I'd Like To Make My Own Acrylic Boxes... Can Anyone Tell Me How?

by Ira Freincle, CPF

Acrylic boxes are one option to consider when framing an object (or a collection of objects as seen here).

Acrylic boxes are not difficult to construct. They do, however, require care, and accuracy in measurement. When finished, they provide certain advantages to framers that shadow box mouldings may not. In my previous article, "Ain't No Shadows in My Boxes (*PFM*, August 2001)," I mentioned these advantages.

The instructions in this article are based on the fact that framers have certain kinds of equipment that adapt to acrylic work quite well. Some of the techniques I use may offend plastics assemblers,* but they will work for framers.

If you have the machinery, you can buy bulk sheets of material, and thus save money on material costs. If you don't have the basic machinery, you can still make your own boxes, but you will have to buy your material by a form of chop service, meaning you buy your acrylic precut to the sizes needed. Then you scrape, cement, and polish them yourself. Doing this should save at least 50% of the cost for the box, since the major part of the assembly is hand labor.

The best way to size material is on a standard table saw. A framer's miter saw will not rip cut long pieces; however a swing arm saw will work quite well as long as the size of the pieces do not exceed its capacity. Most framers have a board and glass cutter, and most of these come with an acrylic cutting device. As long as the cutter has a heavy frame, this tool will do a very good job. The frames of some glass cutters are not very rigid, in which case the cutting pressure must be kept light to prevent springing the frame. This works as well but requires more strokes for a cut.

The other major piece of equipment that will be a tremendous help is a large flat top surface. You must be able to lay a 36" or 48" straight edge along it in different directions, and not have any bumps or hollows. Some glass vacuum press tops will do very nicely. If you don't have such a surface, you can still do the work, but you will have to shim out the hollow spots. You must have tight joints to prevent the formation of bubbles in the joints.

Bend or Weld?

There are two ways to make a box—bend it with heat or assemble it by welding. Bending thicknesses of 3/16" or greater requires that the bend lines be partially routed to allow the bends to be sharp.

However, since the routing process is not within the skill set of many framers, I will discuss the welding approach here. I use the term welding because the pieces are fastened together with a solvent. Injecting the solvent into the joint softens the surfaces, and since they are under slight pressure they join together as the solvent evaporates.

Additional tools required include a scraping tool to smooth the cut edges, and can be obtained from a plastic supplier. It has a heavy blade with two handles for easy holding.

You can also use a standard single edge razor blade, with or without a handle. However, the heavy handled blade is easier and more comfortable to use than the razor blade,

In any case, either will do a good job removing tool marks from the edges. The problem with the razor blade is that it must be held tightly, and therefore you will be inclined to cut or abrade your skin.

You will also need a tool with which to apply the cement solvent. This can be either a small bottle with a needle, or a hypodermic type syringe. The commercial tool for applying solvent is a small bottle with a thin needle on the top through which the solvent is applied to the joint. The problem with the bottle is that if you give it a slight squeeze as you are bringing it toward the work, a small amount of solvent may squeeze out and fall on the acrylic. This will cause a small, but very unsightly tide ring to form on the surface of the plastic. The hypodermic syringe keeps better control of the solvent, especially for an inexperienced person.

If you are cutting on a table saw, it would be wise to purchase a saw ground for acrylic, and some form of blade lubricant. If you don't lube the blade, the plastic chips will melt and fuse to the saw, damaging the cut edge. If you are using the glass cutter, you don't have to kube the blade, but you must remove the chips after each cut.

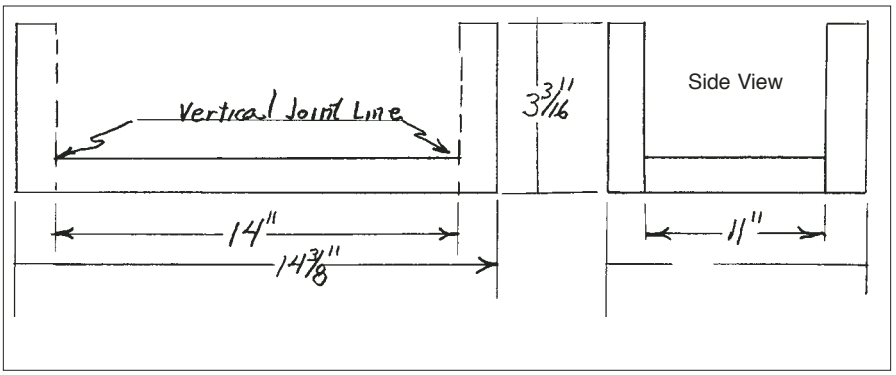

Figure 1: One method is to attach the side pieces to the edges of the face.

Measurements

The size of an acrylic box can either be specified as *Inside Dimensions* or *Outside Dimensions*. It doesn't matter which you use as long as you realize that ⅛" thick acrylic will affect your dimensions by ¼", and 3/16" acrylic will affect them by ⅜".

If you assemble the box by cementing the sides to the edges of the face (see Figure 1), there will not be any joints visible from the front. This looks nicer and makes it harder to see any bubbles that might form, However this method will require that you join the box with the face in a vertical position. This can get very clumsy if you are making a large box.

If you assemble the box by cementing the edges of the sides to the face (see Figure 2), you will see the joints, but if you assemble them carefully, you will not get bubbles and they will look good. With this method, since the face will lie flat it doesn't require jigging to retain the largest piece stable in a vertical position. Only the much narrower sides need to be stabilized in a vertical position.

Let us assume that we need a box that is 11"x 14" by 3" deep on the inside. We will assemble it by gluing the sides to the face. The piece will be made of 3/16" thick material. The method you use to assemble a box will affect the dimensions of the pieces you need.

To assemble the piece by cementing the side pieces to the edges of the face,(see Figure 1) the pieces change as follows:

1 pc (Face)	11"x14"
2 pc (sides)	14⅜" x 3 3/16"
2 pc (Ends)	11"x3 3/16"

If you apply the edges of the sides to the face.(see Figure 2) you will need the following:

1 pc (Face)	11⅜"x14⅜"
2 pc (Long sides)	14⅜" x 3"
2 pc (Short sides)	11" x 3"

If you change the size to 11"x14"x3" *outside* dimensions, the sizes become:

Method #1

1 pc	11"x14"
2 pc	14"x2 13/16"
2 pc	10 13/16"x21 3/16"

Method #2

1 pc	10⅝"x13⅝"
2 pc	14"x3"
2 pc	10⅝"x3"

Confusing? Think about it. Keep in mind that you will remove approximately 1/64" to 1/32" of material on each edge when you scrape so allow double this on all dimensions. If you find you have to remove more than this to clean up your cutting technique, then add more material. Actually, if you scrape the same amount from all edges, you will still have excellent fits; the overall size will be slightly smaller than you anticipated. Therefore, strainers, etc. should not be cut until the box is finished.

Do not attempt to make these cuts by hand using a straight edge and a hand cutter. It can be difficult to hold the rule and work accurately enough to get good straight, parallel cuts. To cut them yourself using a glass cutter, proceed as follows:

1. Mark the cutting dimension on the protecting paper on the acrylic.

2. Line the mark up with the point of the plastic blade. (Incidentally, if you have never seen the blade installed before, it looks like it is upside down.)

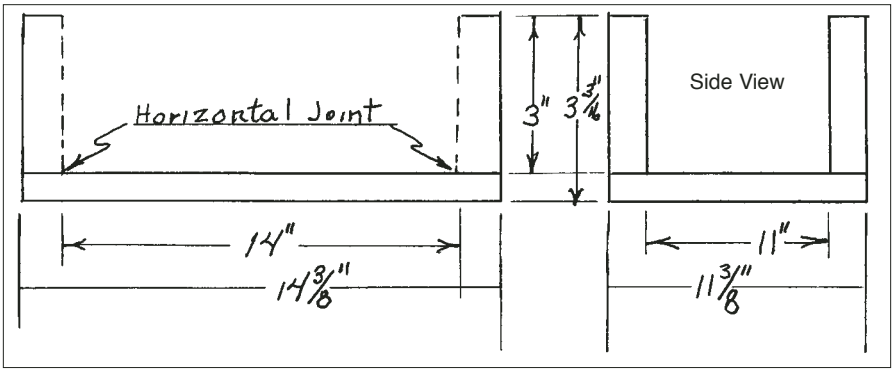

Figure 2: A second method is to attach the edges of the sides to the face.

When you think you have the mark lined up, ease the blade down to the paper so it leaves a slight impression. If the impression lines up with the mark, you have the correct placement for the cut.

Increase the spring pressure on the cutter more than what you use for glass. (Don't forget to slack off when you are finished or you will ruin any glass that you may cut for later projects.) Put the point of the cutter about 1/32" down from the top of the plastic. The cutter will not slide up onto the surface as the wheel does on glass. For acrylic that is 1/8" thick, you have to make about three passes to get a good break. For 3/16", it requires about five to eight, and 1/4" requires about 10 to 12 passes.

After scoring, put the breaker wheels at the top edge of the work and press down on the lever until you hear a crack. Move the breaker down about halfway on the piece and repeat. If this doesn't give the full break, repeat until it does. How far apart the breaker is moved depends on the height of the piece. After breaking the piece, slide a thin razor blade down the joint to cut the back side protection paper.

If you wish to have a supplier cut the pieces, I would suggest you have a trial box made before you do something for a customer. This way you can determine how much scraping is necessary to clean up the supplier's tool marks. Have a project in mind, and use it for a display sample to show customers. Also get some scrap to practice scraping, cementing, and flame polishing. In point of fact, your first box should be a trial no matter how it is cut.

Scraping

If the acrylic pieces are cut by a saw, the cut pieces will have tool marks, grooves, and shiny spots on the cut surface. If cut by the glass cutter, the cut edge will be rounded and may not be square to the face. In any event, all the edges must be scraped. This may require starting with a slightly larger blank to allow the necessary scraping. You will be surprised at how fast scraping removes material so don't get carried away.

Mount the piece in a vise with thin wood protection on each side. Even a framer's vise will work if you make the strips about 1" high and about 6" long. You may have to move the workpiece along to keep it from whipping as you scrape. Do not scrape in an area where the piece bends or whips. Move the piece so that area is clamped in the vise. Try to scrape with either full strokes, or as long as possible, so you don't scrape hollows.

Hold the scraping tool at about a 45 degree angle to the edge of the work, and square to the face. Draw the tool toward you. (Note: If chalk squeaking on a blackboard bothers you, you will not enjoy doing this.) The scraped area should look like a piece of ground glass with no cross marks or other unscraped areas. Keep scraping until the surface appears uniform. If you can only scrape a small part of the length, try to scrape each area the same amount and take a long finishing scrape over the entire edge.

Now before we start cementing the box, we must remove the protective paper about 1" back from all edges on both sides of each piece to be cemented. Do this by pressing a straight edge down on the paper as a guide, and tear the paper along its edge. We leave as much paper protection on as possible to prevent any scratches or solvent drips. If the side pieces are less than three inches wide, you may as well remove all of paper and try to be careful.

Cementing

We will make our first box using Method #2. It makes life a little easier to not have to prop a large piece vertically and worry about it falling over. Put the face piece flat on the

flat surface. Starting with a long side, place a side piece on top of the face along the edge with its end even with the end of the face.

Secure it in place with weights and check to make sure the two pieces are in tight contact. Full, or partially full, staple or nail boxes make good weights and are reasonably square. Put one about 3" to 4" in from the corner and up against the side so it is locked in place.

If it helps, you can fasten the acrylic to the nail box with tape. Do not put tape around the edge where you are cementing. It will drag the solvent through and cause tide marks or worse.

Hold the edge down on the face with one hand and move it slightly so you can tell if is touching the face in full contact or just in a small area. If the full length is in contact, you can apply solvent to the full length. If only a short part is in tight contact, apply solvent only to that length as a start. Allow that to set for about 10 minutes and then move along.

Welding

Fill the syringe by putting the needle into the solvent bottle and pull out the plunger so the solvent is sucked into the hypodermic. Point it up (make like a doctor) and squeeze out any air. Then wipe it. This will prevent drips. Put the tip into the joint corner about ½" in from the end.

Do not start applying solvent at the corner, It will flow out and around the back. Even if this doesn't glue your piece to the whatever it is resting on, it will cause a tide mark. Squeeze out a little solvent and watch it run in the joint. Slowly slide the point *back* from the end, squeezing out solvent as you go. Stop when you get to the end of the tight contact area. Do not push the needle forward. This will force the softened plastic into the end of the needle and clog it.

Allow the pieces to set and dry for about 10 minutes. Put a weight on top of the cemented part to hold it down and check to make sure the next area is in contact. If it is not, you can shim up the face with thin pieces of paper, matboard, etc. to raise the face to the edge in the next area to be cemented. Proceed along the entire length in this manner. Allow the cemented side to set dry for about a half-hour to an hour before going on to the next side.

Put a short side against the long side at a corner and proceed to cement along the new joint. Do not apply solvent to the vertical joint of the two sides. It will run out along the surface and mar it. Capillary action will pull some solvent into the vertical part of the joint but this is okay. Just make sure the corners are lined up properly before the solvent flows up.

When this short side is cemented, put the other *short* side in place against the other end of the long side and cement it. Do not go around in a circle. If there is a small dimensional error, the last side will not fit properly. There will either be a gap, or the new piece will be too long to fit. After all the sides are cemented to the face, we will stand the face up and then apply the solvent to the corners.

Remember, the joint must always be set so the bottom is closed. If the joint is vertical, the solvent will run out, spread along the surface, and mar the finish (see Figure 2). The assembly part of the job is then finished.

Polishing

The edges of the acrylic box can be left with the scraped finish, but it is not as pretty. So if you wish, you can polish the edges to a transparent shiny surface using a buffing wheel, tallow, and abrasive.

Another method of finishing the edges is to flame polish them. To do this, you need a propane torch with a small tip. You don't want too much heat because the acrylic will burn or flame. In any event, it will create very large bubbles which will completely ruin the piece. *[Editor's note: Be sure to take all safety precautions if using this polishing method.]*

Set the torch for a medium blue flame. Hold the torch so the flame will hit the edge at a 45° angle, and pull the flame along the edge with the torch leading the flame. The surface will melt and flow smooth and shiny. If a spot doesn't shine, allow the work to cool for four or five minutes while you work the other sides; then come back and rework the spots. Do not attempt to rework hot acrylic, it will burn. I suggest that you get a few pieces of scrap and practice until you get the idea.

Do not apply alcohol, solvent, or any liquid other than water or plastic polish to flame polished plastic. It will craze and crack so badly the edges will break apart. Have fun; try it on scrap.

Strainer

The box is now complete. However I suggest that you leave the paper protection on the pieces until you are ready for the final closing. You now have the finished box dimensions and can make a strainer to fit inside. The strainer is the base frame which supports your mounting sur-

face and whatever you are framing. For smaller boxes (up to 16"x20") that will house lightweight objects, the strainer can be ½"x1" stock. Buy dimensional, rather than house framing stock. It is better quality than many others and less likely to warp. House lumber is specified as 1"x3", 2"x4", etc. (It is always actually smaller than the nominal size.) Dimensional stock is ¾"x3", or ¾"x1", etc and is that size. Make your strainer about an ⅛" smaller than the cover for an easy fit. *(Editor's note: Lumber should not be used for conservation framing. Instead, conservation-quality materials can be used to build a support.)*

Fasten the acrylic cover to the strainer with # 6 or #8 flat head wood screws. Use a combination counter sink wood drill to go through the box and strainer at the same time (See Figure 3). This type of drill makes a small starter hole in the wood, a larger clearance hole in the plastic, and a countersunk space for the head of the screw all at once. Keep the screws 3" to 4" from the corners, because the screws will spring out that ⅛" allowance, so you don't want to strain the corners. Put a screw in the center of a side, and the divide any left over space so screws go in approximately on 4" to 6" centers.

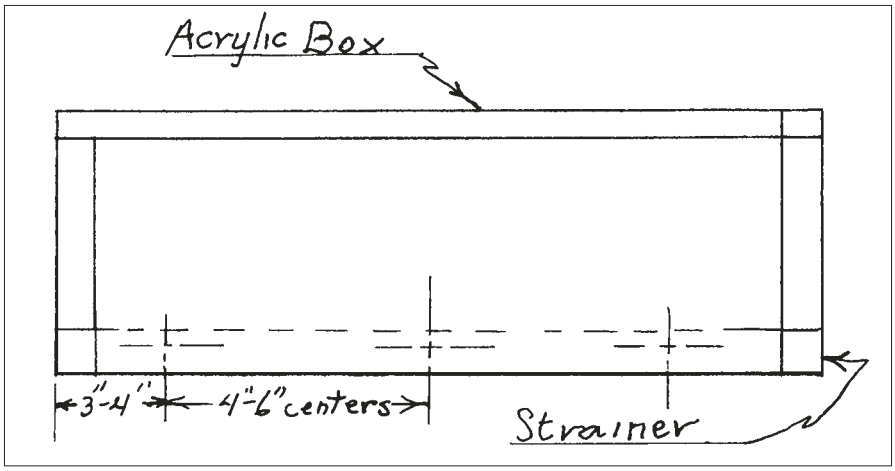

Figure 3: The strainer, the base frame to support your mounting surface, can be constructed as seen here.

To use a trim moulding, first install a ¼"x¼" piece of wood all around the outside of the box. Secure it with the same screws that hold the strainer in place. You will now need a longer screw to go all the way through. Cut the frame to a sight size ⅛" larger than the box. The trim strip will fit it the frame rabbet. The frame can be held in place the same way you would normally hold things in the frame. Put paper on the back as usual. We have found that either the Wall Buddy type hanger, or the Hangup type security hanger work well.

Regarding proportions of the box, the face should be ½" to 1" higher than the object(s) inside. The size of the box requires the same aesthetics as mat proportions. Depending on what's going inside, the spacing from the object to the acrylic box can vary from 1" to 3". ■

**For instance, commercial assemblers use a small plastic bottle to apply solvent. It is prone to dripping, which makes circular tide marks on the acrylic if you don't wipe it. If you do wipe it, it can smear and must be polished out. Also, commercial assemblers cut with specially ground saws and drills. Ordinary wood/metal working ones will work, and are less expensive.*