

## Stained Glass Repair & Installation

### Repair or Rebuild?

Sometimes it's less work to dismantle and rebuild a panel than it is to repair it. Sometimes the amount of repair needed is more than the panel is worth. One of the most important skills for any glass artisan is to know when it's worth repairing and how a repair should best be done.

### Repairing on Site

Although it is sometimes possible to do a repair onsite without removing the window, it's both difficult and risky and should if at all possible be avoided. It's always preferable to remove the window and do the work in your shop. An exception is when a broken piece of glass is a shape or size that can be replaced using the *insert method* without dismantling the panel.

You can solder a vertical panel if you're patient. Here's how:

- Touch the heated soldering iron to the end of the solder wire to just pick up as much solder as the tip holds.
- Touch the iron to the spot to be soldered to apply a small dab of solder.
- Repeat with small applications of solder until you're satisfied.
- Hold a piece of cardboard beneath where you're working to catch any drips of solder.

### Removing Windows

Removing an old window can sometimes be as big a job as repairing it. This is a time for maximum patience. The panel will have to be taken out slowly and gently. Any attempt to force it out is likely to cause more damage. If it's a leaded window with considerable damage, you may want to attach a piece of plywood or gyproc to hold the window in place while you remove it.

### Straightening Bent Windows

If the window has bent either outwards or inwards only slightly and the lead hasn't been seriously stretched, it can usually be bent back into shape without being taken apart.

- Lay the panel flat on a table.
- Lay an electric blanket or heating pad on the panel and turn it on to apply steady heat to the panel.
- Place a piece of gyproc or plywood over the panel. Place a light weight on top to assist gravity in pushing the glass down to level.
- Leave for a few hours or however long is needed to allow heat to soften the lead and gravity to bend the panel back into place.

It helps if you understand why so many leaded glass windows bowed in or out. Traditionally, glass artisans assumed the need for reinforcement was to prevent wind from pushing the glass inward so they applied reinforcement inside to prevent that happening. They didn't realize that other factors could cause it to push outward. Glass and metal are drawn towards heat. Plumbers learned the trick of making solder uphill by applying heat above the joint they want to solder. Windows draw towards heat the same way. Windows facing south will draw out towards summer heat. Windows facing north will draw in towards winter heat. Another factor is pressure changes from exterior doors opening and closing. Each opening and closing cause a stained glass window to press out than suck back in. Many year with thousands of door openings can cause single-glazed windows to flex in and out enough times to break the connection between the reinforcement and the window.

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### Replacement without Dismantling

Sometimes a broken piece of glass can be replaced in a leaded or zinc/brass channeled panel without taking the panel apart:

#### ***Insert Method:***

- Remove the broken piece.
- Trace the opening from the broken piece.
- Cut a replacement piece 1/16" larger (1/32" in all directions).
- Insert one edge of the replacement piece into the opening and slide as far as possible into the lead channel until it drops into the opening.]
- Slide the replacement piece in the other direction to fit into the opposite side channel.
- Hold in place with electrical tape and putty to hold in position.
- This requires making the replacement piece a very precise size and shape. Until you have some experience, it's a good idea to practice by cutting out a piece of heavy paper or card stock to experiment with the fitting.

#### ***Peel back method:***

- Remove the piece to be replaced.
- Cut the two ends of two lengths of the lead at junctions.
- Fold the lead away from the heart to enlarge the opening.
- Cut a replacement glass to fit and insert.
- Fold the lead back over the replacement glass.
- Solder the previously cut joints.

#### ***Cut away method:***

- Do the same as for the peel back method but instead of folding the lead away, just cut the face off the lead enough to expose the edge of the lead heart.
- Install the replacement glass.
- Trim off a strip off a piece of lead to match the piece cut away.
- Install the replacement piece of lead and solder to attach.

### Removing Old Putty

How difficult it is to remove putty depends entirely on how old it is. The older the putty is, the harder the putty is and the harder it is to remove. Relatively new putty can be just scraped out but old putty often has to be slowly chiseled out. Soaking old putty overnight in mineral spirits is an effective way to soften it to make it easier to remove.

When scraping out old putty, ALWAYS wear a dust mask. As you scrape out the putty, you will be producing fine lead dust than you DO NOT want to inhale.

### Silicone

Sometimes artisans will silicone panels in place. This is especially popular for installing cabinet doors. You can remove these by carefully cutting the silicone away from the wood with a razor, Xacto, or box cutter.

### Epoxy

Some artisans are actually moronic enough to use epoxy to install panels. There should be a special place in hell for such fools. The only way to release epoxy is to apply heat – with a heat gun or by placing the entire panel in boiling water or in a kiln

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heated to 400°F. Resist the urge to speed up the process by going hotter. Remember..... wood ignites into flame at 451°F.

### Repairing Foiled Projects

- Score the glass in a sunburst.
- Tap the glass on the back of the scores to run the scores and remove it.
- Run the soldering iron along the foil and, with tweezers or pliers, pull off the foil that was on the piece of glass you removed. Try to avoid removing any of the foil on the adjoining pieces but don't be too upset if you fail. You'll just have to apply a bit of foil to replace where you removed.
- Trace the opening and cut a piece of replacement glass. Take care to make it slightly smaller than the opening to allow for the copper foil to be attached.
- Foil the replacement piece
- Set the replacement piece in the opening and solder in place.

### Repairing Leaded Panels

#### *Cutting off border*

- Cutting off lead border is as easy as cutting through the lead with a lead knife or lead nips. Cutting off brass, copper, or zinc is more difficult. When you melt the solder joints, the solder resets as soon as you remove the iron. A trick to prevent that is to use a kitchen butter knife or a putty knife slid under the channel edge to pry it away and prevent the solder from rejoining the pieces.

#### *Tracing for replacement piece*

- If a number of pieces need to be replaced, or you're releading the entire panel, it's advisable to do a crayon tracing of the

entire panel so you'll be able to identify where each piece goes.

- Number each piece with a Sharpie or taking a digital photo of the panel can also help identifying each piece for reassembly.
- If you're replacing just one or a small number of pieces, just place a piece of paper or cardstock behind the opening and draw the pattern – then cut the replacement glass slightly larger to allow for the inset into the opening. It's a good idea to draw the replacement piece before taking the panel apart.

### Turning a Panel

When you've completed soldering one side of a panel and want to turn it over to work on the other side, you must be especially careful to keep the panel intact. An effective way to do this is set the panel on a piece of plywood so you can tilt up the plywood with your panel attached. Hold them together and tilt them up to vertical. Holding the panel vertical, remove the plywood and place it on the other side of the panel. Then, with the panel held firmly against the plywood, tilt it back down to horizontal with the panel on top of the plywood.

### Matching Glass

Sometimes you will have to remove and replace otherwise perfectly good pieces to avoid the finished repair looking like an obvious repair.

If you have to choose between matching the color or matching the texture, the repair will be less obvious if you choose the color match. If the client is willing to pay the extra cost for your extra time, you can produce a good copy of the desired texture by kiln firing a piece of the right colored glass onto a mold material to pick up the desired texture.

- Pour some investment compound or liquid clay about ½" thick into a container large

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enough to cast the glass PLUS an inch or more larger in all dimensions. This extra size is ESSENTIAL.

- If you have a piece of any other glass with the same or similar texture, press it into the casting compound to imprint the texture. You can also use any found material with a close match to the texture you want to duplicate.
- Let the casting compound thoroughly dry and remove it from the container.
- Set the casting mold in your kiln.
- Place a sheet of glass on the mold.
- Fire to contour fuse (1400F for COE 96, 1425 for COE 90, 1450F for float) with a 30 minute hold.
- The edges of the glass will have distorted as the glass started to migrate to become thicker. Cut it to the desired size and shape needed for your repair.
- Because the kiln produced replacement piece is now thicker than the usual 3mm for art glass, you will have to manually expand the opening in the lead to allow for the thicker glass.

### Patina

If you're repairing a lamp or panel that has been patinaed, it's a judgement call whether or not to scrub off all the old patina. That will produce a better finished result but is a very great deal of extra work. Most often you can just ignore the patina and melt off solder where needed then apply patina to the new work. A diluted patina on new lead or solder will help make new work look more like the older unrepaired parts.

The most effective way to make new lead look old is to vigorously buff it with linseed oil. A natural bristle shoe brush works great to do it manually or any natural material buffer on an electric drill or Dremel.

### Lamps (or other 3D)

Glass lampshades and other 3D projects tend to collapse when you remove pieces for repair. A trick that helps hold them in position is the tape them together with electrical tape. This is one of the rare materials that will stick to the glass, can be stretch if needed, and will leave no glue residue when removed.

### Reinforcing

The best solution is always to design to either avoid needing any reinforcement or to minimize the amount needed. Some common methods for reinforcing are:

- "Restrip" (*thin copper or brass strip*) either inside came, between foiled pieces, or overlaid as fins.
- "Reforce" lead (*with brass strip in the heart*)
- Brass or zinc bar overlay. Take special care when attaching reinforcing bar to not crack a piece of glass while heating the bar. It takes a lot of heat to apply solder to a heavy bar and the heated bar in contact with glass can cause the glass to crack. A good "trick" is to mark on the bar where you want to attach it, then with either a torch or heavy duty soldering iron, melt on a bit of solder at that point. Let the bar cool, then place it over the panel and the solder on the bar to the solder spots on the bar.

### Repairing Scratches

Scratches can be polished out with cerium oxide but it takes a lot of polishing to remove even a shallow scratch and polishing will always leave a noticeable distortion in the glass. It's almost always less work to replace the piece than to polish out the scratch. If you can feel the scratch with your finger, it is most likely not worth the time to try polishing it out.

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### Installation

The optimum installation method for stained glass windows is to install clear double glazed sealed units on the exterior, then install the stained glass panel set ½” away from the sealed unit with a ¼” gap on both top and bottom to allow air to flow between the stained glass and the sealed unit.

Installing stained glass panels sandwiched inside a sealed units should be avoided for the following reasons:

- They are more likely to loose their seal and develop condensation.
- Any residue from flux or putty will become highly visible on the glass.
- If damaged, repairs are costly and often impossible.
- Heat build up inside the sealed unit can distort the stained glass panel.
- You can easily remove the stained glass panel if you want to take it with you when you move.
- The reflective glare on the covering glass detracts from the stained glass panel.

### Match the Old Work

The objective of a repair isn't to do better work than the original but to conceal that it was a repair. Sometimes that involves working to a bit lower standard than your usual work. A good “trick” to produce an uneven bead is to intentionally tremor your arm holding the soldering iron.

Resist the urge to work to your best standard it that will make the new work obviously not part of the original. An amateur will want to show off how they can do better work than the original. A professional will put their best efforts into concealing that what they did was not part of the original.

### Costing Repairs

It's safe to always assume that repairs will take twice as long as you expect them to. If you charge by the hour, the time needed isn't a problem but if you quote a fixed price for a repair job, take care to allow for that “always takes longer” factor. It's not unreasonable to charge just as much for knowing how to do a job as you do for actually doing it. It's always better to quote too high and not get the job then to quote to low and end up regretting getting it. There is no formula that can provide anything reasonably accurate. You'll always have to SWAG an estimate (Sophisticated Wild Assed Guess). As a guideline, our studio uses a minimum \$20 per piece to be replaced as the base cost and adds to that for anything out of the ordinary. On foiled projects, it makes no difference where the piece is located but on leaded panels, it's a lot less work to remove and replace a border piece than a piece in the middle of the window that requires removing several other pieces to get it out then replacing those other pieces to reassemble. If in doubt, charge extra. Lots extra.

### Repairs as a business

Repairing stained glass projects takes considerably greater skill than making them. Because there are few artisans able or willing to do repairs, those that do them can generate attractive earnings. Not only can you increase your income doing repairs, offering to do them increases the perception of your skill level and will equally encourage more clients to hire you for custom work.

Don't be afraid to charge well for your work. Repairing stained glass is an uncommon and specialized skill. There's no reason you shouldn't be handsomely compensated for supplying a service few others can provide.