

Rivets and Riveting

Instructor: Deb Jemmott

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Rivets are mechanical holding devices that join two or more elements by pinning them together with a wire or tube. The wire or tube is held in place by creating a "head" on both ends. The best rivets not only hold components together, but also serve as a design element in their own right, thus adding to the aesthetic value of the piece.

There are two basic kinds of rivets – solid rivets and tube rivets. Both types may be created in many ways. Three basic methods are:

The **Flush Rivet** can be used as a "married metal" look, for example, copper rivets in a silver field.



The **Blind Rivet** may be used when it is important to show no rivet at all on one side of a piece.



The **Extended Rivet** uses a tube or other spacer between the two outermost elements being joined. This interior section can be a soft material, such as bone or wood, or left as open space. The tube supports the rivet wire, keeping it from bending during the riveting process



Basic Solid Rivet Procedure

- Choose a rivet wire. A rivet shank must have enough material so the ends can mechanically hold the pieces together, generally 18ga wire at the minimum.
- Anneal the rivet wire.
- Make the rivet head. Rivet heads must function to hold the pieces together, but beyond that, the head can be used as a decorative element. "Found" rivets with heads already formed are plentiful, but you may have to use your imagination. A few possibilities are:
 - Nails (copper or brass)
 - Escutcheon Pins
 - Earring Posts
 - Model Train Parts
 - Doll House Parts
 - Aeronautics Parts



To make a head on a solid rivet:

- Anneal the rivet wire.
- If a lot of material is needed to make the head (flat, balled, rosette) melt a ball on the end of the wire.
- For any of the rivet heads that have a flat underside, slip the wire, balled end up into a steel or brass plate with a hole the same size as the wire. **DO NOT USE A DRAWPLATE!!** Hammer on the balled end until it is the desired shape. The head may also be textured with stamps, chisels or hammers.
- For a domed or button head, use a concave setting tool such as a nail setter to help finish the hemisphere after hammering the wire's end into that basic shape.
- For a split rivet, use a FINE jeweler's saw blade to cut the head and/or tail in half or quarters or other sections.

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- Mark and center punch the site of the first rivet on the top part of the piece. A rivet should be at least one rivet diameter from the edge of the piece. Remember that for metal clay, the distance from the edge is doubled. This is especially important if only one rivet is being used to allow movement (called a "free rivet"). The wear of movement can cause the rivet to break through the joined elements. Remember that it takes at least two rivets to lock the elements in place.
- Find the appropriate drill bit for the size of the rivet wire. The rivet wire **must** fit tightly in the hole. If the hole is too big, the rivet will bend during the riveting process.
- Drill a hole at the site of the center punch mark. The drill bit must be kept perpendicular to the material.

B&S	mm	in	# drill size
20	0.81	0.032	67
18	1.02	0.040	60
16	1.29	0.051	55
14	1.63	0.064	51
12	2.05	0.081	46
10	2.59	0.102	37
8	3.26	0.129	30
6	4.11	0.162	20
4	5.19	0.204	5
2	6.54	0.258	1/4"

Safety Notes

- Safety glasses or goggles should ALWAYS be worn when drilling metal.
- ALWAYS hold the item being drilled in a ring clamp or drill press vise – NEVER in your hands!

- Place the top piece on the next component. Using the drilled hole as a guide, mark the placement of the hole on that second piece. Do the same for all of the elements to be riveted together.
- Center punch and drill the first hole in each of the pieces.
- Mark, center punch and drill all of the remaining rivet sites in the top piece.
- Line up all of the pieces to be riveted. If there are several, they may need to be clamped or double-side taped together to keep them from slipping during the drilling process. Place a temporary rivet in the first hole through all of the elements being joined to help keep them stationary.
- Drill a second hole through all of the pieces to be riveted. Choose the hole that is farthest away from the first one.
- Slip a rivet into the second drilled hole. This will help stabilize the pieces so the other rivets will line up properly.
- Drill through all of the pieces using the holes in the top piece as a guide.
- Separate the pieces and clean up any burs from drilling.
- Insert the first rivet and cut the rivet to the proper length. A good rule of thumb is to leave 1 to 1 ½ times the diameter of the wire above the surface of the piece to make the "tail."
- File the end flat with a fine file.
- If the rivet head is shaped, it will need to be protected while forming the rivet tail. Find or make an indentation in a block of nylon, Delrin, steel or brass to

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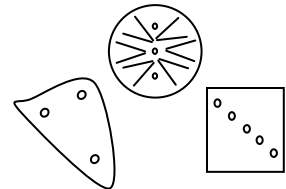
accommodate the rivet head. This will support the rivet head so it does not flatten while the rivet tail is being formed.

- Spread the rivet tail by hammering in the center of the wire, then around the edge, back to the center, then around the edge and so on until the desired shape is achieved.
- Use a setting punch, decorative stamp or chisel to make the head and/or tail more decorative.

Washers

Joining thin or soft elements (fabric/leather/wood) with a rivet can be tricky because the head may pull through these materials. Washers help prevent this by adding durable surfaces to the piece which help to spread the load of the rivet heads and lock them in place. Washers can also serve as protective elements especially on textured or delicate pieces so they won't be damaged by a stray hammer mark. The hole(s) in the washer should be the same size as the diameter of the rivet wire. Washers can be decorative as well as functional.

Washers can be round or square or any other shape that would enhance the design of the piece.



Tube Rivet Procedure

Lengths of tubing, eyelets or grommets may be used to create a tube rivet. The electronics industry offers some wonderful small eyelets in brass, stainless and, occasionally, silver-plate. Tubing must be seamless for this process. Thin wall tubing may tear rather than curl over, so it should be tested on a practice piece before using it on a finished piece.

Follow the procedure for the Basic Solid Rivet until it come to cutting the rivet to length.

- A good rule of thumb for a tube rivet is $\frac{1}{2}$ the size of the diameter of the tube above the surface of the piece on each side.
- File the end flat with a fine file.
- Place the tube in the rivet hole and set it on a flat surface. Insert a tapered tool into the tube and slowly work it in a circular motion to begin the flaring the end of the tube. Flip the piece over, and slowly work the other end of the tube in the same way. Sometimes a series of tapered tools should be used to achieve an even curl of the tube. Keep working both sides so the tube will roll evenly.
- Use dapping punches, small ball end hammers, plumb bobs, or progressively larger punches until the end begins to roll.
- Use a small riveting hammer to complete the roll on the top of the tube.

You may also split the tube into sections with a fine blade in the jeweler's saw, and then spread the tabs as with a split rivet.

Special Considerations for Cold Connections on Metal Clay

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While any of the traditional methods of cold connection can be used with metal clay, some special considerations and opportunities apply when working with this material.

Due to the structure of metal clay – sintered metal particles with small air pockets between them – fired pieces tend to be very brittle and can break when excessive force is put on the metal. It's critical to consider this when placing the holes for rivets. If a rivet hole is set too close to the edge of the piece, it is likely that the metal will split during the riveting process. Therefore, it is essential to allow extra room from the edge for rivet placement when working with metal clay.

When working with milled sheet metal, measure the diameter of the rivet wire and place the rivet hole **at least** that distance from the edge of the piece. For metal clay, doubling that distance is recommended. If the piece is thin, the hole may need to be set in even more. If the rivet placement must be close to the edge, then line the hole with a metal tube to protect the metal clay from the forces of the riveting process.

Metal clay offers the unique opportunity to embed rivets or other cold connections in the clay before firing. The "foot" that is set in the clay must be shaped so the embedded part will be secure and stable. If using a wire, bend the end that is to be embedded (Fig. A). Cut or file any round-footed item so it has one flat side before embedding it in the metal clay (Fig. B). This will prevent the item from rotating in the metal after firing. Of course, the metal clay must be sufficiently thick at the embedding point to secure the item in place. Depending on the size of the item to be embedded, be aware that there can be some distortion of the piece during firing as the metal clay shrinks around the inclusion.

Items that may be embedded to use as rivets, staples or threaded rods include: earring posts, solid brass or stainless bolts and nuts, and solid brass or stainless grommets or eyelets.

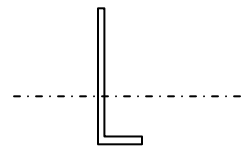


Fig. A

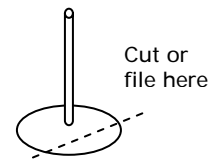


Fig. B

A Special Note about Kiln Firing Sterling Silver

When firing sterling silver into metal clay, use the lowest possible firing temperature. Heating sterling silver above 1200° F for more than just a few minutes at a time causes artificial age hardening that will make the sterling silver very brittle.