How to Make Metal Jewelry: Filing, Sawing and Other Metalsmithing Basics
The quest to make metal jewelry can be a daunting prospect, but don’t worry! A wealth of resources exists to help you learn how to turn metal sheet and wire into showstopping bracelets, necklaces, earrings and beyond.

Two of the most fundamental metalsmithing skills are sawing and filing. Mastering these skills opens a world of design options. To guide you, here are lessons on using a jeweler’s saw and jewelry files written by Helen I. Driggs, metalsmith extraordinaire and Senior Editor of Lapidary Journal Jewelry Artist.

To complement these lessons, we’ve included a fantastic pendant project from jewelry artist Karen Meador that incorporates sawing and filing, along with a couple more metalsmithing musts: hammering and soldering. Try your hand at making metal jewelry with Karen’s design, and then experiment with your own designs. The possibilities are endless!

We’re so glad that you’ve decided to make metal jewelry. Start building your skill set and you’ll soon be building beautiful pieces.

Happy creating!
Mallory Leonard
Associate Editor, Interweave Jewelry Group
The saw frame is typically the first purchase made by the aspiring jewelry maker. It is the most important tool to acquire and master because sawing and piercing are basic operations for all metalwork. It is important to practice sawing without a thought of a finished piece until you’re confident you can follow a line, turn both inside and outside corners, cut along complex curves, and cut all thicknesses of sheet in all metals.

The best way to start is to choose a saw frame, get a few dozen blades in a range of sizes, and buy five or six small sheets of metal. I suggest aluminum, copper, brass, and bronze because they all saw differently. Start with 20-gauge and work down to 18. Then try 24 or 28-gauge. And trust me — save the silver for later, when you know what you’re doing.

I’m including practice patterns and instructions for cutting them out. Follow the photos for learning to thread, hold, and use your saw. Don’t freak if you break a blade — everybody does. You may find you love to saw or you may find you hate it. If you hate it, get over it — unless you really want every piece of jewelry you make from now on to be standard, mill-cut rectangular or square!
HOW BLADES WORK
Sawblades don’t really cut. They actually weaken and then chip small particles of metal away. Take a close look at a blade directly at the teeth (use a magnifier if you need to) and you’ll see they alternate left and right in a predictable pattern called a set. This arrangement allows the chips of metal to fall away on both sides of the blade. The distance from the outer point of the right teeth and the outer point of the left teeth is the blade thickness, and will determine the width of the kerf – or “cut” opening you make with the blade. Finer blades make a narrower kerf.

PURCHASING A FRAME
There are two types of frame: adjustable and stationary. Most makers prefer the adjustable frame because short lengths of broken blade can be strung and used until completely worn out. This is a good feature when you’re new to the saw because you’ll probably break many blades when learning. A stationary saw frame will only accept full length blades, so these are best purchased by an experienced maker. Once you get the knack of sawing, you’ll only break a blade occasionally – unless it’s a dreaded, bad-blade-karma (BBK) day, in which case you should go do something else in the shop for a while. Recognizing and accepting that you’re having a BBK day is humbling but also one of the most important things to learn about sawing. Everyone has them once in a while, so don’t think it’s just you.

Some frames allow the blade to be rotated in an arc away from the cutting line. This allows you to relocate the back bar of the frame away from the kerf (the cut, more on that later) and to use a larger piece of sheet. This kind of frame is handy if you cut strips or lots of cuff bracelet blanks.

Saws come in several standard throat depths ranging between about 3” and 11” in depth. A 4” frame is a good starter size and will allow you to cut typical sheet sizes available from most suppliers. If you’ve never sawn before, look at this graphic and familiarize yourself with the parts and mechanisms of your frame.

PRACTICE PATTERN
Photocopy this pattern at 100 percent. If you’re right-handed, saw in the direction of the RIGHT arrow. If you’re left-handed, saw in the direction of the LEFT arrow.

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WHAT YOU’LL SPEND
- 3” sawframes run between $10 and $35 depending on where they’re manufactured and who you buy them from. Try to buy a quality, hardened tool steel frame with a contoured wood handle.
- Blades average between $1 and $6 a dozen – again, you get what you pay for. When you’re learning to saw, start with good blades even though you’ll destroy them. Good ones usually break only because of bad technique. You can learn to correct your technique, but you can’t correct poor materials, so why struggle with something you can’t fix?
CHOOSING A BLADE

- The more intricate or curvey the cut, the finer the blade—unless your sheet is very thick.
- The blade should have a minimum of three teeth contacting the metal when sawing. Too few teeth contacting the metal will result in choppy, jumpy motion. Too many teeth may result in broken blades. To compare, hold the blade spine against the sheet and look at them both from the side to see if the metal is three teeth deep.
- When you drill a pilot hole for inside piercings, ensure the blade has enough clearance to move freely in the hole.

THREADING THE SAW

Sawframes are engineered to hold the blade under tension. To create tension, a series of thumbscrews, pads, and washers allow minute adjustments to the frame depth, length, and the amount of pull on the blade. Here is how to thread the blade properly into your frame.

(Photo 1) Pick up a blade. Look at the teeth. Make sure they face you and angle down, like a children’s drawing of a Christmas tree.

(Pho9to 2) Hold the blade next to the frame for a visual comparison. The frame should be roughly set so it’s slightly taller—about ¾”—than the total length of the blade.

(Pho9to 3) Insert the top of the blade between the frame and the pad with the teeth facing out and down. Ensure the blade spine is parallel to the back bar of the saw frame, and the very top of the blade is touching the top of the opening at the set screw. Tighten the top set screw to hold the blade firmly. The bottom of the blade should float freely just above the bottom set screw and pad.

(Pho9to 4) Insert the top of the saw frame, with the blade facing up, into the mandrel hole of your bench. Alternatively, position the top bar of the frame against the lip of the bench. (Photo 5) Push slightly against the bottom of the frame handle with your hip, shoulder, or sternum. You will see the bottom bar of the frame move closer to the bottom of the blade. Keep pushing gently until you can capture and insert the blade between the pad and the frame.

(Pho9to 6) Tighten the bottom set screw securely while maintaining pressure on the frame.

(Pho9to 7) Release pressure on the frame slowly.

(Pho9to 8) Verify the blade is tight by “pinging” it with your fingertip. It should make a clear, musical sound. If it doesn’t, you’ll have to adjust the frame to increase pressure on the blade.

(Pho9to 9) With the blade still in position, loosen the frame set screw. Hold the frame in your hand with the back of the frame against the heel of your hand. Pull down on the bottom bar with your fingers to increase tension on the blade. Tighten the frame set screw and test the ping of the blade again. It should be high and clear.

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**MAKING YOUR FIRST CUT**
Thread a 2/0 blade into your frame. Attach the pattern to the 20-gauge aluminum. Position the metal on the bench pin according to whatever your dominant hand is. Take a deep breath and relax your hands and arms. Exhale.

(Photo 13) Hold the saw in your dominant hand. Position the frame at a 45° angle to the sheet, next to line number one. Put your nondominant thumb over the spine of the blade and gently stroke upward to create a score where you intend to cut. Repeat two or three times.

(Photo 14) Position the saw vertically. Hold the frame loosely — you don’t need a death grip – lock the wrist and begin to move the saw up and down a small amount until the kerf has been started.

(Photo 15) When you have a good start, begin to saw using the entire length of the blade. Go slowly; do not push forward or down; and do not twist the blade. The saw blade should move freely – like a sewing machine needle.

(Photo 16) Guide the metal by holding it on either side of the blade using the first and middle fingers of your nondominant hand. Steer the metal, not the saw. Slow down when you get to the edge of the sheet, and let the cut metal fall away from the blade.

(Photo 17) Cut the entire length of line number one. Check your work. Continue sawing all of the practice lines in order. Read the special techniques for inside and outside corners, and save cutting out the hole for last.

**ATTACHING THE PATTERN TO METAL**
There are many ways to transfer a design to metal, but I find this method the easiest:

(Photo 10) Photocopy the drawing, trim the excess paper, and coat the back of the paper with a thin coat of rubber cement. Let the cement dry.

(Photo 11) Brush a thin coat of rubber cement on clean, dry metal and let the cement dry.

(Photo 12) Carefully roll the paper onto the metal, pressing the dried cement together so it bonds. Start at one edge and continue across. Be careful not to wrinkle the paper as you roll it onto the sheet.

**PRACTICE MAKES PERFECT**
You will cut the entire square of aluminum into tiny shapes and strips by following the pattern in sequence. If you’re right-handed, the waste side of the sheet should be to the left, and vice versa. By the time you saw all the lines of the pattern, you’ll have learned all of the essential sawing maneuvers. Try to stay on the lines, not to one side or the other. After you’ve cut the entire square, move on to the next metal square using the same pattern.

Try the 18-gauge copper with the same pattern and a 1/0 blade. After that, try 20-gauge bronze with the 2/0 blade, and finally 24-gauge brass with a 6/0 blade. Note the increase in hardness as you cut the different metals — hopefully, your skills will advance at the same rate of difficulty you’ll have sawing them. If not, practice until they do.
**Cutting Out a Hole**

Cutting a hole is easy once you figure out which direction to saw in. You'll want to drill the pilot hole near the cutting line in a position that allows you to transition efficiently and directly into the cutting outline without a sharp change of direction.

If you're sawing a complex pierced or fretwork design, saw the innermost holes first, and then work out toward the exterior of the design — that way, the intact, exterior metal supports the fretwork.

*Photo 18* Because I'm right-handed, I want the "hole" I'm sawing to be to the left of the blade. If you're left-handed, do the opposite. Make a dot with a marker near the cutting line.

*Photo 19* Centerpunch the dot on a steel block, and drill it with a number 54 bit (a good, all-purpose size for most blades).

*Photo 20* Unscrew the bottom set screw and string the metal onto the blade with the pattern facing away from you (toward the top of the frame). Slide it all the way up the blade.

*Photo 21* Thread the bottom of the blade as usual. Make sure the blade is under tension. Slide the metal down to the bench pin and start sawing toward the cutting line in a gentle curve. Once there, continue to follow the outline. Remove the completed piece from the saw by releasing the bottom set screw and sliding the metal off.

**If You Break a Blade**

Go ahead and get the swearing out of the way. Pick up the broken blade sections to see if any are long enough to reuse. Save what you can, and dispose of the rest — you don't want steel mixed in with your scrap. I keep an envelope in my bench pan just for useable, broken blade sections.

If the blade has snarled in the metal, unscrew one of the frame set screws and try to work the blade loose. If it is hopelessly snarled (extremely rare) and you can't budge it, unscrew all of the set screws, remove the saw frame, and pull the blade out of the kerf with toothed pliers. Throw it out; it will probably be bent or twisted beyond repair.

Thread a new blade and try again, but make sure the sheet hasn't warped, bent, or twisted, and that the kerf is clear and open — or you'll end up killing another blade.

**Special Scenarios**

Once you've sawn the straight, gently curved and tightly curved lines without breaking a blade, don't get cocky — you'll need to saw the inside and outside corners next. These are the hardest cuts to master, especially in thicker gauges or harder metals.

The most important tip for these sawing scenarios is to pivot the metal in place around the blade *at the same time* you're moving the saw. Remember, the blade does not cut, it chips, so move the saw up and down in short strokes and pivot the corner point of the cutting line around the blade until the teeth are facing the direction you want to saw next. Sharp direction changes are very difficult for everyone, so don't get discouraged.
Explosive laughter and sarcastic suggestions erupted across a formerly focused studio. It was very late, and we were punch-drunk and blind from all the bead setting we'd been practicing. Somebody suggested inventing supermarket tabloid headlines to describe ways people worked. Maybe you had to be there, but most of the suggestions underscored everyone’s insecurities over whether we’re doing it “right” or not. The headline that made us all go into fits of giggles was “Air filing: The hot new metalsmithing craze that’s sweeping the nation!”

Filing without proper support to the piece and the file — in midair — apparently is a big, giant, neon no-no. Who knew? Now most (most) of the time I do file properly. You know — squared shoulders, feet flat on the floor, piece firmly held on the bench pin, biggest file possible, one long stroke away, pick up file, repeat, proceed to finer file in new direction, and so on. But sometimes the file or the piece just can’t be positioned in a way that anyone other than a Cirque du Soleil contortionist could manage to work with. So I do what any other red-blooded metalsmith would do: I air-file — but only on curved surfaces, honest! I’d like to think I get points for knowing I am consciously doing a “bad” thing, and I stop air-filing as soon as I can. If you’re an air-filing repeat-offender, you might just be able to break the cycle after this review of proper filing technique and some tips from a few filing superstars.
Marcia Lewis  Author of Chasing: Ancient Metalworking Technique with Modern Applications, Marcia Lewis has been chasing metal for over 35 years. She worked in Europe over several years as a goldsmith’s apprentice and an assistant silversmith and on fellowship before beginning a 25-year career teaching post at Long Beach City College. Her training in Europe included many, many, hours of precise filing. Here are her tips:

When filing on any material, don’t apply pressure in the backward stroke of the file. Why? Because the teeth on a file all point in one direction and only cut in the forward stroke. By applying pressure in the backward stroke you are (a) working too hard, (b) not able to see what your previous stroke did to the metal. In fact, lift the file completely off the surface of the object on the backward stroke for better visibility. And remember: fast filing isn’t necessarily accurate filing. Start slow and get faster as you become more accurate.

Keep your files clear of debris by frequently using a filecard (a wooden brush with short, curved, steel bristles available in any hardware store) – especially when working on soft materials such as copper, aluminum, plastics, or wood. A dull or clogged file will slow you down. Using more pressure doesn’t make a dull or clogged file work any better.

Lexi Erickson  Lexi teaches jewelry at high school and college levels. She is President of the Pennsylvania Society of Goldsmiths and teaches jewelry fabrication and design at the Baum School of Art in Allentown, Pennsylvania.

- Many teachers will ignore the #0 file – but it is the best for rapid metal removal. Use it right after you cut out a piece with your saw. The 0 file will quickly smooth out burrs left on your metal and fix wobbly lines. Many a “whoops” has been corrected quickly by a 0 file.
- I recommend a set of #1 files called Habilis files for beginners, which includes a half round, flat, round, triangular, and square file. You may find you only need the triangular or square file a few times a year, but when you need them, nothing else will do. Tevel Herbstman at Allcraft in New York stocks them.
- If you can only afford one good file, the #2 Grobet half round is the best investment for a general purpose file.
- For the ultimate feel for your piece, try a #6 finishing file. It is smooth to the touch and imparts a lustrous finish on edges. Since I burnish the edges of my finished pieces, the #6 is my final step before burnishing.
- Don’t forget that files come in many sizes – a 4-inch #6 barrette is great for finishing those tiny inside edges that a flex shaft or buffer can’t reach.
- Craftsman makes a great set of needle files, and if you break one, the company will replace it: they come with a lifetime guarantee. For larger files, be sure to use files made for metal. A bastard file meant for wood will really mess up your piece.
- For tiny areas, riffler files are good for smoothing or enlarging a cut out. And never forget: your sawblade is actually an extremely thin file. Use it to clean up tiny cuts, inside cuts, and difficult to reach areas. For this purpose, #6 blades work well.

AND ANOTHER THING  Here are two ways to approach different filing scenarios:

**Flat edges**

The file must be guided perfectly straight. Clamping the metal in a vise and guiding a large flat file with both hands will help to prevent curving strokes and rounded corners.

**Curved surfaces**

Both the file and the work must move in an arc. The file moves away from the body and the piece moves toward the body. If the piece is small, hold it in a hand vise, ring clamp, or pin vise. To steady the work, brace the hand holding the work against the bench pin.

Maintaining a perfect circle is one of the most difficult filing challenges. The push stroke must be controlled to avoid creating a flat area – do not keep the file in one place. And never – never – file perpendicular to the piece or across the edge.
little bird

BY KAREN MEADOR, PH.D.

I designed my first little bird years ago, for a beginning soldering class that I was teaching. My students always have choices regarding what product they want to make, but everyone in that class selected the little bird. We've been making these in my classes ever since. I hope you enjoy making your own little bird.

tools & supplies

- 26-gauge copper sheet, approximately 3” square
- 16-gauge sterling silver dead soft round wire, approximately 1½”
- Metal cutting shears or saw
- Hole punch or drill
- Flush cutters
- Hammer
- Bench block
- Chisel
- File
- Sandpaper, medium to fine grit
- Steel wool
- Permanent marker
- Rubber cement
- Silver solder
- Copper solder
- Fire brick
- Liver of sulfur
- Butane torch
- Pickle pot and pickle
- Disc cutter (optional)
- Texturing hammer (optional)
- Rotary tool and polishing wheels (optional)
- Tumbler (optional)

1 Cut a 1¼” circle from the copper sheet with a disc cutter or by hand. Use a permanent marker to draw a line on the circle as shown, and texture the upper two thirds of the disc. File and/or sand the edges of the circle until smooth. Very lightly sand the surface.

2 Use the templates provided to cut out the bird and 2 wings from a piece of paper. Use rubber cement to glue the bird and wings pattern onto the leftover copper sheet. Cut out the pieces with metal cutting shears or a saw.

3 Remove the paper patterns.

4 Use a hole punch or drill to make a hole that represents the bird’s eye.

5 Use a hammer and chisel to make feather marks on the wings. Place the chisel where you want the mark, and hammer the top (handle) of the chisel. Gently hammer the back of the wings to flatten them.

6 Sand the underside of the bird and the wings, to give them some tooth for solder. Use flush cutters to cut a 1½” piece of sterling wire. File and smooth the ends of the wire. Carefully clean all the copper pieces and the wire until the water sheets off the metal.
Use tiny snips of silver solder to join the wire to the disc atop the line drawn in Step 1. Place the solder on the underside of the wire where it hangs off the disc. Heat the piece in the direction that you want the solder to flow, pulling it along the bottom of the sterling wire.

Pickle and clean the fire scale from the piece. Using copper solder, solder the bird to the disc, and the wings to the bird as shown.

Pickle, rinse and dry. Clean up any fire scale. You can use medium to light grit sandpaper, and use a polishing wheel on the rotary tool to clean the crevices. Punch a hole in the top of the disc to accommodate a jump ring. Patina the piece with liver of sulfur, and remove the patina from the sterling wire with light grit sandpaper or steel wool. Lighten the patina on the bird to contrast it from the disc. Tumble or polish by hand.

Master Soldering!

Continue your journey in soldering!

Master metalsmith, Lexi Erickson takes you step by step through the essentials in her video, How to Solder Jewelry. Learn right from your computer, at your own pace. And Lapidary Journal Jewelry Artist’s special issue, Everyone’s Guide to How to Solder Jewelry is a must-have for your studio library. Refer to it any time!
More Resources:

https://www.facebook.com/JewelryMakingDaily

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