Chapter Six   Making Tubing Jackets

Copper tubing jackets have long been used for making bullets. Quite often a suitable bullet jacket is not available. Perhaps the correct diameter of jacket cannot be found, there isn't a suitable length available, or the jacket wall thickness is not what is needed. A drawn jacket could be made but the cost to make a jacket from strip is fairly high both in terms of the equipment necessary to do the work and also because of the cost of the strip itself. Not many shooters are willing to spend the kind of money needed to be able to draw jackets, especially if not many jackets are needed.

Making jackets from copper tubing is not difficult and the equipment needed to do it is affordable. Tubing jackets can be made using a hand operated press or a hydraulic press can be used. The hydraulic press is best if the jacket wall is over about .035" or if many jackets are needed.

Tubing jackets are best made using hard temper, straight lengths of tubing. The soft coiled copper tubing can also be used but it is much more difficult to work with. The coiled copper always has dents, kinks, bends, squashed sections, and other defects. These defects are difficult to remove and can cause the bullet to fail to perform properly. Coiled tubing is not always available in the diameters and wall thickness wanted.

Straight, hard drawn tubing is available in two types. One is ordinary water tubing that is available in three wall thicknesses known as M, L, and K. Type M tubing has the thinnest wall, type L is thicker, and type K is the thickest. The wall thickness increases as the diameter of the tubing increases. One-quarter type L tubing has a wall thickness of .030" while ½ type L has a wall thickness of .040". The charts below give the specifications for the different types of water tubing. This tubing is alloy UNS-C12200 or 122. It is pure copper with some trace elements.

One curious and confusing thing about this water tubing is that the size listed for the tubing is smaller than the actual diameter. This can be a real problem when buying tubing. I usually tell the salesperson what actual, measured diameter tubing I want. For example type L ¼ tubing has an actual diameter of 3/8". If you order ½ type L you will probably end up with tubing that is actually 5/8" in diameter. It is important to be certain that what you order and get is what you really want. The charts below will show the "nominal" size, the actual size, wall thickness, and the weight of the tubing per foot. It is important to note that the thickness of the tubing can vary some from the listed specifications. Generally the thickness can vary about plus or minus .0015" for smaller sizes of tubing. For the larger sizes the thickness can vary as much as .002".

Type K Copper Water Tubing			
Nominal Size	Actual Size	Thickness	Pounds/Ft.
1/4	3/8"	.035"	.145
3/8	1/2"	.049"	.269
1/2	5/8"	.049"	.344
5/8	3/4"	.049"	.418
3/4	7/8"	.065"	.641
1	1 1/8"	.065"	.839

Type M Copper Water Tubing			
Nominal Size	Actual Size	Thickness	Pounds/Ft.
1/4	3/8"	.025"	.106
3/8	1/2"	.025"	.145
1/2	5/8"	.028"	.204
5/8	3/4"	.030"	.263
3/4	7/8"	.032"	.328
1	1 1/8"	.035"	.465

Type L Copper Water Tubing			
Nominal Size	Actual Size	Thickness	Pounds/Ft.
1/4	3/8"	.030"	.126
3/8	1/2"	.035"	.198
1/2	5/8"	.040"	.285
5/8	3/4"	.042"	.362
3/4	7/8"	.050"	.455
1	1 1/8"	.055"	.655

It is also possible to get a type of tubing that is referred to as Drawn Copper Tube. I call this Industrial Tubing to differentiate it from the copper water tubing. This is also alloy 122. The Drawn Copper Tubing has very slightly tighter tolerances than the water tubing and is available in different wall thicknesses and diameters. A major difference between the two types of tubing is that the diameter specified for Drawn Copper Tubing is the actual measured diameter.

There is no nominal size to worry about. If you order 3/8 tubing you will get 3/8" diameter tubing. The biggest problem with this tubing is finding it. At least some of the more common sizes of the copper water tubing will be carried by the larger plumbing supply stores and a few of the home handyman stores. Most of the sizes listed in the chart are available from commercial copper and brass suppliers. Some of the sizes are no longer made or seldom made. As a rule the sizes and thicknesses that are useful to bullet makers are available but usually a minimum order must be placed. The minimum order requirements vary from distributor to distributor. Some will allow the buyer to get different sizes to make a required dollar amount, some will not. The only way to know is to contact the distributor and find out what their policy is.

Some of the Drawn Copper Tubing sizes have very thick walls and these sizes are very handy for making up tough bullets for large, dangerous game. Quite a few bullets for use in Darkest Africa have been produced using this copper tubing.

Drawn Copper Tubing											
Dia.	Thickness	Lb/Ft.	Dia.	Thickness	Lb/Ft.	Dia.	Thickness	Lb/Ft.	Dia.	Thickness	Lb/Ft.
3/16"	.032"	.0606	5/16"	.065"	.1959	1/2"	.065"	.3443	3/4"	.049"	.4183
3/16"	.035"	.0650	3/8"	.035"	.1449	1/2"	.078"	.4008	¾"	.065"	.5422
1/4"	.035"	.0916	3/8"	.049"	.1945	9/16"	.065"	.3938	7/8"	.065"	.6411
1/4"	.049"	.1199	3/8"	.065"	.2454	5/8"	.035"	.2515	1"	.032"	.3760
1/4"	.065"	.1464	1/2"	.035"	.1982	5/8"	.065"	.4432	1"	.035"	.4113
5/16"	.035"	.1183	1/2"	.049	.2691	3/4"	.035"	.3047	1"	.065"	.7401

There are other types of copper tubing such as 101-OFE-HIT which is also known as Oxygen Free Electronic tubing but these types are either harder to find or more expensive than the water tubing or drawn tubing. One type of tubing that is sometimes found is ACR. This is Air Conditioning and Refrigeration tubing. It is the same as type L water tubing except that the tolerances seem to be slightly better and the ends of the tubes are capped to keep the inside of the tube clean. It is a little more expensive than water tubing but not significantly so. ACR can be used in place of type L tubing.

Other types of tubing can also be used to make bullet jackets. Steel hydraulic tubing forms well and makes a very strong jacket suitable for dangerous game and various brass alloys can also be used. As a rule the steel and brass tubing will need to be made into jackets using a hydraulic press of some sort. The force needed to make the jackets is much more than a hand operated press will handle and, usually, the hand press dies are not adequate for the job.

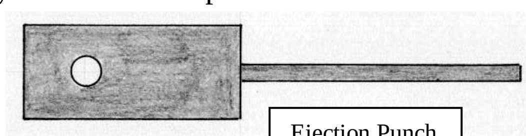
Steel tubing does make a good jacket but most of the tubing that is available has a rather thick wall. This, plus the high strength of the steel, makes it unsuitable for most bullets and steel will rust unless it is protected in some manner. Rusty bullets are not especially desirable.

Brass tubing can be found but it requires a good deal of pressure to form it into a jacket. Except for the very thinnest tubing it isn't recommended for hand presses. Most of the brass tubing that can be found will be alloy UNS-C3300 also known as 330. This brass is one of the yellow brasses and has the same bad fouling problems. On the whole brass tubing is something to avoid.

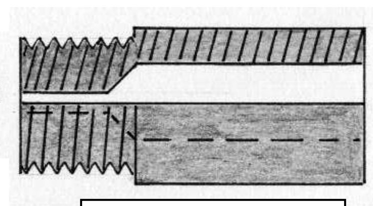
The copper tubing is relatively soft and can easily pick up grit that can damage the swaging dies. Dropping the tubing or dragging it on the shop floor is almost sure to embed some abrasive into the surface of the tubing. A little bit of care when handling the tubing will keep the swaging dies from being damaged.

A length of PVC pipe or a section of corrugated drain line makes a good storage container for the tubing. One end of the pipe can be capped and a loose fitting cap can be put on the other end. This will keep the tubing clean and ready when needed. A heavy cardboard shipping tube will also work well to store the tubing and the open end can be plugged with an old shop rag. Keeping the tubing clean and dust free will help keep the swaging dies working.

Cutting the tubing is the next step in the process of making a jacket out of it. The tubing will be pushed into a *jacket making die* which will close one end of the tube. The jacket making die looks like a point form die. It will have a cavity machined and polished into the die and a small diameter hardened spring wire ejection punch will push the formed jacket back out of the die.



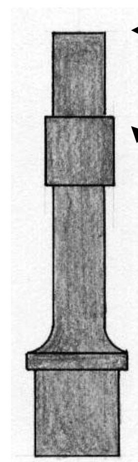
Ejection Punch



Jacket Making Die

The piece of tubing that will become the jacket is pushed into the die by a *jacket making punch*. The punch has a tip that fits down into the tube and is a snug fit to the tube. There is a collar on the punch that will push against the mouth of the tube. The tip of the punch supports the tube to keep it from buckling or collapsing as it is pushed into the die. A jacket making set will include three and possibly more forming punches. Each punch makes one length of jacket.

The length of the cut piece of tubing must be matched to the forming punch to be used. If the cut tube is too short the jacket will stick in the die. If the tube is too long it will cause several problems, problems that may not be noticed until the jackets are used. Each forming punch will have the length of the cut tube marked on the punch. The tubes will need to be cut as close to this length as possible.



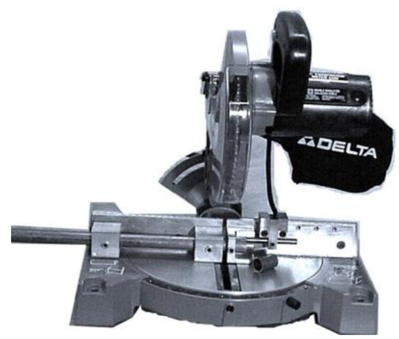
Jacket Making Punch

There are a number of ways to cut the tubing. The old standby, a tubing cutter, is probably the worst way. The usual tubing cutter uses a circular disk that presses into the tubing while the cutter is rotated around the tubing. With each rotation the feed screw on the cutter is tightened which pushes the cutting wheel deeper into the tubing. Eventually the tube is cut off. But the problem with this is that the cutter tends to crimp the end of the tube as it cuts it. This isn't a problem if you are hooking up some plumbing but the crimp is a big problem for a bullet maker. The forming punches will not enter the tube unless the crimp is somehow removed. It is possible to use a tapered punch to push the crimp back open so that the punch can enter the tube but that's a slow way to make process the tubes.

A hand hacksaw with a fine tooth blade or a jeweler's saw will work to cut a few pieces of tubing but it is a slow process.

A better way to cut the tubing is to use a small band saw that has a fine tooth blade. A support can be made to hold the long end of the tubing while the pieces are cut off. A piece of wood or aluminum can be made to fit onto the bandsaw table and a series of small pin holes can be put into the false table. A pin can then be placed into a hole so that the tubing can be pushed lightly up to the pin. This will set the length of the cut tube. As the cutting proceeds the tube will eventually move off of the pin so that the cut piece of tubing is free and will not hang up on the pin at the end of the cut. Most bandsaws will have a slot in the table so a miter gage can be used. The miter gage can be used to push the tubing across the saw so that the cut is square. The saw will leave a burr that can be removed with a deburring tool or with a file.

Another way that works pretty well is to use a motorized miter box saw. This saw is used to cut molding, picture frames, or window frames. Miter box saws are often on sale at hardware or home handyman sales so the cost isn't too high and the saw can be used for doing woodwork as well as cutting tubing.



6 ½" miter box saw with tube guides and stop on back rest.

To cut tubing with this type of saw a piece of wood is attached to the back rest of the saw table. Most saws have several holes in the back rest so different accessories can be mounted and wood screws can be run through the holes to secure the piece of wood. Before putting the wood on the back rest a notch that is large enough for the tubing to fit into is cut on the bottom outside edge of the wood. The tubing will fit, loosely, into the notch when the wood piece is on the saw. The notch will keep the cut piece of tubing from being sucked up into the saw blade when the saw is running. Holes can be drilled into the wood so that a small nail can be placed into the holes. The tubing is then lightly pushed up to the nail and the tube is cut to length. The length of the cut tube is set by where the nail is placed.

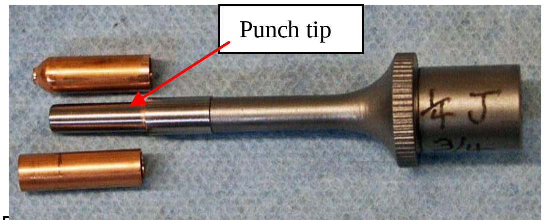
The saw will come with a high speed steel or carbon steel blade suitable for cutting wood but no good for cutting copper. Special carbide tipped blades are made for cutting non-ferrous materials and should be used. Get the smallest diameter blade that will cut completely through the tube. If a ten inch saw is used it will usually be possible to put a 7 ¼" blade on the saw. The smaller the blade the less it will cost. Get a blade with as many teeth as can be found. The more teeth on the blade the smoother the cut will be.

When cutting tubing bring the blade down to the work and gently feed it into the tube. Don't just slam the saw down on the tube as the blade may chip a tooth that way. These saws are typically quite noisy so hearing protection is desirable. Quite a few fine chips will be made as the saw cuts so eye protection is a must. Tubing cut with this set up will have a smooth, square end and, as long as the saw blade is sharp, will not have much of a burr to remove.

Sometimes little cut-off saws can be found at stores like Harbor Freight Tools. These are usually cheaply made imports but they do work, at least for awhile, and are very inexpensive. The saw usually has a high speed steel saw blade that spins at a high RPM. The blades are not the best of quality so they will wear out quickly but a better Jeweler's saw blade can be purchased from tool supply houses. A good quality blade will run about $20.00. Carbide blades are also available but any side pressure on the carbide blade will shatter it so it is probably best not to use them. A stop of some sort can be put on the cut-off saw so that the tubes can be cut to uniform lengths. One problem with this type of saw is that some makes will not quite cut through a one-half inch diameter tube. This is a little frustrating as the tube then has to be wiggled back and forth to break it free.

There is usually a little burr to be removed but so long as the saw blade is sharp the burr is minimal.

As mentioned the length that the tube needs to be cut to is marked on the forming punch. Sometimes the markings may have worn off or the punch was not marked. As a rule of thumb the length of the cut tube will be the length of the punch tip plus enough extra to allow the end of the tube to be closed. The extra length changes as the diameter of the tube changes. For 3/16” and ¼” diameter tubing the extra length would be about 3/16” . For 5/16” and 3/8” tubing the extra length would be ¼”. For ½” and 5/8” tubing the length is 5/16”. So if a 3/8” forming punch has a tip length of 1.0” another ¼” would be added to the length of the cut tube. The cut tube would be 1 ¼” long.



Forming punch, cut tube, & jacket. Length of the tube equals the tip length of the punch plus enough extra to allow the tube to be closed.

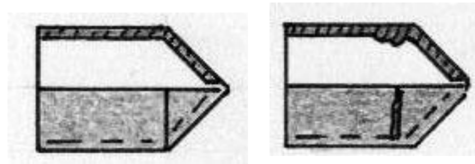
It should be noted that the rule of thumb is just a starting place. Once a few jackets have been made the length of the cut tube can be increased or decreased as needed. The length of the cut tube is important. If the tube is too short the problem will be obvious. The tube will be too short to form properly as there will not be enough material force down into the jacket making die to close the end of the tube enough for the ejection pin to push the tube back out of the die. The result will be a stuck tube in the die. The stuck tube can be removed using the removal punch or a short piece of tubing can be cut, deburred, and placed on the punch. The piece of tubing increases the length of the tube in the die so that the tube can be closed enough to remove it.

The stuck tube removal punch looks like a jacket forming punch except that the tip of the punch is threaded with a special thread. The threads on the punch are lightly lubricated with release lube and then the stuck jacket is swaged using the removal punch. The tube will flow into the threads on the punch locking the tube to the punch. Reversing the press pulls the tube from the die. The special thread form and the release lube allow the tube to be unscrewed from the punch.

Stuck Tube Removal Punch

A tube that is stuck on the forming punch can usually be removed by raising the press ram so that one-third to one-half of the tube is pushed back into the swaging die. Then the ram is lowered and the tube will come off of the forming punch. If that doesn’t work the punch and tube are removed from the press. The tube is placed on a heavy steel plate and the tube is tapped with a small steel hammer. Tapping on the tube will expand it and the tube can be slipped off of the punch and discarded. Be careful not to hit the forming punch with the hammer.

If the tube is too long the problems are not as obvious but the extra length can cause difficulty in every operation after the tube is formed. A tube that is too long will form completely so that it can be ejected from the die but the tube will usually have wrinkles or folds near the closed end of the tube. This is caused by the unsupported tubing buckling as the end is formed. There will also be an uneven thickening inside the tube between the end of the punch tip and the corner of the jacket. This build-up of material will cause the tube to stick on the draw punch when the tubing jacket is reduced in diameter in the draw die. It can also cause the jacket to stick on the end flattening punch and can cause the core from the core swage to not fit all of the way down in the jacket. Bullets made with these tubing jackets will often have uneven folds near the base of the bullet.



The two jackets to the right show a properly made jacket that has the base folded and is ready to be annealed, drawn smaller, and then the base will be flattened. The outside of the jacket is smooth and free from defects. The inside has a uniform diameter and is straight from the jacket mouth to the corner of the jacket base. The other jacket has been made using a tube that was too long. There is a heavy fold on the outside of the jacket near the corner and there is a lumpy build-up of material inside the jacket close to the corner of the jacket. The build-up of material is the excess tube length that has buckled up and folded up on itself at the bottom of the jacket.

Before the tubes are swaged in the jacket forming die the tubes should be lightly deburred inside and out. Do not overdo this step. Only chamfer the inside of the tube ends so that the burr is removed and no more. Making the chamfer to deep will have the effect of shortening the tube and could cause the tube to be stuck in the die. The outside of the tube should also be deburred using an outside deburring tool or a fine cut file. If the burr is slight it may not be necessary to remove it on the outside of the tube. Do not use a sanding belt or other abrasive to remove the burrs.

Once the tubes have been deburred the inside of the tubes is lightly lubricated using swaging lube. This can be applied using a cotton swab or a bore mop. If the lube is warmed it can be applied using a pressurized lubricator. Lubricating the punch tip will usually be ineffective as the lube will be wiped off of the punch as the tip enters the tube.

The outside of the tube needs to be lubricated as well but usually every second or third tube can be lubed. There will be lube left in the die and that will almost always be enough to do the job.

Once the tubes have been formed in the jacket making die they will usually need to be annealed and reduced in diameter. Annealing is a simple task that can be done using a hand held propane torch, a pottery kiln, or heat treat furnace but it is often improperly done. The most common problem is over-heating the tubing jackets. Copper tubing jackets need to be brought to about 1,200 degrees Fahrenheit to soften them enough for drawing and swaging. Heating at a higher temperature will only increase the amount of scale that forms during heating. If a temperature controlled furnace is not available the jackets can be heated to just a dull red.

The other problem is that the jackets are often held at a high temperature for too long of a time. Once the jacket turns color it has been heated for a long enough time and the heat should be removed. Just as too high of a temperature increases scale, heating for too long will also increase the formation of oxides.

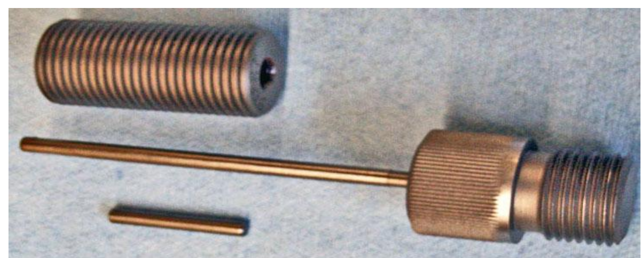
If a furnace or kiln is used the jackets can be wrapped in stainless steel foil to protect them from the oxygen in the air. A pouch is made from the foil, the jackets are placed in it, and the pouch is sealed. During heating the air in the pouch is either forced out of the pouch or the air in the pouch is depleted so that no damage can be done to the jackets. After the jackets have been heated for a long enough time to insure that all of them have reached a uniform temperature the pouch is taken out of the furnace and left to cool. When the jackets are cool they can be removed from the pouch and used.

It is also possible to fit a flow meter to the furnace and flood the furnace cavity with argon or nitrogen. Nitrogen is cheaper and works about as well as argon. Using an inert gas to force out the air and thus the oxygen, can be effective but lower cost furnaces may not seal well enough and it can take quite a bit of gas to do the job. The furnace must not be air tight so that the air in the furnace can be forced out but neither does it want to be especially leaky. The foil pouch is probably the better method if a high quality furnace is not available.

If the jackets are being heated using a hand held torch the jackets can be dropped into a bucket of water once they have reached the correct temperature. The water will keep any more scale from forming and will remove some of the scale that might have formed.

An alternative to plain water is to use the highest strength vinegar available as the quench. Two or three tablespoons of ordinary table salt should be added to each gallon of vinegar. Water can also be added to the vinegar to increase the volume of fluid but the more water added the weaker the vinegar will be. This quench is more effective at removing scale and tarnish from the jackets than just water. The vinegar/salt mix should be rinsed off after the jackets are cool.

If the cores are to be bonded to the jackets in order to make more effective hunting bullets the jackets should be thoroughly degreased before annealing them. The lube can “burn” into the jacket and prevent the lead from bonding. If the bullets are not to be bonded the lube does not need to be removed before annealing.



A simple draw die set for a hand press. The set has a draw die, draw punch, and sometimes a short punch extension for drawing long jackets.

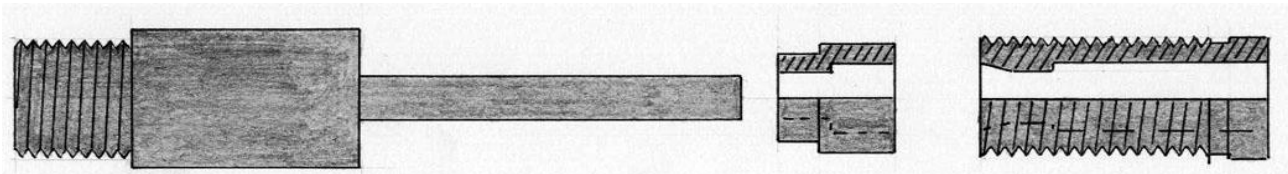
Once the jackets have been annealed they will usually have to be sized to fit into the core seating die in the bullet making set. Many .50 caliber bullets will end up being larger than the tubing so they will not require the jacket to be sized but almost all other calibers will need to have the jackets sized to fit the core seat die. Even if the jacket diameter is close to the bullet diameter the jacket will need to be sized. An example would be the .375 caliber. 3/8” tubing would be used for this caliber and 3/8” is .375” the same as the bullet diameter. But at .375” the tube is too large for the seating die which would be .3745”. Actually the jacket would need to be no larger than .374” to easily fit into the die. But a 3/8” jacket could be used without sizing if the bullet diameter was .377” as in some of the old blackpower cartridges such as the .38-72.

Copper tubing jackets are made in the sizes shown in the tubing charts earlier in this chapter. The most commonly made sizes are ¼”, 5/16”, 3/8”, and ½”. Larger and smaller diameters are made as well, as are metric diameters. Tubing jackets are basic jackets. Each basic diameter can be drawn down, sized smaller, many times. A basic ½” diameter jacket can be used to make .510 diameter bullets or it can be sized to make .500” bullets. The ½” diameter basic jacket can be sized to make .475”, .458”, .416”, .400”, .385” or any diameter jacket in between those sizes. Likewise the other basic sizes can be made smaller and smaller until the next smaller basic jacket can be used.

All that is needed is a reducer die for each bullet diameter wanted. As a rule the basic jacket can be sized to any of the smaller diameters using only one reducer die of the correct diameter. Rarely, two reducer dies are needed.

So many different jacket diameters can be produced with the basic jacket making set by simply adding low cost reducer dies.

Sizing the jackets is an easy task and goes pretty quickly. A reducer die is placed in the top of the press instead of the punch holder. A punch that will push the jackets through the die is placed in the press

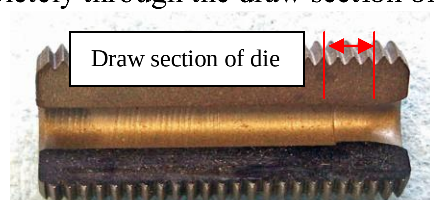


Jacket draw punch | Locator nest (spring not shown) | Reducer die

ram. The punch may have a locating nest on the punch that will help to keep the jacket square to the die as the jacket enters the die. The locating nest has a compression spring that holds the nest up and keeps a little pressure on the jacket.

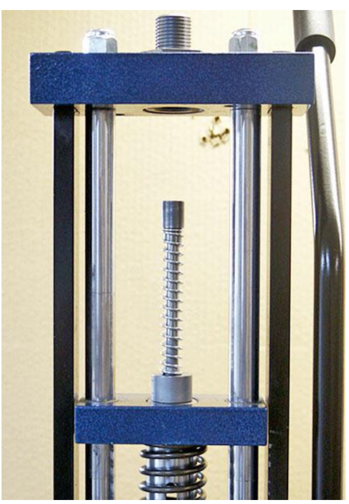
To use the reducer die the jacket is annealed and then lightly lubricated with swaging lube. The jacket is placed onto the draw punch and is held by the locator nest on the punch. Then the press ram is moved up and the jacket is pushed through the die. The reducer die will typically have a short draw section and will be counterbored for most of the length of the die body. Whenever possible it is best to push the jacket through the draw section of the die so that the jacket will be stripped off of the draw punch and will be loose in the counterbored part of the die body. This will keep the next jacket to be sized from pushing into the mouth of the first jacket which would damage both jackets.

Sometimes a short "helper" rod is needed to push the jacket completely through the draw section of the die. This is usually when very long jackets are being made and the press doesn't have enough stroke length to push the jacket through the die. In this case the jacket is pushed into the die, the press ram is lowered, the helper rod is placed into the jacket in the die, and the press ram is raised to push the jacket clear of the die. The ram is lowered, the helper rod is caught, and the next jacket can be drawn.



Draw die. Most of the die is counterbored leaving a short draw section at the mouth end of the die.

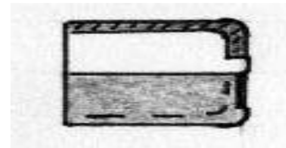
If the press has a dual stroke set-up it may be necessary to draw the jackets using the long stroke mode. Instructions that come with the dies will explain if this is needed.



Walnut Hill press with sizer die and draw punch with spring loaded nest.

The last step in making a tubing jacket is to flatten the base of the jacket. A core seating die, in the correct caliber, is used for this with a special end flattening punch. The end flattening punch is similar to the jacket forming punch except that the punch is a loose fit to the tubing jacket. Some end flattening punches may have a guide collar as on the forming punch and some may not have the collar. End flattening punches used to make short jackets work a little better if they have the collar but if the jacket is long the jacket will adequately guide the punch and the collar is not needed.

To flatten the end of the tube the press ram is raised up enough so that the jacket can be inserted into the die, then the ram is raised all of the way up to flatten the jacket base. The punch holder in the top of the press is moved up or down as needed to flatten the jacket base using the least effort in the case of a hand operated press. If a hydraulic press is used the lowest pressure setting that will do the job should be used. The base of the jacket will be flattened but the corner of the jacket should have a radius. It isn't necessary or desirable to flatten the base so that a sharp corner on the base is formed. This simply puts the die under excessive force and the sharp corner does not help the bullet in any way. In fact a sharp corner on the jacket base can cause the bullet to catch and damage the cartridge case when the bullet is seated in the case.



Finished jacket. The corner of the jacket base has a radius which will aid in seating the bullet in the cartridge case.

If thin jackets are being made it is often possible to skip the end flattening operation and just seat the lead core in the annealed and sized jacket. Seating the core will flatten the base reasonably well but the best quality bullets will be made if the end flattening step is done.

The finished jacket will have a hole in its base. The hole will vary in size according to how large the starting size of the jacket is and what size ejection pin is used for the jacket making die. A ½" jacket making die could have a .210" diameter ejection pin or a .161" diameter pin. The larger the pin the easier it is to eject the jacket from the die but the larger the hole will be in the base of the finished jacket. Using a small ejection pin is tempting in order to reduce the hole in the jacket base but if the pin is too small it will be hard to form the jackets completely and the difficulty in ejecting the jackets from the die increases rapidly.

.338 bullets made with tubing jackets. Lead tip & tight open tip.

The hole in the base does present a bit of a problem if the core is to be bonded to the jacket. Making bonded core bullets is very desirable when making hunting bullets but lead will flow through even tiny holes so a jacket with a hole cannot be bonded. The solution is to close the hole in the jacket. There are various ways to do this such as swaging a copper disk in the bottom of the jacket or using a special peening die set to move the jacket material inward to close the hole but an even easier way is available. The hole can be effectively closed for bonding purposes by simply wiping a bit of pottery clay over the jacket base. The clay will plug the hole and allow the bonding to be done. Once the bonding is done the bullets can be tumbled in walnut shells to remove the clay.

Brass and Steel Tubing Jackets

Copper is the material of choice when making tubing jackets but other materials can be used. Brass tubing, usually called Yellow Brass is alloy UNS-C27000 or often simply called C270, is available in many sizes and thicknesses. Quite often the same tools that are used to make copper jackets can be used to make brass jackets if the outside diameter (OD) and the wall thickness of both types of tubing are the same.

Brass is harder than copper and has a higher tensile strength which means that it will take more effort to form into jackets and into bullets. For large calibers and if a thicker tubing is used a hydraulic press and stronger swaging dies will be needed. Brass will be rather brittle so a thorough anneal will be required. Even then it will take more pressure to make bullets from the brass jackets and the bullets made will be somewhat larger in diameter than those made from copper in the same swaging dies. Usually a bullet sizer die will be needed to bring the brass jacketed bullets back to the proper diameter.

Brass jackets have a deserved reputation for fouling the bore more than a copper or gilding metal jacket would but there are special solvents that will remove the fouling. Brass is more costly than copper and bullets made with brass jackets will not expand as well as a copper jacketed bullet. However lack of expansion could be an advantage if a non-expanding, non-deforming bullet is desired. Bullets intended for large, dangerous game such as Cape Buffalo or elephant might be better made with brass jackets. But the same thing can be accomplished by using a thicker copper jacket. Brass jackets are possible but considering the disadvantages probably not worth making.

Steel can be used to make bullet jackets and steel jacketed bullets have been used successfully in Europe and in military bullets for many years. There was some concern that continual use of steel jacketed bullet would wear out barrels faster but this has not been shown to be the case with modern barrels. Steel will rust so the jacket needs to be plated or clad with something like nickel, copper, or a copper alloy. Steel jackets have been coated with tin, cupro-nickle, or both but this proved to be a bad idea and is no longer done.

Steel is much harder and has a much higher tensile strength than copper which means that, except for small caliber jackets, a hydraulic press and the stronger forming dies will be needed. The tooling to make steel tubing jackets will be the same as for copper tube jackets. It may be necessary to use Jacket Drawing Lube instead of Bullet Maker's Lube when forming the jackets.

Not all steel is the same and many types of steel tubing will not be useable. The best type of tubing is hydraulic tubing. This is available in limited diameters and thicknesses but the sizes that are available work pretty well. Hydraulic tubing that has a ½" diameter is most often found with a .050" wall thickness. 3/8" hydraulic tubing is available with a .035" wall thickness. These two sizes will make most bullet jackets that might be wanted.

Steel hydraulic tubing is fairly costly so that any bullets made using it will be quite a bit more expensive than those made with copper tubing. Like brass tubing bullets made from steel tubing will be non-expanding unless some action is taken to weaken the jackets when they are made. Steel jackets would be especially suitable for big, heavy bullets intended for African game but so long as copper and copper alloys are available steel isn't especially useful to the home bullet maker.

Partition Jackets

Partition bullets or H Mantle bullets are made so that the jacket has a front core, a rear core, and a partition between the two cores. If the bullet is sectioned the jacket will look like the letter H. This type of bullet has been proven effective on game and if made correctly can have a high retained weight after expansion on game.

At the same time a bonded core bullet will also have as good if not better retained weight so whether the partition bullet is really worth the effort to make it is questionable. But partition bullet jackets and bullets can be made if wanted.

The tooling to make partition jackets is a bit different from that used to make a conventional jacket. The same copper or other type of tubing will be used but the jacket forming die will be made similar to a core seat die. The die will have a highly polished, straight through hole in it. An external and an internal punch will form the cut tube into the jacket.

Both punches will have a tip that will form the front and rear cavities in the jacket. The punches will look similar to the punch used to form a flat base jacket except that the internal punch would also have a tip instead of being flat faced. The cut tube is deburred, lightly lubricated inside and out, and placed in the die. As the press ram moves up the external punch will enter the die with the punch tip going into the cut tube. The tube will be pushed down onto the tip on the internal punch. As the pressure on the tube increases the tube will be forced to flow towards the center of the tube. The punch tips will support the ends of the tube to keep the tube from collapsing while the partition in the tube forms. Then the press ram travel is reversed and the finished jacket is removed from the die.

The formed jacket will usually have a small hole in the center of the partition as it isn’t possible to get the tubing material to completely close the partition. It is possible to seal the small hole in the partition in another swaging step that uses to special punches to peen the hole closed but usually this is not necessary. The hole will not cause any problems and is best left as it is.

In order to be able to remove the formed jacket from the punches the punches must have a little taper. This will let the jacket slip off of the punches. Usually the base punch will be made to produce a longer cavity in the base of the bullet than the top punch. Typically the top core will be lost when the bullet expands so the bottom core plus the jacket should make about 70% of the bullet weight.

Longer or shorter jackets can be made by trimming the finished jacket using a pinch trim die set or, more often, a few extra top forming punches are used to make the different jacket lengths.

Once the partition jacket has been formed it will be annealed in the same manner as any other copper tubing jacket.

The partition bullet will have two cores. One for the front of the bullet and one for the rear. The core swage die will usually be able to make these lighter, shorter than normal cores but sometimes a special internal punch will be required to make the light cores.

Once the cores are made they are degreased and placed in the jackets. Sometimes both cores can be seated at the same time. The internal punch will have a short tip that fits into the base of the jacket while the external punch will be made the same as any core seating punch. But sometimes it is better to seat the cores in two steps.

If two steps are needed a special internal punch that has a tip which fits a little loosely into the top cavity of the jacket is used. The jacket goes into the seating die front end first and the bottom core is dropped into the jacket. Then a punch that has a collar on it is used to seat the bottom core. Only light pressure is used to seat the core. The collar on the punch keeps the punch centered in the seating die. Then the jacket is ejected from the die. The internal punch is replaced with one that has a short tip on it that fits snugly into the jacket base. The jacket is placed back in the die with the front core up, a core is placed in the front core, and the core is seated as usual.

Partition bullets can have the cores bonded if wanted. The hole in the partition must be sealed as mentioned earlier. Once the hole has been sealed the base core is bonded by putting a drop of soldering flux into the jacket and then slowly heating the jacket and core until the lead melts. The top core can also be bonded but usually isn’t.

To bond the top core the base core is done first. Then the jackets with the base core are placed in a shallow steel pan with water in it that is at the level of the partition in the jacket. The flux and top core are placed in the top cavity and bonded. The water in the pan will keep the bottom core cool so that it doesn’t melt.

Once both cores are bonded the jackets with cores should be boiled in soapy water or cleaned with a commercial blackpowder solvent to remove as much of the flux residue as possible. When working with bonded core bullets all of the punches and dies should be well cleaned and oiled immediately after use. Any flux reside will cause the tools to rust.

The base of the partition bullet will be open and usually a flat base is used. It is possible to make rebated boattail bullets but there are several extra steps required. It may not be worth the extra time and cost to make the rebated boattails.

If the jacket is .030” thick or less it will be necessary to roll the jacket over the base of the bullet a little. If the jacket is thicker the base will not need to be rolled and flattened. The thinner jackets can have the base of the bullet blown open by the muzzle blast as the bullet leaves the barrel so rolling the base over prevents that. Thick jackets will resist the forces on the bullet and don’t have to be rolled over.

Rolling the base over is done by first seating the cores in the jacket. Then the bullet is pushed base first into the point forming die just until the jacket contacts the ogive in the die. This will begin to roll the base over and the bullet is ejected from the die. The bullet is then placed, mouth first, and lightly swaged. A special base punch that has a spherical cavity is used to roll the jacket base over the core a little more. Then the special punch is changed for a flat base punch and the bullet is swaged a final time. This will roll the jacket over the bullet’s base and flatten the jacket against the lead core.

The bullet is now finished. Additional forming operations may done if wanted. A soft point bullet can be made and quite often, if a blunt ogive is used, the bullet is swaged in a dual diameter die to convert it from a conventional straight sided bullet into a bore rider type. Bore rider bullets are quite popular and useful for many double rifles or for use in short throated rifles. The bullet can be seated out of the cartridge case as far as possible to allow maximum powder chargers to be used without having the bullet contact and stick in the rifling. The forward portion of the bullet will simply rest on the rifling to guide the bullet in the barrel.