

Beginning Stained Glass Video Extras – The Course In Text

Hi, I'm David Gomm an instructor at Gomm Stained Glass, LLC.

As we put the video together, we tried to explain each of the steps to building stained glass windows in the most clear way possible. But as with any creative process, there is always room for improvement and so we put this primer together to give you further instruction that goes along with the video.

You may want to follow along while watching the video. If you ever have any questions, e-mail me david@gommstudios.com

Introduction:

Welcome to our Beginning Stained Glass Course. In this video we'll be covering all of the basics of stained glass, like cutting glass and how we put it back together. By the end of the video, you will have been introduced to all the techniques you'll need to build your own beautiful stained glass piece.

In other courses, we cover each of the steps in greater detail, but in this course we'll stick to the basics and show you some of the tricks of the trade. After you're done you may want to consider taking a class from a local stained glass shop. You may also find help at schools or adult ed programs in your area. Check your phone book or on the internet for classes in your area. You'll find it helpful to get one on one instruction because a lot of the time, after you've been shown the techniques of building a window, it helps to have someone with the skills to watch you and kind of coach you through the process.

General Shop Safety:

1. Be aware of what's around you. Make sure that the area you work in is well lit. Protect yourself from the hazards you might create and the hazards others might create.

Wear appropriate clothes, long sleeves are a good idea. No open toe shoes, thongs, sandals or bare feet! Shirts should cover you so that glass chips and splinters don't fall down inside other clothing. Aprons are a good idea, especially when wearing a low cut blouse. You're wearing clothes to protect yourself from injury.

2. You need to read labels. Part of being safe while working with stained glass is to realize some of the hazards of the materials you are working with. There are generally warning and caution labels on those items which pose a danger. So read and follow directions on the chemicals that you use in your shop.

3. Wearing safety glasses is mandatory, glass splinters are very difficult to remove and you don't ever want one in your eye. It's especially important when cutting, grinding, soldering and when someone is working next to you.

4. When you solder, keep your hands away from your mouth, don't eat, smoke or chew gum while soldering and make sure to wash your hands well after soldering. We like to use Dawn dishwashing liquid to wash our hands and we wash them and then wash them again. Many shops sell liquid soap, which is designed to get rid of heavy metals.

Another good idea is to wear work clothes in the studio and when you leave the studio, change and launder them separately so that you don't track hazardous material into your home.

5. Never wear a ball cap with the brim forward when grinding. Glass particles can bounce off the brim and past your safety glasses. If you want to wear a ball cap to keep glass chips out of your hair, turn it so that the brim is backwards.

The Two Methods Of Construction of Stained Glass are:

The older method of using lead came, a piece of extruded lead which surrounds the glass;

and the copper foil method...this video will cover only the copper foil method because it's an easier method for beginners. It's also a stronger form of construction and it allows more fine detail than lead construction. The only advantage that lead offers is speed.

History:

I can't help myself, I have to talk a little about the history of stained glass. In the days of the renaissance, most stained glass was made for churches because it was a very expensive process. In fact, regular window glass was expensive back then as well because all glass was hand blown, they didn't have the nice perfect clear glass

that is so common today. The art glass found in churches was called STAINED glass because it was painted on to get most of the colors of the glass and then the paint was fired onto the glass to form images and colors. In the late 1800's Louis Comfort Tiffany started a kind of revolution in stained glass, he tried to make art glass that used colors in the glass to form the images that he was trying to depict. His method was very popular and his studios turned out many beautiful stained glass windows that were installed in churches and public buildings all over the United States. He began to use a method of mixing colors called plating.. which is where layers of glass are placed on top of each other to get the color you want. He was known to layer as many as three colors of glass on top of each other.

To demonstrate,.. Hold up a piece of blue glass and a piece of yellow glass,.. you've heard it before, yellow and blue make green and you can see that they do.

So Tiffany plated or layered glass. In order to hold these piece of plated glass together, they had to develop a way different from forcing the glass between pre-formed lead came and somewhere along the way they came up with the idea of using copper around the glass. They would cut sheets of thin copper into strips and wrap it around the edge of the glass. When it was in place, they would then solder the copper and encase the copper in solder, which is half lead and half tin. They also discovered that they could make 3-d objects using this "copper foil method" and they began to make lamp shades which were very popular. This gave them a way to use up the warehouses of scrap glass that was left over from the huge church windows they were famous for building.

Overview of the Process

We start with a pattern. The pattern gets nailed down to a board which is larger than the finished piece of glass. We use horseshoe nails around the outside edge of the pattern to keep the piece from growing on us.

We trace our pattern and cut out pattern pieces from poster board. We use these pattern pieces to trace around and cut glass and grind it to the perfect shape so it will fit in our framework of nails. We leave just a little bit of "wiggle room" in the glass panel so it won't get too tight as we put copper foil on the glass.

We wrap each piece of glass in copper foil. The copper foil gives us something to solder to. We solder the panel so that we can join all the pieces back together into a solid panel.

After soldering which is quite messy, we clean the glass and solder joints and sometimes we add patina to the solder and sometimes we wax the final piece of glass.

Picking Out Patterns - Choosing Your Design

Before you can build a panel, you've got to decide on a design. A good place to start is to keep in mind where you want the window to go and how you're going to hang it. Your window can be hung in an existing window by rings and chain or it can be built to fit the window. You may want it to fit in a door. All these things need to be considered as you design your window.

Your stained glass retailer will have books, magazines and patterns to choose from. You can also use the internet as a source for patterns. It is best to get advice from your stained glass center on your first pattern because they will be able to help you pick a pattern which will be good for your ability and they should be able to help you understand if the pattern has "impossible" cuts or would be difficult. There are very talented glass designers out there and there are others who are less talented. You want to pick a pattern which will allow you to be challenged, but not defeated.

You need to build a medium sized window before you take on that grand entrance project or begin to make gift items. You need to gain the experience of each of the steps and how they relate to each other before you jump into a big project. Yet if you start out in class making little tiny items, you just don't get the experience of each of the tasks that a medium sized project will teach you.

The panels we're going to build in this video are designed to be hung in a small frame and changed for another panel each month. We call it the stained glass seasonal quilt. There are 12 different patterns and you can see them all by visiting www.gommstudios.com and visiting the stained glass quilt page (found under gifts). We'll be working with the February pattern and you can find that pattern on the DVD. You can order the other quilt patterns from Gomm Stained Glass, LLC.

Tracing the Pattern onto Paper and Poster Board.

Since we don't want to destroy our original pattern and since we need cardboard pattern pieces, we'll need to trace our pattern. We use thin poster board for our patterns. Thick poster board is difficult to get a good clean cutout. There is oiled pattern board sold by stained glass shops for patterns you'll be making many

copies of. Any cardboard will do. We actually used the cardboard from cereal boxes one time, when we'd run out of poster board.

Lay down the poster board as shown in the video, add a layer of carbon paper, a layer of paper, another layer of carbon paper and then the original pattern. Trace the pattern as shown in the video. Use a dull pencil. Use short back and forth strokes as you trace the pattern.

We number each pattern piece in a pattern so that it will be easy to find where each piece of glass goes. So we keep the numbers close to each other. As you number the pieces, you would expect that you would find 2,3 and 4 near to each other. We try to wait to number pieces after we're sure that we've traced all around that piece, this keeps us from missing pieces as we trace.

After tracing, it's often helpful to look at the pattern and determine if there will be pieces of glass where the lines in the glass need to run a certain direction. Tree branches may need the lines in the glass to run with the branch, wheat fields may all need to run horizontally and grass pieces may need to run vertically. This step will help a lot when you lay out your pieces. Draw lines on the pieces of the pattern where you prefer the lines in the glass to run in that certain direction.

When you complete tracing your pattern, remove two of the four nails and peek at the pattern underneath. If you missed any places, you can still put the paper back down and fix those places.

Cutting Out The Pattern

There are regular scissors, copper foil three bladed scissors and leaded method three bladed scissors. We recommend that the outside edge of the pattern be cut out with regular scissors. We also recommend that beginners use lead thickness three bladed scissors for their first projects. The added room that is subtracted from the pieces will keep you from having as much of a challenge when fitting your glass together.

Using pattern shears by choking up high where the blades meet and taking short choppy cuts will help you to keep them under control and will make cutting out the pattern easier than if you were to use them as you do a normal pair of scissors.

When you get to the end of a line, pull the scissors loose by tearing the little center waste away from the pattern. Then close the shears fully. This will discharge the zigzagged waste that builds up between the blades.

As you cut a curve, tip the scissors in the direction of the curve. This will lessen the pressure that builds up between the different pieces as they get cut out.

Laying Out The Work Copy

Next we need to lay the work copy of our pattern onto a board. Choose one which is a little larger than your pattern. Lay the paper on the board and begin on one side nailing the pattern to the board. You want to keep the paper flat on the board and put the nails so that the flat edge of them is right on the line of the pattern. You want to be sure that two nails are placed at each place there is going to be another piece of glass, one on each end. This will provide a barricade which will keep the pieces of glass inside your pattern and will keep your window from growing.

After I get my pattern nailed down, I like to lay all my pattern pieces out so I can easily get them as I select colors. Some artists like to put them in little envelopes according to color. Still other artists wait and cut one piece of the pattern out at a time and then cut out one piece of glass at a time.

Cutting The Glass – with a Hand Held Cutter

There are nearly as many ways to cut glass as there are artists doing the cutting. I've noticed that folks who started in the window glass trade prefer to hold their cutter as they did when using the type of cutter you buy at a hardware store. The difference between the hardware store cutter (\$5) and the stained glass cutter (\$15 to \$40) is that the stained glass cutter is self oiling where the hardware cutter is not. Also, the hardware cutter has a steel cutter wheel which is bigger in size than it's stained glass counterpart and it is sharpened at an angle which is ideal for cutting window glass. The stained glass cutter has a smaller cutter wheel made of carbide (a very hard, brittle metal) and the angle that it is sharpened at is good for the full range of glass (from most soft to most hard).

When I was five years old, my father brought home some glass and a cutter from the hardware store. "I'm going to cut this piece of glass," he told me, "Do you want to watch?" Of course I did. He set the piece of glass on the kitchen table, placed the cutters' rolling wheel on the glass and pushed from one side of the glass to the other. There was a scratchy zipping sound as he pushed. He held the glass up and

said, "It doesn't look like it cut very well, does it?" I nodded in agreement. "Let's try it again." He ran the cutter over the scratch that he had just made. This time the sound was different, there was some of the earlier zipping sound, but also a grinding and tearing sound. "That looks a little better," Dad announced and then he made a couple of more passes along the same line just to make sure that the glass was cut. Then he started to tap the glass. From there my memory fades, I remember that we were not successful in cutting our glass. We tried several other cuts but the cutter just didn't seem to work.

Now, half a century later, I remember that experience with fondness. I know how to cut glass now and I find this first encounter with glass cutting very instructive.

First, we don't actually *cut* glass. We create a weakness in the glass that will allow it to break where we want it to. Dad and I were expecting to run the cutter across the glass and have it fall apart. This rarely happens.

Second, it helps to lubricate the cut. I've seen glass artists spray their cutter with WD-40 and squirt 3 in One oil on the glass. One inexpensive method is to dip my cutter into a small container of kerosene or lamp oil. We used that for many years. My favorite lubricant is to mix some orange essential oil with mineral oil, because it smells good and is good for my skin. The point is that any light lubricant will help the cutting of the glass to be more successful.

Third, never, never, EVER, run a glass cutter over the line you just scratched a second time. The second pass will ruin the cutting edge immediately, which is why our cutter never seemed to work right after that first pass.

Finally, Dad did know what he was doing in one aspect. He knew that if you were going to cut a piece of glass, you were going to have to start at one side and continue on to the other side.

So, let's start to cut a piece of glass for practice and we'll refer back to the story to really understand what's happening.

There are three levels of complexity to glass cutting. A straight cut, an inside curve and an S-curve.

Hold your glass cutter as if you're going to stab the glass. You will find that with practice, this method will give you great control over the cut. If you are right handed, hold the cutter in your right hand. If left handed, use your left hand.

Remember that you always start at one side of the glass and finish on the other side of the glass. The glass will break at the weak point of the cut, so if you try to turn on a sharp corner, the break (or run) may not follow where you wanted it to.

First let's do a straight cut. Dip your cutter in oil, place the wheel on the glass at or very close to the edge, place firm pressure on the cutter, allowing the weight of your arm to transfer from your shoulder down into the glass and roll the wheel on the glass cutter across the glass. Listen to the sound of the cutter, if you can't hear it making that zippy sound, press harder, if the sound is really loud, you may need to ease up and if the sound grinds, you may be pushing the wheel of the cutter sideways instead of letting it roll along.

Try not to "crash" off the edge of the glass. It will tend to chip or break the glass if you do. Try to stop or at least ease the pressure off the glass cutter as you roll to the edge of the glass.

When you finish a straight score, grasp the glass, at the score line in each hand with your hands forming fists next to each other, your thumbs on either side of the score line and rock your hands outward, your thumbs rocking away from each other. The two pieces should snap apart easily. If not, the score probably wasn't hard enough or the wheel of the cutter wasn't rolling along the glass. Just don't try to go over a score a second time, or you'll ruin your cutter.

Now let's try an inside curve. This is a little more tricky because you need to get that wheel to keep running smoothly across the glass and not running sideways. Dip your cutter in oil and begin to follow the line. You can put the thumb from your none cutting hand on the back of the cutter head to help guide the cutter along the line you're cutting.

If you tried to break the glass with your hands like you did on the straight piece it would probably break wrong. This is because as the glass score (the scratch or weakness you've just created) gets closer to the edge of the glass, the more it wants to break at the easiest point, so it wants to break the little corners at the edge of the inner curve. So we take two pairs of pliers and place them opposite from each other, apply slight pressure on the glass until the score runs at that weak point. Then you want to do that at the other corner. Once those corners have broken, you'll be less likely to break the glass in the wrong place. And you can go ahead and break the two pieces of glass apart by rocking your hands apart or by bending the two pieces of glass away from each other using pliers.

As you use pliers, remember that you are just using them to grip the glass and easily rocking one side of the glass away from the other side of the glass. Some students have thought they were supposed to really squeeze down hard on the glass and use the pliers to crush the glass somehow, but just firm pressure is what we're after.

Finally, let's try a compound cut. Dip the cutter and use your non-scoring hand to guide your progress across the glass (thumb on the back of the scoring head). This cut really doesn't want to cooperate so we need to use the nut on the bottom of the cutter to tap underneath the score. We tap gently all along the score. As you tap, you'll see that the score begins to "run" or break underneath the place where the weakness was created in the glass. Keep tapping all along the score until the glass falls off. You'll want to angle the glass close to the table so it won't fall any farther than necessary.

Those are the three types of cuts you'll encounter when cutting glass. When you cut glass, always try to cut on the smooth side. If you want the rough side of the glass to face out on your finished piece, turn the pattern piece upside down and cut on the smooth side. Then you can turn it over and it will fit properly.

When you trace around your pattern piece using a Sharpie marker, you'll create a line all around the perimeter of the pattern piece. Ideally, you want to cut the glass just on the inside of that line so that the glass will be exactly the same size as the pattern piece. With practice you'll be able to, but don't fall into the trap thinking that you can cut your pieces a little large and grind them all to fit. That will lead to sloppy cutting and a long time on the grinder.

House Keeping

Keeping the bench clean is very important. We didn't mention it in the video but it will help you to stay organized and avoid mistakes as you cut out your glass. As you score a piece of glass, then pick it up and break it, little pieces and fragments of glass often fall on the table. If you will get in the habit of using a hard brush (like a wallpaper brush) after you break glass (every time) and sweep all the debris into one spot on your cutting table which is convenient and then sweep it away into the trash often, you won't accidentally cut yourself on those fragments. Also, if you are scoring a piece of glass and there is a fragment or crumb of glass under the piece you are scoring, very often the pressure at that point will cause your glass to break wrong. And those pesky fragments can sometimes scratch a piece of glass as you slide it on the table. So keep them swept up.

Cutting The Glass – with a Strip Cutter

A strip cutter does what its' name implies, it cuts strips. To use one, you have to have a cleat attached to the edge of the work bench. The T-square of the cutter runs along the cleat so that the cutting wheel will run straight on the glass.

To set the cutter, place the pattern piece you're working on against the edge of the cleat, loosen the nut on the strip cutter and pull the cutting wheel till it lines up with the edge of the pattern piece. Check the distance at each end of the pattern piece to insure that the glass is going to be cut just as you want it. Tighten the nut.

Place the glass to be cut right up against the edge of the cleat. You'll be able to see if the glass you are cutting has a straight edge by how it lines up with the cleat. Sometimes little fragments of glass get in between cleat and the glass and they hold the piece away from the edge. Sweeping them away with a wallpaper or other similar hard bristle brush, will help to keep things straight.

Dip the carbide cutting head in oil, run the wheel along the glass to spread the oil. You'll notice that I did that as I was cutting glass in the video. That first pass is just to spread the oil, I wasn't scoring the glass and then running over it a second time. It's just as important to avoid scoring over a place a second time with this type of cutter.

Use firm pressure to score the glass. This is a bit tricky because we have to maintain enough pressure on the glass, keep the edge of the strip cutter against the edge of the cleat and keep the glass from sliding out of place. But once you've mastered this cutting technique, you'll have perfect straight lines all the time.

When I cut pieces of glass using a strip cutter and the pieces are from 1" to 4" wide, I like to use a pair of running pliers to break the glass. Place the running pliers with the "U" shaped jaws rounded part up. The heavy line on the top of the jaw should be placed directly over the score. A gentle squeeze will do the job.

Cutting Out The Actual Pieces

In the old days, we had to use china markers to mark our glass. They were waxy and made your hands purple. And when you went to grind your glass, the marks would lift off and float away. Now we have the advantage of using a black Sharpie brand marker on light and clear glass and using a silver Sharpie brand marker on

dark colors of glass. They don't make such a mess of your hands, although the marker will still sometimes float away when grinding.

As you begin to layout your pieces on the glass, you can lay out several pieces at once if you remember that each time you cut you have to be able to start the score on one side of the glass and continue clear across the glass. If you try to place your pieces too close to each other, you may find you get more breakage trying to make impossible cuts. On the other hand, if you leave too much room in between the pieces, you'll waste glass. At least a quarter of an inch is recommended.

As you score the glass, if you hit a spot where you get stuck (like a little hole or imperfection) don't get rattled, you can stop and then continue, you can use your thumb to help push you over rough places. As long as you score continuously from one side to the other and you don't back up and try to score over a place twice you'll be all right. Sometimes you may have to look up and get your bearings as you're cutting, it's still okay to stop or slow down, just keep the cutter in the same place and enjoy the experience.

When cutting out pieces, it's okay to cut a triangle out of the piece of glass and then shape it into a circle. In other words, it's often a good idea to cut out an easy shape to cut out and then cut it closer to the shape you want. Many times I will cut a shallow inside curve, rather than taking the risk of breaking the whole piece of glass. I know that I can use a grinder to get in tighter on my curves. This should never be used as a crutch for lazy and sloppy cutting, but wasting glass isn't very fun, so you'll have to learn what you can and can't cut by trial and error.

I like to keep all the pattern pieces I need on my nailed down pattern and then as I take the pattern piece off of the board and cut the glass piece, I make sure the glass is going to fit and then dry it off (after grinding) and place the glass on the pattern where it goes and I put the pattern piece in an envelope with all the others I'm done with for safe keeping.

Grinding glass – make that thing fit

As you cut each piece of glass you should hold your pattern piece to it and make sure that the two are really the same size. If it is too big, trace where it needs to be trimmed with the marker. Then take the piece of glass to the grinder and grind down the places you marked. You may also want to remove any sharp edges from the glass to protect your fingers later.

Keep the little sponge on the grinder wet at all times. If a paste starts to form as you grind, you are in danger of hurting the diamond surface of the grinding head and if a dry powder forms as you're grinding, you are actually ruining the diamond surface. It's very easy and quick to ruin a diamond surface because, without water to cool the diamonds they get dull fast.

It's a good idea to run the entire piece of glass lightly around it's edge and then continue on around grinding off the extra you need to get a good fit. This "quick pass" around the edge will knock off sharp edges that might cut into your fingers as you grind heavier and push harder on the glass.

As you grind, remember that you can always stop if the piece of glass seems to be going the wrong way. Sometimes a sharp edge will cut into the table and start to go into the grinder bit more than you want. If that happens, simply stop, move the piece and start over.

As you finish each piece, it's a good idea to go fit each piece as you go along. Precision of fit will work in your favor if you make sure that each piece fits perfectly. Dry off the pieces as you finish with them so that you aren't placing them on the pattern wet, otherwise the paper will wrinkle and the glass won't sit flat.

Foiling Glass

The idea of applying copper foil to glass is to provide a way for the solder to stick the glass together. As you begin to stick the foil onto the glass, you may be surprised that it doesn't stick as well as you might have imagined. Try to clean the edges off with a rag, removing any powdered residue from the edges.

There is copper foil which is standard and used in most applications and there are black backed foil and silver backed foil which are used when clear glass is foiled and the finished piece is going to be finished silver or black. There are also many different thicknesses of copper foil. When you want a thick line to represent a branch or stem you might want to use thicker foil which will give you a heavier lead line. Thin foil is often used when foiling very small pieces where thicker foil would bury the detail and also in places where detail is very fine and important, such as around faces.

Start with your copper foil of choice. The most common sizes are 7/32" and 1/4" widths. Use one hand to guide the foil and one to hold the piece of glass. Start the

edge of the glass and line the piece of glass up so that each side of the foil hangs out the same amount on either side. Look down each side of the glass and try to have the same amount on each side. Roll the glass over and line up the foil again. Go all the way around the piece and then cut the end of the foil off flat.

Now take your fingers and press the foil down on each side. Use the fleshy part of your finger to gently press the foil over the edge, this especially important on curves where the foil may break. By gently pressing, little by little, you will have less chance of breaking the foil. Once the foil is folded over, use your finger nails to bend over a nice tight corner on each corner.

Finally take a fid, or the edge of a marker and burnish the foil tightly against the glass. As you burnish, try to pull the foil towards the glass so that it has a tendency to get tightened up instead of pulling away from the glass where it might get pulled off of the glass.

Now look at the final piece, does the foil overlap the same on both sides? Are the lines nice and smooth? If there are little breaks in the foil, you may need to cut tiny pieces of foil and patch them up. If a piece of foil overlaps creating a little square at a corner, take a sharp knife and cut it away.

Place the piece back on the pattern board, making sure that the piece is right side up and the lines in the glass are running the right way.

Sometimes the glass pieces in your window start to get wedged tight against each other as a result of adding the extra thickness of foil to each piece of glass. When that happens you may need to grind a piece or two to relieve the pressure in the glass, we strive to have a little extra room so that the internal stresses of the completed panel are kept to a minimum. If you find it necessary to grind a piece of glass which has already been foiled, make sure to remove the metal any where that you need to grind. Touching copper foil to the diamond surface will ruin the grinder surface instantly.

Soldering and deciding if reinforcement is needed

Start by pulling all the perimeter pieces of glass in your pattern to the outside edge up to the nails. Next go over the entire window and move the pieces so that you have the same amount of gap between pieces, this will result in a uniform lead line and make the window look much more professional.

We use soldering irons plugged into rheostats to regulate their temperature and we keep them in soldering iron stands while not in use. Turn on your iron before beginning. Usually an 8 setting on a rheostat that goes to 10 is good. We use the rheostat as low as five when soldering edges of sun catchers and a ten setting when doing wide lines and lots of them.

Apply a small amount of flux to each of the joints of the window. The flux is a light acid which cleans the metal by eating away a fine layer of the metal, this allows the solder to stick to the copper. Now, gently allow a drop of solder to join the glass at each joint. Try not to move the glass around. You'll notice that the solder only sticks to the copper, it doesn't stick to the glass. After the entire panel is tacked together, pull all the nails out of the board (rock the nails side to side to save the tips of the nails and to avoid putting extra pressure on the glass.

Now you can remove the pattern by sliding the glass off of the paper. Remember that sliding the glass around too much or too roughly can bend the foil over on the other side, so try to be gentle. Also note that the tacked window is very flimsy and trying to pick it up at this point might just let it crumble since it doesn't have any strength.

Once the paper is removed, we no longer run the risk of burning the paper as we solder. If we left the paper and soldered, we would have created a bit of a problem, because the burnt paper would be stuck to the copper and as we soldered the back of the panel, we would have to deal with more popping and bubbling of the solder than usual.

You can now solder all the lines in the panel, but try to keep 1/4" away from the edges. We do that because we will want to put a metal edge on this piece and we leave a space from the edge so the metal will still go on easily.

Use the heat and pull up technique demonstrated on the video. Try to let the solder bead round up a bit as you apply the solder. Trying to run solder too flat will make it difficult to look good, there will be a lot of shrinking of the solder and lines show up if there isn't enough solder. If you try to put too much solder on the bead, it will look messy and may fill in small details. However, if you have a place where there is a break in the foil, you can often get it covered over by adding a little more solder to the break and allowing the solder to bridge over the broken spot. If that doesn't work, let the area cool and add a dot more to the spot. Then touch it quickly to smooth it out.

Once side one is completely soldered, you're going to want to solder side two. To turn over a window safely, slide it halfway off the table and while lifting one edge, support the edge which is dropping with the other hand, when the glass is vertical it will be at its' most strong position. Now you can turn the window around and put it down in the same manner. Lay half on the edge of the table, let the top down with one hand while raising the bottom with the other hand. This isn't as important on a 12" x 12" panel, but when you're working with a 36" x 36" panel, this technique will be very important.

On the second side, the solder will have a greater tendency to pop and bubble because the gases only have one direction to escape which is up through your molten solder. You just need to exercise patience and touch the area where there is a bubble. Touch it and let it cool, if it bubbles again, wait, let it cool. Touch it again and keep doing that until it doesn't do it anymore.

Sometimes, solder will get too hot on the second side and run through to the first side. You will have a nice bead and then it will just disappear and go flat. Let that spot cool well before trying to add more solder and fixing the lead line. When you are done with the second side, you'll want to flip the panel over and fix any of the run throughs. You will have to remove the extra solder. You can do that by heating up the excess a little spot at a time and picking up the iron and then flicking the extra solder off onto the floor. Then go heat up more of the excess and flick that onto the floor. This will allow you to pick up get rid of the excess a little at a time.

Pay good attention to how the solder looks as you go along, try to make the job perfect as you go so you don't have to come back and make the joints look as good as possible. Soldering is the step that is best to learn with someone watching you and coaching you on what to do and how to get a great job.

Lead Safety is important to all who work with stained glass. Now don't get alarmed and think you're working with something highly toxic! We just want you to know that your window doesn't pose a significant threat as long as you:

1. Don't allow food to come in contact with your stained glass. Don't use a window as a serving tray.
2. Don't give a sun catcher to a baby. The glass may be cute, but you don't want your baby sucking on lead and getting lead into their system.

3. When working with lead, don't eat or smoke. We just don't allow food or drink (except drinks in closed containers) in our shop. And no bringing your hands in contact with your face or eyes at any time while working with lead, flux, or solder. Then wash your hands well after soldering a window. It's important that as you solder your window, you be aware that lead can be harmful. Many artists (especially painters who worked with lead based paints) got lead poisoning by accidentally putting their brushes or hands to their mouths while painting. The risk to you is minimal unless you devote a lifetime to stained glass work. Being aware of the risk will keep you from rubbing your mouth while working with lead. After soldering or polishing a project make sure to wash your hands and face well, two times. This will reduce your risk. There are soaps available from most stained glass suppliers that will clean away heavy metals from your skin, we simply use Dawn dishwashing liquid.

4. If you have any cuts on your hands, cover them with Band-Aids before leading. You can also use that liquid band aid stuff to seal cuts.

5. Use a wet mop or rags to clean the dust in the work area. In an analysis made of the floor dust in a stained glass studio, the dust was found to contain 1 percent lead.

6. Solder only in a well ventilated area, and you might want to use an exhaust device that moves solder fumes away from your face. It's preferable to exhaust outside. If you don't exhaust to the outside, use a bench top fan or intake device with a replaceable smoke/fume absorber made for stained glass artists. It should draw solder fumes into the replaceable filter. The filter should be activated charcoal and designed to remove particles smaller than 1/2 micron from the air.

There are also several OSHA approved respirators available for fumes. Consider wearing one in conjunction with a venting system, especially if you plan on soldering for several hours every day. Some of our students wear a dust mask while soldering to keep from breathing fumes as they solder. A side benefit is that it will keep you from putting your hands to your mouth while working.

How does a person get lead poisoning? Exposure to lead occurs primarily through the lungs and the digestive system. Once absorbed by these organs, it is transported throughout the body and deposited in bones and tissue. The body can excrete the lead but it is a very slow process and the body can not get rid of the lead as fast as the exposure can happen, thus Lead Poisoning.

What Are The Symptoms? The symptoms depend on the length of time and the amount of exposure. A slow exposure over a long period can lead to kidney damage, headaches, fatigue, irritability, and sore joints. Acute lead poisoning results in the absorption of a large amount lead over a short period of time. The symptoms include flu-like illness, and encephalitis. So that's the excuse I'm going to use whenever I get cranky, I must be irritable because of exposure to lead! We don't feel that we are in any grave danger working with lead products but we do use caution to avoid exposure.

Adding The Frame And Hanging Rings

With both sides of the window soldered (except for the outer 1/4") we can add the outer frame to the window. Start with two pieces of quarter inch zinc outer bar. Cut them to be a little bigger than the sides of the panel so that some hangs out on both ends.

Nail them in place with horseshoe nails, making sure to cover the bottom of the nail, so that if you slip while hammering the nail in place, you'll hit a finger and not the glass. Your finger won't hurt long, but the glass won't heal itself.

With the two side pieces in place, lay a piece of bar in between the two pieces to mark how long the top and bottom pieces need to be cut. Mark them with a nail or a marker and cut them to length. A hack saw will work for cutting the metal, but a hobby saw really does the job well.

Nail the two pieces in place and hammer the top edge of the side pieces flush with the top bar so that all the excess hangs below the bottom bar.

Each of the corners of the zinc frame need to be soldered and the lead lines need to be extended to come up to and join the frame. As the flux is applied to the metal frame, you will need to brush well since there is oil residue which is used in making zinc bar and keeps it from corroding.

Solder both sides of the panel and trim the bottom bar flush. Then take two 1/4" split rings and hold them in the two corners of the panel. Hold the ring steady with pliers and flux the ring and corner. Solder the split part of the ring into the solder that is already holding the frame together, then fill in the bottom half of the ring with solder.

Clean, Polish, Patina

Take regular blue window cleaner to wipe off the residue of flux. Once the window is fairly clean, spray mold inhibitor type spray on the window. This will get the window clean in a way that will allow the metal to take patina (If you are adding it, for instructions refer to the website for articles on applying patina and the other videos in the series).

After patina, clean with mold inhibit spray again. Then apply a thin coat of metal polish or a thin coat of liquid wax and spread it across the metal (if using metal polish) and across the whole panel (if using wax, let the wax dry).

Then commence polishing with a clean soft rag. Really polish the piece vigorously and your window will shine.

Don't miss our other videos

Don't miss our other videos and the free articles that are on our www.betterstainedglass.com website