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Acrylic Vivarium Construction

First of all I don't have nice tools so TAP Plastics is my 'FRIEND'!
To purchase materials and find information for my projects I usually use the following:
http://www.homedepot.com
http://www.tapplastics.com
http://www.craftics.com
http://www.cyro.com
http://www.ipscorp.com

For all my vivaria building, I use ACRYLITE® GP acrylic sheet from Cyro Industries purchased from TAP Plastics. For Cementing without bubbles Cyro recommends using two part polymerizable cements. I use Weld-On 42 for the two part polymerizable cements. See link below to read specs.

http://www.cyro.com/Internet/SiteContent.nsf/58CF0A9D8BB0671C85256B6F006690F4/$File/1235E+GP+Physical+Properties.pdf?OpenElement
http://www.cyro.com/Internet/SiteContent.nsf/12E7EE4B05128DF285256BB80070953F/$File/1084L+Working+with+ACRYLITE+Sheet.pdf?OpenElement
http://www.ipscorp.com/ind_html/productbulletins/indprodbultnpdf/PB42.pdf

The basic design is building a box. For this example, let us make a 12" X 12" X 12" to keep the concept and construction simple. I usually use quarter inch (thickness) for most everything, but there are equations that you can use to calculate thickness if you were to fill the whole thing with water. Use the Cyro Tec Knowlogy Center Link I find ¼" suits my purposes quite well without taking the time to find the equation on the net.

ENSURE that the acrylic that you purchase is ¼" i.e. measure the thickness yourself. Some manufacturers use metric thicknesses so you may not be getting the full ¼" when you think you are. The retailer may just be doing a "closest match" usually in there favor. (Meaning less than ¼") This is just a warning that I've seen posted on the web, but I've never experienced any type of scam like this.

Definitions:
Base:= bottom of the vivarium
Top:= the lid or top of the vivarium
Back:= the part usually going against the wall or in most of my cases is covered with flat cork-bark
Front:= the panel that you would usually look through directly seeing the back
Lside:= left side as you are standing to the front. If you were looking into the vivaria from Lside you would have the back to the left and the front to the right!
Rside:= right side as you are standing to the front. If you were looking into the vivaria from the Rside you would have the back on the right and the front on the left!

The Cuts:
Since I don't have nice tools, I have TAP make the cuts for me. It is very important for the cuts to be at a 90 degree angle through the quarter inch sheet. This does two nice things. First it helps the panels bond together, and secondly it helps reduce the need for weird bracing. DO NOT 'sand' the edges for smoothness (you can do this at the very end to 'polish the edges). The problem with sanding is that you ruin the 90 degree cut that the

plastic retailer or yourself made with a router. It becomes convex instead of flat if you try to sand the edges.

The Base and Top:

The base and top need to be cut so that when you place the box on it (Rside and Lside on the base and the Rside, Lside, and base {all cemented together} on the top.) there is a quarter inch lip over the Rside and Lside panels. The reason here is that the construction of the box is a repeated use of 'Butt Joints' to form 'T-Joints'. So, for the base and top, we would to order an 11.5" X 12.5" cut! The 11.5" accounts for the fact that the front and back panels are ¼" thick each, and the 12.5" accounts for the ¼" lip over the Rside and Lside panels.

The Lside and Rside:

These panels are cut to the size that they will be in the end. We want a 12" box and the top and base panels are going to form a ¼" lip over the sides. Recall that the thickness of the base is ¼" and the thickness of the top is ¼". To get a perfect 12" X 12" X 12" box (measured from the exterior) we need to take this into account. So we would subtract ½" from the top edge to get the 12" X 12" side. Also, the front and back panels have a thickness of ¼" each; so, we need to subtract ½" from the back edge of the 12" X 12" side as well. Therefore the cuts for the Lside and Rside panels need to be 11.5" X 11.5".

The Back:

On the back and front panels we need to account for the fact that we are sealing these to a square that has already been bonded together. The square has a height of 11.5" so with the addition of the back panel that is ¼" and the front panel which is ¼" we can form our 12" box! To bond this using a 'Butt Joint' to form a 'T-Joint' we need to form a ¼" 'lip' on each of the 4 sides once the square (this is the edge of Rside, Lside, Top & Base already bonded together) is placed on top of the back panel. This assists us in cementing the pieces together so the dimensions of the back panel cut need to be 12.5" X 12.5".

The Front:

To make the front accessible I use an acrylic 12" piano type continuous hinge. So I assume that I have approximately 2" of water in my false bottom, ½" egg crate substrate divider and 2" of substrate along the front panel. Overall the front panel uses the same reasoning as the back panel so the dimensions of the cut are 12.5" X 12.5". I only want the vivarium to hold a maximum of 4.5" of water for short durations. So, I add on the ¼" lip and ¼" thickness of the base panel and then account for some make-shift weather stripping. Making things easier, I have the front panel sliced into two pieces 12.5" X 6" and 12.5" X 6.5" (Since I do not need a 'Butt Joint' for the upper portion the cut for the upper panel of the front can be cut to 12" X 6.25") I add a piece of acrylic for weather stripping to guide any condensation over the hinge as gravity pulls it downwards over the inside thus I can block some of the condensation from seeping into the hinge. I use a ¼" thick strip measuring 11.375" X 1.5" as my weather stripping.

Summary of Cuts and Accessories:

LSide and RSide	**Top and Base**	**Back and Front**
11.5" X 11.5"	11.5" X 12.5"	12.5" X 12.5"
11.5" X 11.5"	11.5" X 12.5"	12.5" X 6"
		12" X 6.25"
		11.375" X 1.5"

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Accessories and Tools

12” piano Hinge	4; C-clamps	Polyester Tape (3M Riveters Tape #685)
2; Acryl-Knob™ Handles	Straight Edge	Disposable Polyester Bristled Paint Brush
1 set; Clear Door Catch	Exacto-Knife	2 pieces of wood; 2” X 2” X 12”
Glass, 4 pieces of each size;		1 piece of wood ;1.75” X 0.5” X 12”
3” X 3” 3” X 2.75”	3” X 5”	Weld-On 42

Construction:

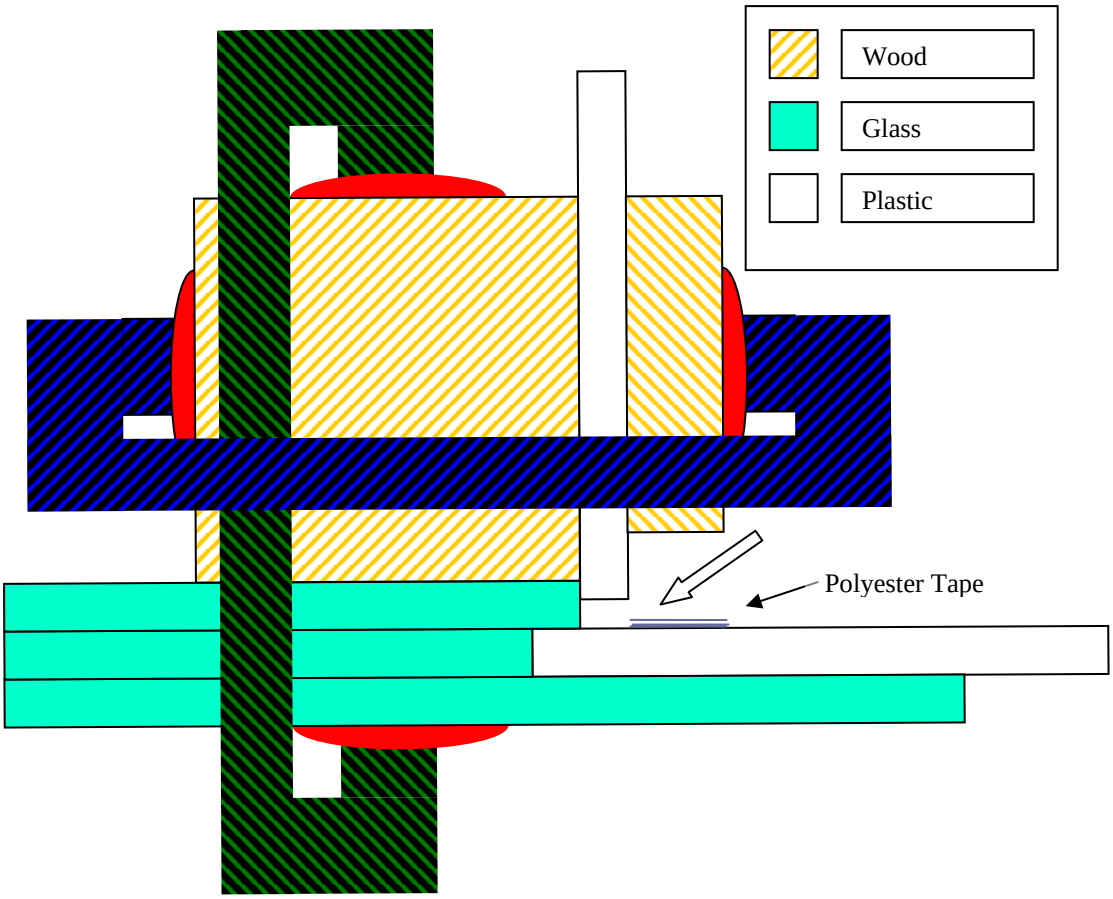
I work on a glass surfaced table, but you can work on a surface covered in polyester film. I use a level to check that the table is level before I start. To me, this makes things easier since the pieces can stand/balance in place without any bracing contraptions or clamps.

I set up the box free-standing to make sure all the pieces fit appropriately. On a level table everything should balance together just fine. I balance with the back panel flat on the table. I take everything back apart, lie the base panel flat down on the table, and proceed to cement one side (Rside or Lside) at a time. I check to make sure that the Lside and Rside will (individually) stand perpendicular when placed on the base panel, free-standing, without any bracing. This indicates that the cuts were exactly 90 degrees. I then peel back the protective paper along the edge of the Rside or Lside; since, I am about to bond one of these panels to the base. I only peel it back about ¼” to ½”.

During the construction process, leave as much of the protective paper on as possible. I start with the 'back' panel first. I peel back the protective paper on the 11.5" sides a little more than ½” and then tear it along a straight edge so that it is out of the way. I leave the protective paper intact on the 12.5" edges for now, and even though I don’t mention it from here on out; if you are going to work on an edge peel back the protective paper and tear it along a straight edge to keep it from bothering you while you work.

I then make some holding frames. See the figure below. I think it is self explanatory. The Blue and Green Things represent clamps. The glass is ¼” thick. I didn't show it, but the glass doesn't go all the way along the edge. I make two of the glass contraptions (four for the whole project), one for each side of the edge so the dimensions of each glass contraption, all assembled is about 0.75" high X 5" long X 3" wide. The square piece of wood is 2" X 2", and the other is 1.75" X 0.5". The acrylic as mentioned before is ¼” thick and 11.5” across (the edge that we are cementing that is!). I make the wood about the length of the acrylic. So in this case I have a piece that is 2" X 2" X 12". TAP Makes Gluing Jigs that sell for about $5, but they didn’t have any in stock when I called.

The arrow indicates where (the interior angle) I will apply the cement using the gun that comes with Weld-On 42. The Polyester tape keeps the solvent from going where I don’t want it to go. The tape is removed carefully about 5 minutes after cementing and clamping everything into place.



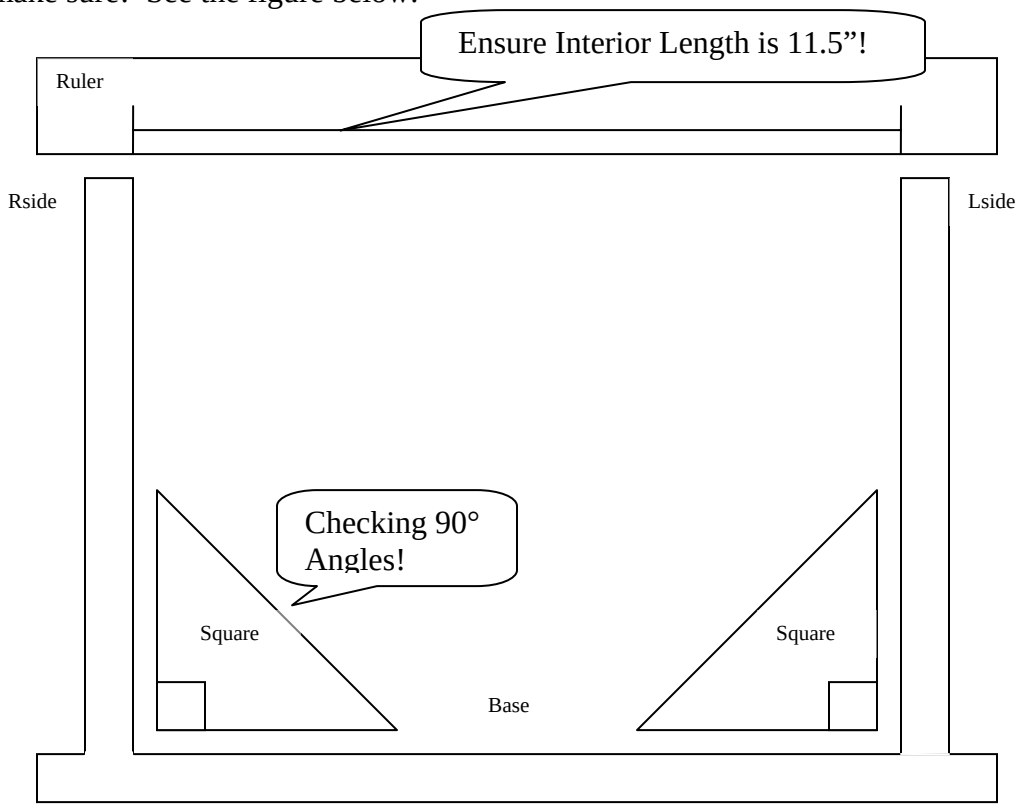
Cementing Rside and Lside to the Base:

I use the cement gun to make a bead across the interior angle inside the gap. Once the gap is filled I lower the vertical pane and re-clamp it into place. Be careful not to squeeze all the cement out of the gap. Weld-On 42 is thick it doesn't run all over the place (like some of the thinner cements that I've tried using a capillary method). The tape keeps the solvent from bonding where it shouldn't. The tape I use is 3M™ Riveters Tape 685, ¾". I think this was the brand-name mentioned for use at Cyro Industries. Note: The cement will not bond glass or polyester to your acrylic. Hence, the glass contraption and polyester Riveters tape. Once everything is clamped into place, wait about 5 minutes and carefully remove the Polyester Tape. I wait an additional 15 minutes and remove the Blue Clamp first and then slide the whole contraption off. Then I leave it in a location that will not get touched for about two days. You do not want to leave it in the clamp because as the cement cures it evaporates, expands, and contracts large amounts in comparison to glass. You want this to have the freedom it needs to secure the legendary bonds of acrylics.

Once I do my first side. I first check and recheck with a square for 90 degree angles and then I let it sit for two days for a good cure. I then set up and do the other side using the above procedure.

At this point if I flipped my project over, I'd have a table-like piece of plastic. See figure below. The base is flat along the table and the Lside and Rside panels are sticking up

into the air perpendicular to the base. The Lside and Rside panels are parallel to one another, and I check this with a ruler before continuing further! I usually check the parallel feature when I have the second side clamped in. Once everything has cured I use a Square Just to make sure. I've never had it be off at this point, but I always want to make sure! See the figure below.

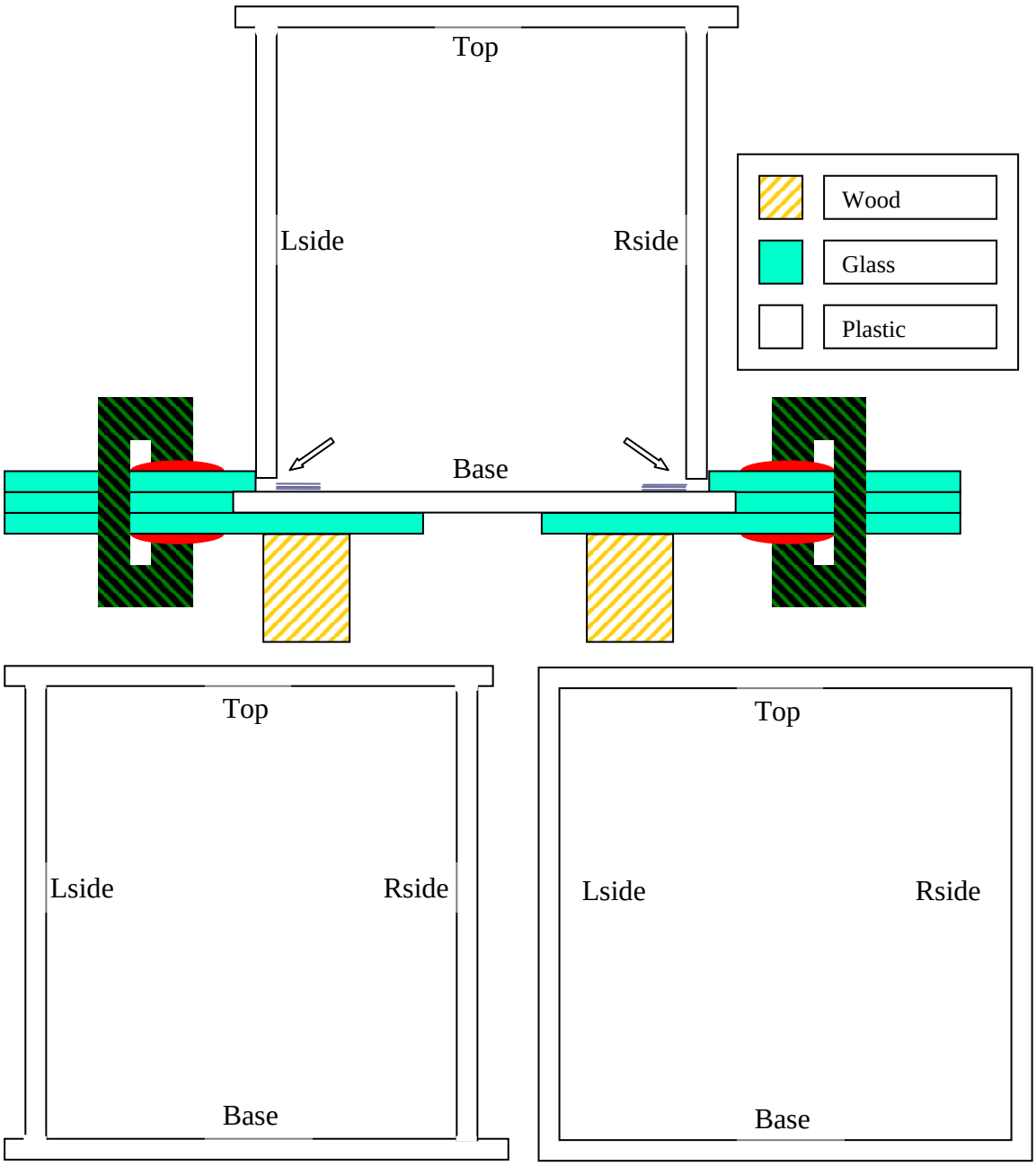


Cementing Rside, Lside and Base panels to the Top panel:

For the top pane, I do not clamp the top. I use two of my glass contraptions from the first figure on each side of the front panel. I place a bead of solvent along-side the polyester tape and then lower the Lside and Rside panels simultaneously onto the Top panel to cement the Top panel in place. Once again, carfully remove the polyester tape after about 5 minutes. I then let everything cure for about 2 days.

Machining:

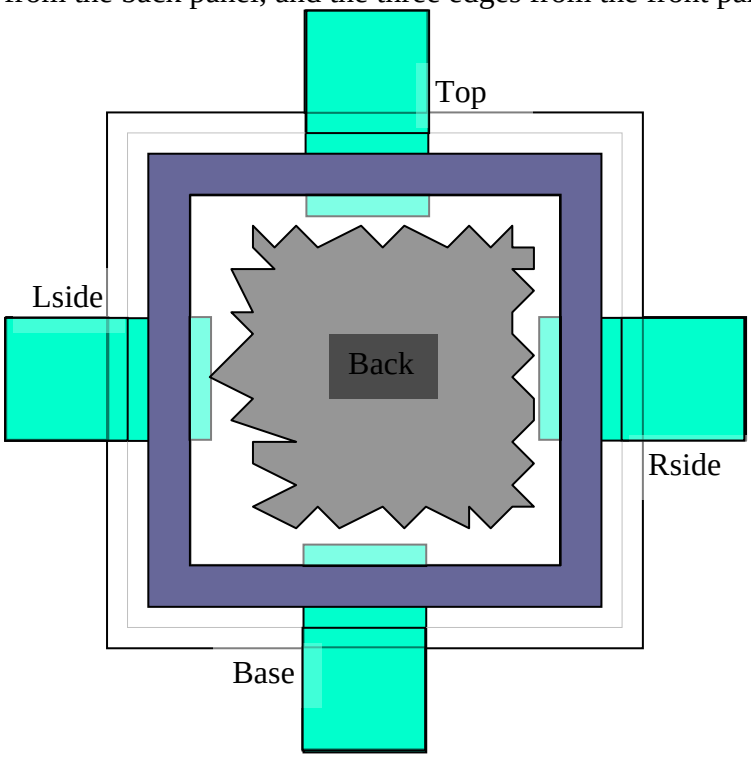
Now, I take a trip to TAP Plastics. I have them use their router to route off the ¼" lipped edges. (There should be 4 of them; 2 from the Top panel, and 2 from the Base panel.) See Figures Below. The Top Center figure represents cementing the Top panel, the Bottom Center is before TAP Plastics Routed off the edges, and the Bottom Right is after TAP Plastics Routed off the edges.



Cementing Top, Bottom, Rside and Lside to Back Panel:

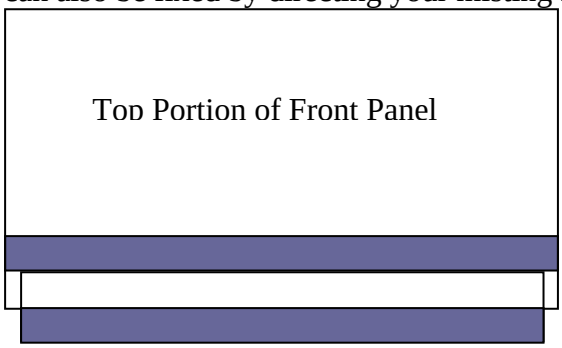
See the figure below. We take the four glass contraptions and center them on all four sides of the Back Panel. Use the polyester tape (purple) to tape an interior square so that there is exactly ½" edge of plastic on the exterior. Notice that I have represented keeping the protective paper (grey) on the back panel. With this I usually tape the 3 pieces of glass for the glass contraptions with tape instead of clamping them as previously described. I place a thick bead of cement alongside the polyester tape all the way around the base. Then I emplace the cemented and cured Top, Base, Rside and Lside routed square (See above lower right figure.) over the cement bead using the glass contraptions to evenly space ¼" from the edges of the back panel. The polyester tape forms a square along the inside of the Top, Base, Rside and Lside routed square. This square should

surround the tape, not be on top of the tape. I then check carefully for bubbles, and extract them with a very small piece of wire. I prick the bubble and then draw out the wire very quickly. I allow the weight of the square {cemented and cured, Top, Base, Lside, and Rside} assisted by slight downward pressure to act as my clamp. Do not squeeze out all of the cement! I carefully remove the tape after 5 minutes and allow the box to cure for two days. Once this has cured, I take this to TAP and have the four edges of the base routed off. You can save the routing until the end and have the four edges from the back panel, and the three edges from the front panel routed off at the same time.



Constructing and cementing the Front:

I add the weather stripping piece {11.375" X 1.5"} to the top pane of the front panel that is 12.5" X 6.5". I use a polyester brush to spread cement and used polyester tape where I don't want any of the cement to go. Then, I clamped it together for a few hours to cure. The weather stripping helps guide water droplets as they dribble down the front pane over the hinge, and not seeping horizontally through to the outside. I've found that the water droplets that do seep through evaporate before they cause any leakage problems. This can also be fixed by directing your misting systems away from the front panel.



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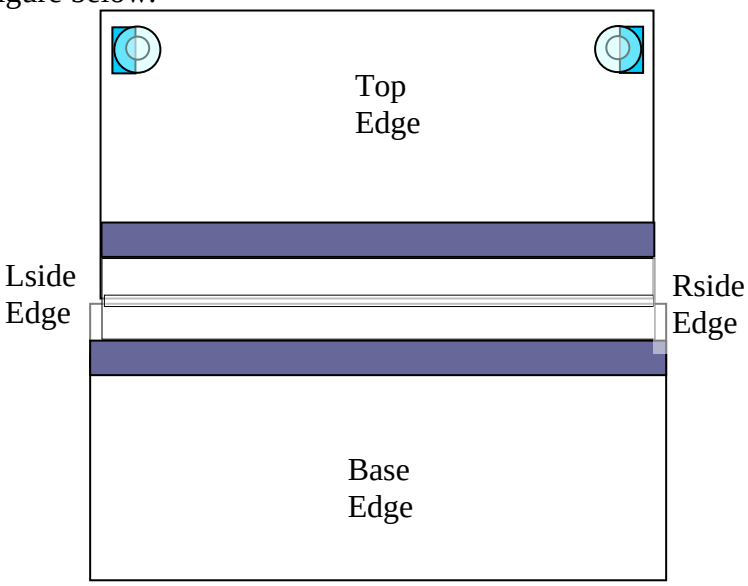
I use the cement gun to squirt the Weld-On 42 onto the hinge flaps. I'm very conservative here. I use a polyester paintbrush to smooth the cement over the flaps being cautious not to get the cement into the hinge. Then with the two pieces for the front pane aligned along the 12" edge for the top pane and centered on the 12.5" edge for the bottom pane, I place the piano hinge online with the seam spreading the piano hinge so that the cement is squeezed away from the hinge. I also use polyester tape to keep the solvent from spreading too far I remove the tape after the cement has set for 5 minutes. See figure below.



Cementing the Front to the Box:

Now that the Front Panel is constructed with the weather strip, piano hinge, knobs, and female door catch parts, we are ready to attach the front panel to the vivarium. Use the polyester tape to mask where you don't want the solvent to go. I apply a bead of cement on the constructed Front panel and then place the panel onto the open side of the box. I keep a watchful eye to make sure that bubbles are not present and use the wire method mentioned above to remove them. Note: as much of the protective paper should be in place as is possible. Removing the protective paper is the last thing to do!!

Hopefully this helps in your vivarium construction adventure.
Take Care: any questions / comments may be directed to statmatt@sbcglobal.net.