Liquid flux is also a great flux for repair because you can purchase a needle-tipped plastic bottle and put the flux exactly where you want it — even on a prong tip.

The name of the flux can be confusing, though. Some people believe that because it is "self pickling" the metal it's used on does not need to be put in a pickle pot after soldering. This is not true. The "self pickling" means that it keeps the color clear and the flux helps clean the metal while actually heating the metal and solder. Your piece must be pickled after soldering. Handy Flux is also available as a liquid flux, but it good only for very small joints, and is relatively difficult to find.

Dr. Frank's Fabulous Flux is a bit less toxic, and available from Paul H. Gesswein & Company (gesswein.com). Jewelry pieces must be warmed with the torch first, and then the flux should be sprayed on. This flux still contains boric acid, but no alcohol. I do find that spraying on a flux seems to be a bit wasteful, but it works well. This brand has been on the market for a while, and I prefer it over Battern's.

SPECIALTY FLUXES

I call these speciality fluxes because they are rather expensive, and I use them for special or difficult soldering jobs. I must confess I like Firescoff, a relatively new ceramic spray. It is fluoride free.

It cleans up in hot water or in an ultrasonic cleaner. It too, comes in a spray bottle, and I am very careful about overspray when using it. The Firescoff website, nventa.com/firescoff, shows the correct way to use and capture unused Firescoff. I have found that when using Firescoff, the spray bottle clogs up when the bottle is about half used. Running the spray head under hot water will help dislodge any particles. There is an additional non-clogging airbrush type gun which can be purchased.

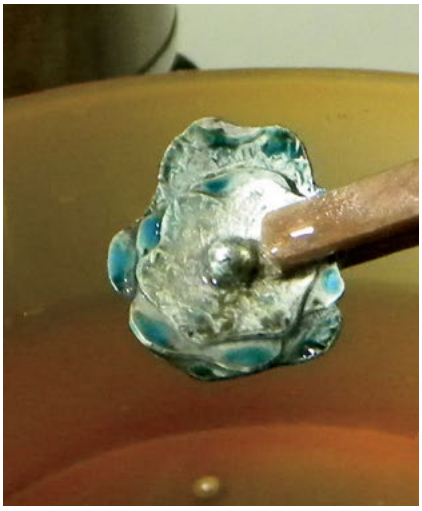
Advertising says Firescoff "provides stray heat protection for gemstones" but I haven't tested that. However, you can perform numerous soldering jobs without pickling in between. I have found no difference with 80/20 or reticulation silver. Firescoff is not carried by all jewelry supply stores but can be ordered from all major supply houses.

Also, I love Cupronil. Again, this is a spray product, and it seems to burn off much slower than the paste or Battern's flux. Cupronil has been on the market since the mid 1970s. I find that it really reduces firescale on large cuff bracelets. I haven't had it clog the spray dispenser, and I clean pieces

reconstitute dried paste flux

Paste flux must stay clean and uncontaminated. It will dry out when left without the lid for a few days. It may be reconstituted by adding some distilled water (I've heard mineral oil is better, but I've never tried it), and I add a drop or two of Dawn detergent as a lubricant.

Put this in the original container and heat in a double boiler, stirring until you have the consistency of Elmer's Glue. Don't add a lot of water, just a teaspoon at a time. Stir well, and soon it will be good as new. To keep your flux from drying out, scoop a bit of the flux into a smaller jar and add a bit of water. If you accidentally leave the lid off, the entire jar of flux is not ruined. Mineral oil will also thin thickened paste flux.



Sometimes you'll get a blue oxide tinge to the sterling after you've soldered a join – a nice hot pickle bath will take those oxides right off.

At 1200 degrees, paste solder will turn clear, and a sterling piece will be almost hot enough to encourage easy solder to flow.

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in regular pickle. Cupronil has an extremely loyal following and can be found at most jewelry supply stores.

TO FLUX OR NOT TO FLUX

Do you flux the entire piece or just the join? The answer is a matter of preference. Because sterling and copper are great conductors of heat, you must heat the entire piece to get the solder to flow. I feel that I get better protection if I flux the entire piece. Gold, being such a poor conductor of heat, only needs the join to be heated, so I just flux the join. Make sense?

You do not have to flux the underside of the piece (the part lying on firebrick or charcoal) because it just creates a mess after enough times. In fact, it's better to hold the piece in your hand.

Sometimes long strings of flux glass will accompany your piece on the way to the pickle, or excess flux glass might keep your piece attached to the brick. Then you'll have to gouge it out with a solder pick. Flux glass is extremely hard to remove from metal, and must be kept in the pickle a longer time. Flux glass cannot be removed by filing or sanding, so keep your solder surface clean and flux free at all times.

ANTI-FLUX

Much has been written about anti-flux and its uses. I have used an anti-flux only once in several decades of jewelry making. If you are careful and pay close attention with the torch, and carefully choose your torch head, very little anti-flux is needed. There are specific anti-fluxes on the market as well as regular yellow ochre powder. Some people use Wite-Out, but it is carcinogenic when heated.

Now, think about this: solder won't flow when the metal surface is dirty. What will make the surface dirty? Just about anything. Making a paste of rouge powder from your buffing wheel and water works well as an anti-flux. So does rubbing your finger alongside your nose and then onto the silver (yuck, I know, but it works). Save your money when purchasing an anti-flux, and then buy some Firescoff or Cupronil. You will be happier.

I hope these flux tips help when you have specific questions about the confusing aspects of purchasing a flux. The best advice is to find a flux you like and stick with it. You will find it comforting when you get to know just how your flux works in each situation. Good luck.

Danger zone! Don't get your piece too hot: you'll be in danger of a meltdown, and you'll destroy the protective properties of the flux.

firescale and flux

For a scientific approach and a recipe for traditional borax flux, please check out Charles Lewton-Brain's excellent article on firescale and flux at silversmithing.com/1fire.htm. A download of an updated version is available for $4.00 at lulu.com/product/file-download/preventing-and-avoiding-fire-scale-when-jewelry-making/2822160

glossary

Anti-flux Anything non-flammable that will adhere to the metal and keep solder from flowing onto an unwanted area.

Cupric oxide Cu0 is a reddish oxide, which forms when a piece of sterling is heated. This is usually removed by immersing the object into warm pickle.

Cuprous oxide Cu_2O is a dark purplish stain which not only occurs on the surface of the piece you are soldering, but also much deeper into the metal. It is difficult to remove cuprous oxide (firescale), but it can be removed by sanding the piece until all discoloration is gone.

Firescale The common name for a purplish stain which shows up on sterling silver when it is soldered. If you are careful, very little firescale will appear during annealing. In sterling, firescale is caused by air mixing with the copper in the sterling, and using a flux solution will minimize the firescale. When soldering brass or bronze, the firescale looks like copper, which means the alloy was overheated, causing the copper to surface.

Flux A borax based solution mixed with water, alcohol, or mineral oil, which will reduce the chance of firescale on sterling silver and copper alloys. It also keeps the metals clean as they are soldered. Most jewelers today use a premade commercial flux for all soldering processes.

Prip's Flux A commercial liquid flux which works well on all metals and is the best flux to use on copper alloys.

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your soldering station

Refrigeration, universal and stem wrenches.

Create a fire-safe zone

BY LEXI ERICKSON

A complete solder station, with tweezers and "burn 'em up" pliers.

So far you have learned the forms and functions of solder and flux. Now we're going to look at setting up a place for to solder, your solder station, including where to put the things you'll need.

It's important to me that I can move between my bench and soldering station quickly and comfortably, with very little wasted movement or time. It's also important that I have, within my reach at all times, everything I would possibly need both for soldering and to handle any emergency. You never know what will happen during soldering, and you have to be able to reach for a different tool or new solder pick quickly.

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COMFY AND SAFE

Seating in your studio is truly whatever you find best for your situation and health. Choose the seating that works for you: it won't hinder your soldering to have either a chair or a stool, just as long as it's comfortable.

When I planned my studio, I thought it would be very handy to have a rolling chair: you'd be surprised how many times I simply roll over a few feet for the next step on a piece of jewelry. My chair is the right height for both my 37" tall bench and for my soldering station, which is just a regular height (about 28") table. I don't solder standing up: not only do I find it extremely uncomfortable, but I also have more control and a steadier hand sitting, so for me a comfy chair on wheels is really important.

Several very successful, non-teaching artists I know simply turn their chairs 90 degrees and they are at their soldering stations. That would be ideal for me, too, but I also teach in my studio, so I have my table a few feet away from my bench to make room for a student and me. Consider if you'll be sharing a station or not when you decide where to put it.

Safety is of utmost importance, along with ease and comfort. Having things organized in a way that is logical, practical, and easy to reach and clean is important for both concerns. My students and friends who frequent my studio laugh at me: the family den might be a mess, but my bench, bench drawers, and soldering station stay perfectly arranged all the time!

If I'm in the middle of soldering and need a set of flat nose pliers, I know they are in the fourth drawer down, second set of pliers over. I can reach them blindfolded. It may be a bit OCD, but hey, it works: in a pinch, when I reach for something, it will be there.

You should have good ventilation in your studio, but this doesn't mean you must rush down and purchase an expensive hood and exhaust system. For most home soldering setups, an open window, a fan blowing across your soldering table, or both are fine. Do realize that if you are sitting under a fan or air conditioning vent, your flame for soldering will act differently, so adjust accordingly. Don't forget that safety glasses should be worn constantly while you are in the studio.

SOLDER STATIONS

Your **soldering station** is simply the place where you solder. It does not need to be any one type of station, but it does need certain attributes and pieces of equipment.

You will need to make sure the surface is fire-resistant if not fireproof. The table or other surface must be stable and not wobbly. Since fuel and oxygen tanks need to be secured so they won't fall over, many jewelers chain their **B-tanks** to their solder tables, which means tables should have front legs. Though not an absolutely necessity, it is easier if your pickle pot is within reaching distance from your soldering station, so leave room for that when planning.

Several fire-resistant materials are available at most local hardware stores, which you may lay on top of the table you choose as your soldering table. Magnum board is excellent, produces no carcinogens when heated, and there is no off-gassing. The company says the board is "classified as non-combustible" (magnumbp.com). You may be able to purchase a scrap large enough to cover your soldering table, or you may have to buy a large sheet and have it cut. If that's the case, several jewelers could go in together and purchase one large board and share.

There is also a ready-made solder station available that turns every table, counter, or other stable surface you have into a fireproof and easily cleanable soldering station. It's $115 and it just so happens that I make it (LexiEricksonDesigns.com).

Some people choose a stainless steel counter, like that in a restaurant kitchen. A less expensive, smaller table topped with either a set of fire bricks, ceramic tile, or a metal soldering station will work well, also.

glossary

B-tank "B" indicates the most popular size of acetylene tank, which is used for a Smith or Prest-O-Lite single gas setup. You can purchase a B tank at your local welding supply. Your tank must be chained securely in your studio for safety reasons.

When transporting your full tank from the supply store, make sure it remains upright and is secured in your vehicle, and keep a window cracked or down while it is in your car. If the tank does fall over, just allow several hours before lighting. Some supply houses will deliver, so ask.

Charcoal block a long-held tradition in soldering, charcoal blocks can be expensive and have a shorter lifespan than the more popular fire bricks. The charcoal holds heat and reflects the heat back to your piece. The drawback is the price.

A soldering tripod with a screen.

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Lexi's turntable, fire brick, tweezers, and pliers.

Silquar High Heat Block and flint striker.

Once you have stability and fire resistance, what's important is that you can sit comfortably at the table, with your legs fitting underneath, so you need to consider your table and chair together. Do consider your soldering station carefully, and don't scrimp when planning your solder table. A metal TV tray just won't work.

HOT STUFF

There is much to say about the torch; here we're just going to look at where it goes in your station. (For a listing of the most popular torches on the market, please check out "Jewelers Torches," in the November, 2010, issue of *Lapidary Journal Jewelry Artist*.) All the safety issues and accessories we've talked about so far revolve around this one critical piece of equipment, and utmost concern should be given to torch placement. For obvious reasons, you don't want to place it next to any open flames, such as a furnace or water heater. I choose not to have mine really close to any electrical sockets, either, but that's probably my own paranoia.

For torch placement in relation to your solder bench, it really depends if you are right- or left-handed. Since you solder with your non-dominant hand, the torch should be on your non-dominant-hand side. This will keep the hose away from you instead of stretched across your lap. (You'll be using your dominant hand to manipulate the solder pick, which actually requires finer control than directing the flame.)

And speaking of hoses, since you are sitting at the solder station with everything you need within easy reach, you don't need 12+ feet of hose, which could just get tangled under your feet and cause you to fall. Six-foot hoses work fine in most instances.

You will need to chain your tank to the solder table leg. ***It must be sturdy and not allowed to wiggle or fall over. If the tank falls over, and the regulator breaks off, the consequences can be disastrous.*** Not to panic you, but it is extremely important that the tank is fastened to one of the sturdiest tables in your studio, and the hose does not stretch across the room. Please be cautious and take extreme care with everything concerning your tank and torch.

That being said, after speaking with many teachers, and from my own personal experience, aside from a student catching a paper towel on fire now and then, I have only heard of one fire/torch accident in the studio, but it was because of the student's own inexperience, and not a torch problem. There are all kinds of safety precautions in place with torches and diligence on your part will insure your safety. Just remember to keep everything that is flammable away from your solder station.

BRICK BY BRICK

Fire bricks, or **refractory bricks**, are used almost universally in schools and studios as a surface for soldering, for building small tabletop kilns, and as fireproof backings on solder stations. These bricks are made from a refractory ceramic, and rumor has it that they will take up to 4000° without melting, though I haven't personally tested that out.

glossary

Fire bricks specialty flame-resistant bricks used in ceramic kilns that can also be used for soldering. Like charcoal, fire bricks will reflect heat back to your piece, making soldering easier, and they last longer than charcoal. Also used for small portable soldering kilns and to line a soldering station.

Flint striker Very inexpensive and the safest way to light your torch. Available at all welding supply houses and hardware stores. Be sure to buy an extra package of flints. (Electronic strikers are fun toys that are available for around $30.)

Don't use regular house bricks: not only do they not reflect heat back, they can explode with high heat. Don't use ceramic tile, either: it will make a really loud crack as it breaks, and makes a horrible soldering surface, as one student found out.

Fire bricks are usually 9" × 4.5" × 2.5" and are available at ceramic supply stores because they are also used in ceramic kilns. Sheffield Pottery sells them mail order (sheffield-pottery.com/kiln-Building-Refractory-Bricks-s/24.htm). These bricks will take a lot of abuse, such as sticking T-pins into them, and lots of heating. Pay attention when purchasing refractory bricks, though, as I have discovered a thinner brick, 1.25" instead

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of 2.5", which my students tell me pulls heat away from the piece and does not work well.

When fluxing your pieces, try not to flux on the brick, as this will cause flux glass on the brick, and later will cause problems, such as the brick sticking to the back of your piece. As your bricks age and darken from use, you can clean them with an old file, rub two bricks together, or rub the brick against a concrete driveway, which may leave a rougher surface. You can also do what I do: just turn it over and you have a clean new surface!

I used to use charcoal blocks for everything. Those little guys are so expensive, though, it's hard to believe they grow on trees, so I changed to the less expensive fire brick.

However, for some types of soldering, or when I think I need a bit of extra help, I still use the time-tested charcoal block. I learned an alternative from another jeweler: scrape a layer of charcoal onto the fire brick, and it is supposed to work just like charcoal. Whatever you do, please do not use charcoal BBQ briquettes: they release toxic fumes and are hazardous for so many other reasons.

Charcoal blocks create a reducing atmosphere (reducing the amount of available oxygen), which keeps your work cleaner and helps with quicker melting. I do all my gold soldering on a charcoal block, which I set on top of a fire brick.

Because charcoal blocks usually break the first time you heat them up, you might wrap binding wire around them. This won't keep one from breaking, but will at least keep it from crumbling. I fit my block into the bottom of a square Altoids tin, and it's surprising how well the block has stayed together confined there.

By drilling small holes in a block with a cup bur, placing small pieces of wire in each hole, and then heating, you can make perfectly round little balls for granulation. But don't stick T-pins into them as they will crack!

Another great tip: as soon as you are through with the charcoal block, either spray it with water or dunk it into your bowl of quenching water. That way the block does not keep burning on the inside — and never leave a hot block just sitting on your bench and leave the studio.

A specialty ring soldering mandrel.

Though charcoal and solder bricks are widely used, there are several other soldering blocks to consider. Solderite pads have a large following, and many people like them instead of charcoal or fire bricks. Solderite won't flake or crumble like charcoal does, and cools down quickly. Silquar High Heat Blocks work well and may be cleaned with water, which is a plus and keeps a nice surface.

There is also a ring stand for soldering rings. This was a great invention, and I have found that the carbon mandrel works better than the ceramic mandrel, which takes a really long time to heat up. There is also a soldering turntable that holds a regular fire brick, and makes soldering much easier because it turns with a nudge of your finger. It's available from me, also, for $59.

PICK PICKY

Solder picks are wonderful and extremely useful, but when I go teach workshops at different studios, the solder picks drive me crazy. I've seen everything from pencils (which can work remarkably well if you don't mind a little flame flare-up here and there) and awls to pieces of coat hanger wire. They are always bent and crooked and have a very nasty looking five-pound blob of solder on the tip. And that's exactly what's sitting on most home soldering stations, too – *arrrrrg!*

There are a number of solder picks on the market. Probably the most universally used is a titanium or tungsten solder pick because solder will not stick to either one. But what really torques me up is when, in a stressful soldering situation, I push down on the solder pick and it just bends like the stem on my ever-prolific ivy. The heat will cause both titanium and tungsten to lose their temper, though the tungsten seems to bend less than the titanium. Nothing is more useless than a wimpy solder pick!

Fortunately, I have found some great solder picks at Harbor Freight. For less than the price of one titanium solder pick, I can buy 50 welding rods, cut them in half, and sharpen one end on a grinder and I have a solder pick that will not bend, no matter how hard I've pressed on it, and boy, have I put pressure on it! The trade-off is that solder *does* stick to these, but I just file it off, or clean the picks periodically on a belt sander, and they are fine.

I always have about a dozen clean solder picks on my bench at one time, and when I get into a sticky situation, pun intended, I just reach for a new pick. I highly recommend these, and once you get used to them, you will like them, too. The gray coating is a flux, and acts like an insulator for the pick, but part of this will be ground off in the sharpening of the picks. Just wear a particle mask when sharpening. And when the pick gets too short, just toss it and get another. They're cheap!

IN A PICKLE

Soldering requires **pickle** and a **pickle pot**. Pickle works better when it is warm, not boiling, as that releases noxious fumes. Your pickle pot can be as simple as a cup warmer with a mug sitting on it, or as grand as a professional pickler. It really just depends on the size of the jewelry you make.

Many schools and jewelers use the lowly, common, everyday crock pot, available at big box stores like Target or Walmart. It's better to get a new one, since old used crock pots may leak ironstone into the pickle, and turn everything in the pot a coppery color. Otto Frei (ottofrei.com)

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An old abused fire brick.

and Rio Grande (riogrande.com) both carry some great picklers, and because they have glass containers, you won't have to worry about ironstone leaking in.

While we are on the subject, there are a number of pickles available, and lots of rumors about pickles. Pickle removes the cupric oxides, which appear on the surface of soldered metal.

Putting soldered silver into the pickle after soldering cleans the piece and etches away the top layer of copper, leaving a clean, white, frosty look on sterling. It leaves a clean surface on copper alloys. It will not eat off your skin if you get a drop on you, but it will leave holes in your clothes if it spatters on you — but only when your clothes are washed.

Historically, pickle was a mixture of sulfuric acid and water, but this has changed over the years. I used to use Sparex #2, but after returning from teaching in South America for several years, I found the recipe must have changed because now it is brownish and usually has a nasty, bubbly, yucky foam on the top of the water. I called the company, and they were less than hospitable, so I quit using it.

Each supplier seems to have their own brand name pickle, and each works just as well as the others for silver, copper-based alloys, and gold. For cleaning nickel, there is a special formula of pickle called Rio Kleen, available from Rio Grande, and is commonly called "nickle pickle" – no, I'm not making this up.

Some people prefer a more bio-degradable pickle, and OttoTech Citri-Pickle is available from Otto Frei. This is a citric acid, and while it takes longer, it is more environmentally friendly. King Arthur Flour offers a sour salt (King Arthur flour.com, item # 2296, $5.95), which is an earth-friendly citric acid.

I use something called PHDown. It's a sodium bisulfate, just like the regular pickles, and is available at swimming pool supply stores. It's the same thing as a regular jewelry-supply-Store-bought pickle, only cheaper. Yep, in hot tubs and pools you are sitting in pickle — but it is greatly diluted, so don't faint. Generally speaking, I use about ¾ of a cup of granular pickle to about a gallon of water, and a bit more for citric acid. It really doesn't have to be that exact.

You will also need a ceramic bowl for quenching water. Plastic bowls may melt if you toss a hot piece of metal into them.

SAFETY GEAR

While a full-face shield is a great thing to have while casting, it's usually not necessary for soldering, but do buy some nice safety goggles or glasses. (Glam them up, if you wish, with a few crystals!)

A 3M particulate soldering respirator is a necessity and available from major supply houses. I use the one available from Rio Grande, order number 201-683, and under $30 for a package of 10.

A lab coat or apron will help protect your clothes from splashing pickle and water. It will also catch many things you may drop, like a tiny piece of solder.

A fire extinguisher is a necessity in the studio. Read the instructions and become comfortable with it *before* you need it. At Bead Fest Texas last year when I was teaching soldering, one of my students left a can of Tundra First Alert Fire Extinguisher (firstalertstore.com/store/catalog.asp?item=1209) in the room. What a great idea to have in addition to a regular fire extinguisher! Thank Heavens I haven't had to use it, but I will recommend it from now on, and a big thank you to the student who left it, whoever you are.

glossary

Pickle Historically a warm sulfuric acid/water or alum/water solution used for removing oxides from metal after soldering. Nowadays, a sodium bisulfate salt is used and comes under various trade names. Pickle removes cupric oxides from the metal after soldering.

Pickle pot Almost any ceramic or glass container can be used for holding warm pickle, from a mug to a professional pickler.

Solder picks A tool used to help place and move solder. A sharp solder pick can also be used to push molten solder into place along a join. Solder picks vary in materials, price, and flexibility.

Also good to have are supplies of Band-Aids and neosporin in the studio.

MORE TOYS

I have listed the big components of any soldering station, but you also need a few more things, like something for lighting the torch. *Do not* use a butane lighter, as these may leak and explode in your hand with the force of a grenade!

A regular **flint striker**, readily available for under $2, is available at jewelry supply houses and welding supply shops. Purchase an extra box of five flints for about $1.50 just to have on hand. The flint striker works well, and one flint will last a long time. For around $30, you can get an electric (battery powered) striker or automatic torch ignitor, which is easy to use and just a cool gadget to have. All major supply houses carry them.

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A new fire brick and charcoal in an Altoids mint tin.

Even a new charcoal block can be very fragile.

Copper tongs are necessary for removing objects from the pickle, as you should not use regular tweezers for this. Regular steel tweezers may contaminate other objects you have in the pickle, and even if they don't, it certainly doesn't do your tweezers any good.

You should have a nice set of soldering tweezers for picking up small pieces of solder. Otto Frei lists pages and pages of specialty tweezers that I drool over. Since I don't allow a third hand in my studio (the early ones are horrible heat sinks when soldering and I never did adjust to the newer ones, which admittedly are pretty good), I always have one or two pair of cheap, extra long chain nose, rubber handled pliers that are my famous "burn 'em up pliers" that I write and talk about all the time. They are great for holding objects or even pushing down on pieces while soldering.

A **universal tank wrench** is a good thing to have because it will fit nearly every tank fitting you have. It will run less than $20, available from the larger jewelry supply houses or welding supply shops. I use a refrigeration key on my tank, and it's a one-way rachet wrench. They are about $30 at an air conditioner/heater supply house.

You will need a few paintbrushes for putting on flux, picking up small pieces of solder, and now and then, brushing something off your metal. While catalogues show something actually called a "flux brush," which you renew by peeling away the outside as you use it, these brushes have coarse bristles, and it's difficult to pick up a 1 mm square of cut solder with one. An inexpensive # 5 round artist's watercolor brush works great, and is available at any art supply or crafts store.

Ok, since I've angered some of you who like to use a ***third hand*** — don't send me any nasty letters — I admit there are some good ones on the market, but they aren't cheap. Truthfully, the more expensive ones work really well, but since they weren't available when I was learning, I didn't start out with one and now I'm old and just set in my ways. The old kind was not stable, while the heavy clips either marred your metal or messed it up and they were huge heat sinks.

Swanstrom has a third hand with a magnetic base and tungsten tips. It runs about $125 and is available from Rio Grande. The GRS system — and everything GRS is top notch — is a bit less and is available from major supply houses. Both of these come highly recommended by professional jewelers.

If you need to heat a piece from underneath for whatever reason, you may want to purchase a 9" tall tripod with a heavy mesh screen. Again, this seems to take longer and can create more firescale on the piece, but many people like this setup.

There's nothing more frustrating than being halfway through soldering a project and discovering that what you need at that moment is out of reach or not there at all. Now that you know what you need and you've figured out how to arrange it in a manner that best suits you, you're almost ready to start soldering.

LEXI ERICKSON has written for *Lapidary Journal Jewelry Artist* since 2006. She has a Master's Degree in Jewelry Fabrication and Design and has taught college and high school jewelry since 1988. She teaches at Bead Fest and in workshops all over the country and has taught in South America. Write Lexi at LexiEricksonDesigns.com, and follow her blog.

glossary

Soldering station This is the actual spot where you do your soldering. It's usually easier and neater to have a separate location from your fabrication or assembly location. All solder stations must be fireproof and free of miscellaneous flammable materials.

Third hand A tool that will hold metals and keep them steady while you solder them. While I'm not a fan of third hands, the newer, more expensive ones can work well.

Universal tank wrench This $20 tool will fit all the fittings on any gas and oxygen tank and works better than pliers or a wrench, which can round out the edges of the fittings or the tank stem.

Titanium and tungsten soldering picks and welding rod.

A new firebrick with bailing wire.

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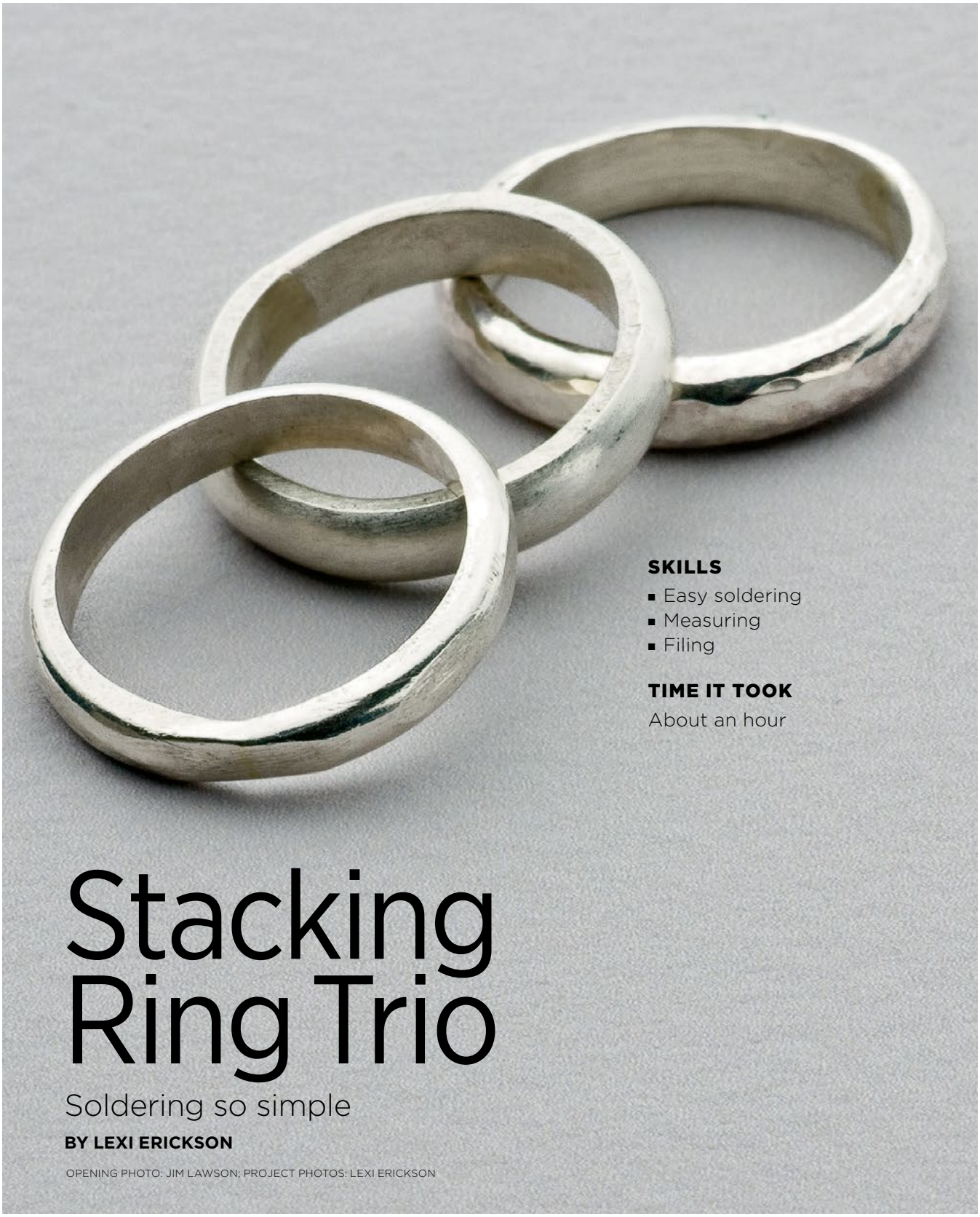

SKILLS

- Easy soldering
- Measuring
- Filing

TIME IT TOOK

About an hour

Stacking Ring Trio

Soldering so simple

BY LEXI ERICKSON

OPENING PHOTO: JIM LAWSON; PROJECT PHOTOS: LEXI ERICKSON

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Instant gratification! This is the first soldering project I give my students. It's quick and easy — and they leave class with three rings!

While it may take a bit more than an hour the first time you try this project, soon you'll be able to make these rings, start to finish, in less than 30 minutes.

There are many gauges out there on the market for accurately measuring ring sizes and the length of a ring blank needed, but I have yet to find one that works. For me, the best way to measure the length needed for a ring blank is the old "piece of paper wrapped around the finger" trick.

And teachers, please feel free to use these instructions, and adapt them as needed. They are certainly not an original idea and have been around for probably hundreds of years — because they work.

Wrap a 3″ x by ¼″ piece of paper around your finger. Mark where it overlaps with a pen, and cut the paper where you marked it. Adjust for large knuckles, if needed. This high-tech technique will give you your ring size.

Lay your piece of paper alongside your 8ga half round wire. Measure and mark off 3 sections the same length as the paper, plus add just a tad bit (a technical jewelry term here) more for each. You will have some wire left over.

Saw through the wire at your mark. You will have three lengths of wire, plus one leftover section that is probably a bit longer. Set the longer one aside. You will not be needing it yet.

Saw through the wire because it will give you smooth ends — rather than the crimped edge left from a pair of shears. It's easier to file and smooth sawn ends. **Photo 1** Almost any type of wire can be made into a ring. Here we have half round 8ga, twisted, and flat wire. I used the half round for this demo.

File wire edges perfectly flat (it's harder than you think), remembering to file away from yourself. The wire edges must fit up against each other with a butt joint. Rounded ends will not solder well, if at all.

MATERIALS

8 gauge half round wire, 12 inches

Medium wire solder: please flatten the solder by rolling it through a mill or hammering it flat

TOOLS

LAYOUT: scrap paper and a pen

HAND: jeweler's saw and blades, 2 pair of chain nose pliers, rawhide mallet, planishing/texture hammers (optional), ring, mandrel

FINISHING: #2 flat or half round file, (optional) rouge or Zam, 00.3M 9mm finishing film

SOLDERING: tank, torch, firebrick, pickle, flux, copper tongs, soldering tweezers, quenching water

OPTIONAL POWER: polishing wheels, flex shaft or Dremel, polishing wheel for rouge or Zam, either a felt wheel or a muslin buff

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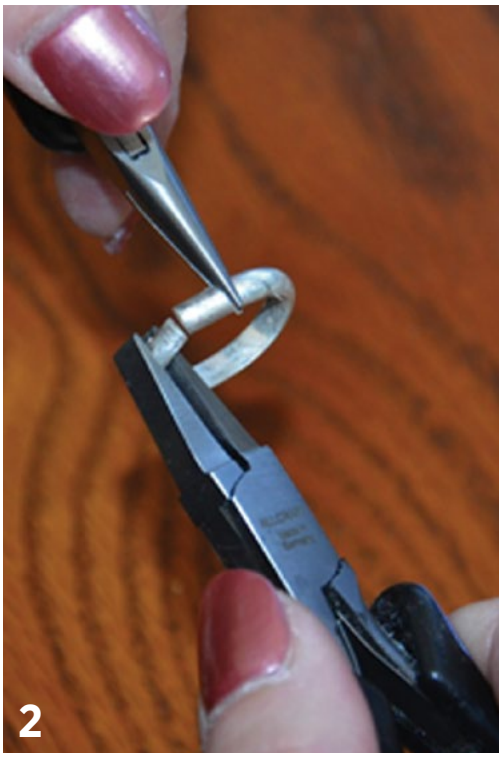

Photo 2 Using two pair of pliers, one in each hand, align the edges of the ring, just like you would in closing a jump ring. Make sure the edges fit together perfectly, with no light showing through.

Don't worry that the ring is not round. You will round it later. Try it on for a general fit. If it's way too large, cut or file down to fit.

Either put your pieces in warm pickle to clean them, or sand the ends of the ring to clean them. If you pickle them, rinse them in water and dry them. In either case, do not touch the joins with your fingers.

Flux the entire ring.

Photo 3 Cut a piece of solder to about 3mm. Lay a piece of flattened wire solder on the firebrick. Place the ring join directly on the solder, which must be touching the join.

Stop and review what you have done so far. You have now fit the ring to your finger and cleaned the ring. You have fluxed the piece and placed the solder where it should be to guarantee it flows up the join.

Now, remember, solder flows in the direction of the heat.

Let's fire up the torch. Help the heat. Begin by heating the back of the ring, directly opposite the join.

Watch the color of your flux. It will quickly become white and fluffy, and when it does, start moving the torch flame side to side along the top of the ring.

When the flux turns clear, move the flame to either side of the join, keeping both sides of the join hot. Watch carefully and the solder will flow right up the join: your ring is soldered now.

Remove the heat, and with tweezers, drop the ring into the quenching water and then the pickle. Congratulations!

Now do the other two rings.

EFFICIENCY TIP: When you feel confident, try this project again, but this time, prep all three joins, lay all three rings out side by side, and solder them one after the other. Your torch is already lit, your firebrick is already warm, and these are the most time-consuming parts of the process. The soldering takes only a few seconds.

Check the join to make sure the solder has flowed up the ring and that there are no blobs or clumps to remove. If you find any unmelted solder or clumps, reheat the ring and make sure the solder flows. Do not file off extra solder — it will leave a weak joint.

Vary Your Rings

- Use patterned or flat wire or both. Flat wire, available from most supply houses, can be rolled through the mill to create different patterns.
- Use liver of sulfur to darken your silver and highlight your patterns or textures.
- Add small faceted stones with gypsy settings.
- Solder on some tubing for tube setting stones.

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Photo 4 Place the rings, one at a time, on the metal mandrel, and use a rawhide mallet to round them out. The rawhide will prevent marring the metal. Do not strike downward on the mandrel, because it will stretch the ring. Remember to mallet each ring round, take it off the mandrel, turn it to the other side, put it back on the mandrel and mallet it again, to avoid a tapered opening.

Choose one ring and texture it with a planishing or texturing hammer. Again, do not hammer down the mandrel. Hammer perpendicular to the mandrel to avoid stretching the metal. Again, flip the ring on the mandrel so as not to create a taper in the band.

Polish the other two rings with rouge or Zam and a muslin or felt buff. Cut a small piece of finishing film and sand the insides of the rings to a nice finish. Place the textured ring between the two highly polished rings.

Photo 5 I was having so much fun I got carried away and made 5 rings: flat wire, half round 8ga, planished finish, sanded finished, and file finished.

You know you will have someone ask for a ring now, so take the leftover piece of wire you set aside at the beginning, and make a ring for a friend. You're on your way to happy soldering!

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