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Introduction

At its heart, soldering is a simple craft with just a few rules to learn. With practice, the rules will become familiar, the process of soldering will feel quite natural, and soon you'll be soldering custom-made jewelry.

Each step you take through this book will build your skills and your understanding of soldering. Don't expect perfection right away. Allow yourself to make mistakes—they are the key to success. When you take the time to figure out what went wrong and then fix it, you grow in your craft.

It's my goal for you to learn how to solder precious metals (silver and gold, in particular) through the techniques and projects taught in this book. Lots of step-by-step photographs will help teach you how to solder correctly. The language and descriptions are simple. Throughout the book, you'll come across italicized words or terms; if you're unfamiliar with one, turn to the Glossary (p. 109) for a definition.

Part One is a thorough overview of the tools, materials, and soldering and metalworking techniques you'll use. In **Part Two**, you'll learn by doing. The first projects teach you good foundational skills, such as how to solder jump rings and make your own custom findings. Each successive project builds on these skills to teach more about the subtleties of soldering. As you move through the projects, soldering will help you construct some challenging jewelry designs—from hollow beads and boxes to stone settings.

Although I promise that the techniques are easy, they are not watered down. These are the same skills I learned in college, the same skills I practiced during many years working in jewelry shops, and the very same skills that I use to this day. And the equipment is modest: You don't need a fancy torch or a special bench. It's my goal to help you learn how to solder beautiful jewelry at home using simple and affordable tools.

—Joe Silvera

PART ONE
Soldering Basics

In this section, you'll learn what you need for a simple soldering setup—from the easy-to-use butane torch that's at the heart of these techniques to the materials such as solder, flux, and pickle that you'll use in every soldered jewelry project.

I'll also teach you some of the techniques that will help you become a pro with the torch, such as fueling and adjusting your torch and matching your heating pattern to the type of project you're soldering.

What Is Soldering?

The act of soldering is simply joining metal parts together using heat and a fusible alloy that is also called ***solder***. (It can sometimes get confusing: The term "solder" is both a noun and a verb.) Soldering is used in the manufacture of almost everything metal related—from munitions to outdoor furniture, electronics to jewelry.

In jewelry soldering, you join metal using heat and pieces of solder. Solder is an ***alloy*** of metals that melts at a lower temperature than the metal it is joining. Solder is usually composed of the same metal you are trying to join. For example, sterling solder is a mix of ***sterling silver*** and zinc.

Metal is soldered when you place pieces of solder on a seam brushed with ***flux*** and heat the metal evenly until the solder melts and flows. When the metal is heated, it expands slightly and creates a vacuumlike draw, also called capillary action, that pulls the melted solder into and through the join. Because solder doesn't fill gaps easily, the two parts to be joined must meet perfectly.

safety warning

Because you may be a "kitchen-table jeweler," remember to keep soldering materials separate from food and food-serving items. Your common sense will guide you, and I also provide specific safety tips along the way. No eating, drinking, or smoking in the area where you are soldering. Clean the space thoroughly after soldering. For more on workspace safety, please see p. 17.

Knowing how to solder will open many doors in your jewelry making. You can use your new skill to permanently close jump rings, attach posts and pin backs, and make custom findings such as clasps, beads, and stone settings. You'll get hands-on practice in making these items (not to mention some charming jewelry) by creating the projects featured in this book.

frequently asked questions

Can I solder jewelry with stained-glass solder?

No. Low-temperature solder, the kind used for stained glass or available at hardware stores, is used for what's called ***soft soldering***. It adheres mostly to the surface, forms weak bonds, and contaminates precious metals (and therefore should not be used with silver or gold). High-temperature or jewelry solder flows at high temperatures, on average 1325°F (718°C) and above, and this process is called ***hard soldering***. This kind of soldering forms strong bonds that can be bent, formed, and hammered.

What's the difference between soldering and fusing?

Fusing is a way of joining metal by heating it very close to the melting point until the surface collapses slightly, closing the seam. Metals such as ***fine silver*** and ***Argentium sterling silver*** fuse easily because they don't oxidize (or blacken) when heated.

Traditional sterling silver, copper, brass, and some alloys of gold don't fuse easily because the copper in them oxidizes, which can prevent fusing from happening. Fusing requires the same high temperature every time a join is made, which is problematic for the multistep joins involved in projects such as stone settings, boxes, and beads—you're more likely to end up with a lump of silver than a piece of jewelry.

Soldering occurs at a temperature that's lower than the melting point of jewelry metals, and you can choose solders that melt at different temperatures for the best control and care of your metal—especially important for the multistep joins mentioned above. Soldering has a few advantages over fusing: Fusing can cause your metal to shrink and thicken, and it can create unwanted texture. Also, with soldering, you have more choices in the metals you use, and you can even mix disparate metals in one jewelry piece.

Soldering Tools

As a jewelry maker, you have undoubtedly amassed an assortment of pliers, hammers, and so on. This section does not detail those basic tools, but rather specifies the minimum items you need for soldering and making the projects featured in this book. Naturally, there are many "nice to have" tools not listed here, which you may acquire as you become more proficient.

TORCHES

Soldering torches come in many sizes and use various gases, such as propane, acetylene, hydrogen, or butane. These gases are often mixed with oxygen to increase the temperature of the flame produced. Professional-grade torches are expensive ($500–$1,500) and use high-temperature flames for fast soldering or melting large amounts of metal. For the projects in this book, however, you'll use only two sizes of a simple, affordable, handheld torch—what's often referred to as a micro or mini torch and its big brother, a jumbo butane torch. You'll be amazed how much work you can do with these humble tools! What's more, you'll work only with butane gas, which is inexpensive, easy to purchase, and generally safe for home use, unlike some of the other fuels. In fact, the smallest of the micro torches are used by culinary students for making crème brûlée.

I suggest keeping two sizes of torches handy: a small one for detailed work and a large one for fast heating and large jobs. (In the project section, I recommend when you'll need the extra power of the jumbo butane torch.) Use the micro torch for jump rings, wirework, and delicate joins. Use the jumbo torch for big pieces and thick metal—the large flame will cover more surface area and heat the metal more effectively. If you try to use the small torch on a big job, you'll find that the heat dissipates as you move the small flame around the large area, and it will be very difficult to bring the metal up to soldering temperature.

There are several models to choose from. Look for a torch that has easy-to-use controls for regulating the gas and oxygen, as these are elements you will adjust often. Expect to pay $30–$80 for a quality micro or jumbo torch. For better performance and to keep your torch working a long time, use the best quality butane that you can afford.

Two sizes of butane torches: the micro (front) and the jumbo torch

Metalworking Techniques

In addition to understanding soldering techniques, you'll need to be skilled in a few other ways of working with metal to complete the projects in this book. Here's a brief course in annealing, filing, drilling, sawing, and other basic metalworking techniques.

Annealing

If your metal becomes work-hardened, you can always anneal it to return it to a dead-soft, malleable state: Simply heat it and quench it. Sterling silver and gold anneal at around 1200°F (649°C), when they glow light red. Brass and copper anneal when they are medium red. Hold the color for one minute, remove the flame, and as soon as the redness disappears, quench the metal in water. Practice will help you gauge the correct color for the metal you anneal.

I recommend using the jumbo butane torch for fast annealing. Follow these steps:

1. Apply flux. Flux protects metal and tells you when it is starting to anneal. Without flux, metals such as sterling, copper, and brass will get lots of firescale when exposed to the high temperatures of annealing. Plus, it can be hard to see the early stages of red heat on light metals like silver. Flux turns clear at 1100°F (593°C), which is very close to the annealing point of sterling. Flux all sides completely. Fill in any gaps while the metal is at a low temperature and the flux is powdery white. For even less firescale, use a preventative flux such as Firescoff.

2. Place on a charcoal block. Charcoal helps keep your metal clean and reduces firescale because it reduces oxygen during heating. The side facing the charcoal will be the least oxidized.

3. Add heat. Dim the light, if possible, to better see the color as you heat the metal evenly with a torch. Another trick for spotting the annealing point is to mark your metal with an ordinary permanent marker such as a Sharpie. The lines will disappear when the metal reaches the annealing temperature.

4. Hold. Back the flame away a little and hold a light red color on the surface for one minute. Don't let the metal get hotter and glow red or orange, or you might melt it or create texture!

5. Quench. Remove the flame and let the metal cool for a few seconds until it turns dark and no longer glows red. Quench it all at once in water. Sterling, brass, and copper are more malleable if quenched after annealing.

6. Pickle. Soak the metal in hot pickle for 5–10 minutes. If the metal was well protected, it should have very little firescale. If it wasn't protected, the surface will be black or blotchy with coppery red patches—oxidation that will require a considerable amount of polishing to remove.

Use the jumbo butane torch for fast annealing.

Hammering

Hammers shape, ***forge***, and texture metal. Use ordinary unpolished hammers, such as household ball-peen or claw hammers, to hit steel punches and stamps. You can also use a special hammer for metalwork called a ***chasing hammer***, which is made for hitting tools like these. The wide face is flat or slightly curved so that it's easy to hit the end of the punch. Hold the handle at the round, thick end, for easy, repetitive hammering, and use the ball side of the hammer to work directly on metal.

You may already use a polished chasing-style hammer for working directly on wire or metal. Reserve a hammer like this for that purpose to preserve its surfaces; any pattern or defect on the hammer will imprint on soft jewelry metals. Polished hammers have a smooth surface that burnishes and polishes metal; they are also shaped to avoid nicking metal with the edges of the hammer's face. Don't use them to hit tools, such as punches and stamps, which are made of much harder steel. If you do use a polished hammer on steel, you'll ruin the surface, though the hammer can be polished again.

Hammering on metal creates texture. The shape and curve of the hammer face influences the texture, from subtle to obvious. Texture hammers have patterns embossed on their faces for directly stamping metal. When trying to texture both sides of your metal, keep in mind that the texture on the first side will be flattened as you texture the second side. Hammering also forges the metal, making it harder and larger, and possibly distorting the shape.

Follow these steps for hammering your metal pieces:

1. Hold the hammer with a loose but firm grip. Hold the thick grip of the handle with your index finger resting on the narrow neck. Use your index finger as a pivot and squeeze your thumb against the handle to guide the hammer head. Swing the hammer in your hand, allowing your palm to act as the stopping point. A looser grip lets the hammer bounce up after you strike, giving you half the swing for free, and reduces wrist strain. Practice by trying to hit the same spot on a foam mouse pad. For more help with your aim, keep the same loose but firm grip, but point your index finger on top of the handle.

An assortment of hammers with a steel bench block in a rubber base.

2. Place the metal on a steel block. Make sure the block is clean and smooth. Place the block on a cushion, like a mouse pad, to soften the noise. Keep the metal in the middle of the block. The metal moves while you work and can slide away from edges or corners, possibly nicking your hammer.

3. Curl your fingers that hold the metal. Use your other hand to hold the metal flat to the block where you strike and to move it as you hammer. Keep your fingers curled under to avoid smashing them!

4. Flatten with a plastic or rawhide *mallet.* Place the concave side down on the steel block, remove your fingers, and pound the metal flat. Flip it over and repeat to flatten it again. If the metal is hardened and won't flatten easily, anneal it or try tapping it with a hammer with a polished, slightly curved face.

Filing

Filing refines the metal's shape and removes defects such as scratches and excess solder before polishing. Use coarse files to remove metal quickly and fine files to create a smooth finish.

Files come in large sizes for fast work, and smaller versions (called needle files) for detail work. The higher the number, the finer the file. For example, a #4 file is much finer than a #0. Files come in different shapes, such as flat, round, triangular, and half-round. The half-round file is handy for filing almost everything: Use the flat side for straight edges and convex curves, and use the round side for concave curves. A barrette file is tapered on the end and has teeth only on its flat side. The other side has a smooth, triangular safety edge, which makes it good for filing corners. Match other shapes, such as triangular, square, and round, to the shapes you're filing.

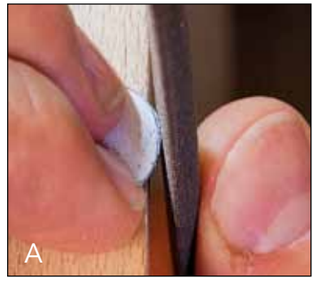
Unlike the irregular grit of sandpaper, which allows sanding in any direction, steel files have rows of teeth, so you need to file in the right direction to be effective. File forward: Apply more pressure as you file away from yourself. Filing backward or toward yourself will not remove much metal at all.

Useful basic files (from left): #4 fine half-round file; #0 medium half-round file; half-round and round needle files in pin vise handles; assorted basic and mini needle files

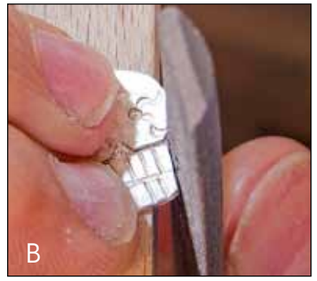
tip

RECLAIM THAT DUST Try to capture the dust from filing, especially from precious metals such as silver and gold. You can turn in your metal shavings and dust for credit toward new metal. When I'm not at my jewelry bench, which has a built-in collector, I catch the dust in a shallow tray on my lap. Sweep the dust into separate, labeled containers. Save big scraps in labeled containers to melt or to use for other projects. You may be surprised at how much dust and scrap you'll collect after making all the projects in this book!

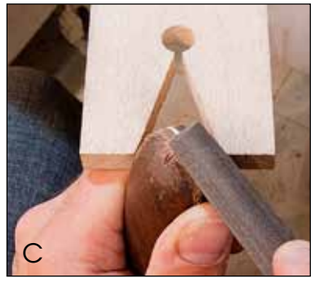
HOW TO FILE METAL



Remove excess metal.



Refine the shape and clean up any defects.



Polish away rough texture on the edges by filing.

Support your work on a bench pin. Use a V-slot ***bench pin*** clamped to your work surface. Protect your table with a scrap of leather under the pin and a thin piece of wood between the table and the clamp underneath. Sit directly in front of the V-slot of the pin and brace the metal against the wood with your fingers.

File the shape. If you're working with a pattern glued to the metal, file to the outline and remove any excess metal **[A]**. Let the edge you're filing overhang the side of the bench pin a little. Work close to the thick wood edge, which will help you keep the file perpendicular to the edge. Working this way will make a smooth shape, and the top will be a mirror image of the back. If you file at an angle or work without support, the edges will look rough and random, and your piece will get distorted. Filing correctly now means less work later!

File the edges. After the shape is refined, file the edges to remove any high points and rough file marks **[B]**. You can hold the metal in a ***ring clamp*** for easier filing: Choose the straight or curved side to match the edge you're filing. Insert the ring clamp wedge on the opposite side and push it in to tighten the clamp. Tap the wedge on your table to tighten it more. If the metal is too thin, angle the wedge a little to push it in further. Brace the clamp in the V-slot of your bench pin while you file. Turn the wedge sideways to open the clamp.

File a straight edge. Hold the piece in a ring clamp and brace it against the bench pin. Use the flat side of a straight file to file evenly across the edge. Start at the tip and file straight or at a slight angle across the edge as you move to the back of the file. To avoid tapering, file 2–3 strokes and then reverse the piece to file from the other direction. Check your work against the straight file for gaps. Rest your index finger on top of the file as you work to feel the angle.

Keep the file flat against the edge of the metal. Look at the edge after each stroke. It should be flat and not beveled. Try not to hit the corners when you start or finish each file stroke or you could round them over. Land on the edge and lift the file off at the end. Doing this correctly will make the edge straight and smooth. For a really nice finish, file again with a fine #3 or #4 file to remove coarse file marks.

File a curve. Working a curve is slightly different. Use the round side of the ring clamp braced in the V-slot of the bench pin **[C]**. Start with the metal angled away from you. As you file across the edge, rock the clamp back toward you to extend your stroke. If you prefer, you can turn the clamp and angle it away from you, so that you can see the curve of the metal. Rest your index finger on top of the file and work across the edge horizontally. Your focus is on the shape and curve of the metal. But you can't see the edge after each stroke, so check your work often. Open the clamp and change position to file the next section.