

Acrylic Model Case Construction

Ed Thieler
28289 Oaklands Rd.
Easton, Maryland 21601
410.820.5028
edthieler@yahoo.com

*“Every model worth
building is worth
protecting in a case.”*

Rationale

An ounce of prevention is worth a pound of cure.

Dirt

Once dust and fly specks are well established on the model surface and rigging they are almost impossible to remove and those efforts often result in inadvertent damage, especially to delicate parts.

Damage

It never fails that some observers feel compelled to touch models: to see how strong they are, or to see if the rudder really turns, or to see if such a small thing really exists. Depending on the model characteristics, probing fingers can leave skin acids and oils on the surface and may result in structural damage.

Display

A model in a proper case looks better, brighter, and more complete.

Precautions

Models in cases are subject to an important hazard – heat. They should never be exposed to direct sunlight. The temperature can rise to significant heights inside the case resulting in damage to the model.

There is unresolved debate regarding air exchange in cases. Some believe models should have a certain rate of fresh air exchange. Others believe that stagnant air is of no consequence. Ship models in sealed bottles seem to weather the centuries quite well. There is evidence that most woods, glues, paints, and other materials used in model making give off acetic acid fumes. These may be responsible for accelerated “lead corrosion disease” in a case. If no lead is used in the model I believe that most case construction allows for enough air exchange and that somewhat stagnant air probably doesn’t matter.

Types

The case should not distract from the model. A heavy wood frame, although it may be a fabulous example of the cabinet maker's art, probably will obscure the model and detract from it. A frameless case is almost invisible. The model is what is seen and not the wood surrounding it. Narrow wood or metal frames may be a nice compromise when necessary.

Considerations

Leave some space between the glass and the model – not so tight as to make it look cramped inside and not so great as to make the model appear lost inside. For a 20" boat I use about 1 3/4" – 2" at each end, about 1 1/2" – 1 3/4" on each side, and about 1 3/4" at the top. For a five foot model I left 3" at each end.

Construction - Materials and Procedures

Acrylic Sheet – Thicknesses - 0.084" (5/64"), 0.093" (3/32"), 0.125" (1/8") (Lexan [polycarbonate] does not glue well.) (Figure 1).

Leave the protective paper/plastic on. I use a 10", 80 carbide tooth table saw blade to cut the acrylic sheet.

Rabbets – The triangle shaped kerf of most saw blades (Figure 2) does not make a good capillary rabbet so I use a 10", 200 tooth, table saw blade with a flat kerf (Figure 3) to rabbet the edges of the ends and tops of the two faces, and the tops of the two ends of the case. A zero tolerance table saw insert (Figure 4) is important to support the acrylic and prevent cracks in the material. It is also important to use a "hold-down" (Figure 5) so the rabbet depth is even (Figure 6).



Figure 1. Acrylic sheet.

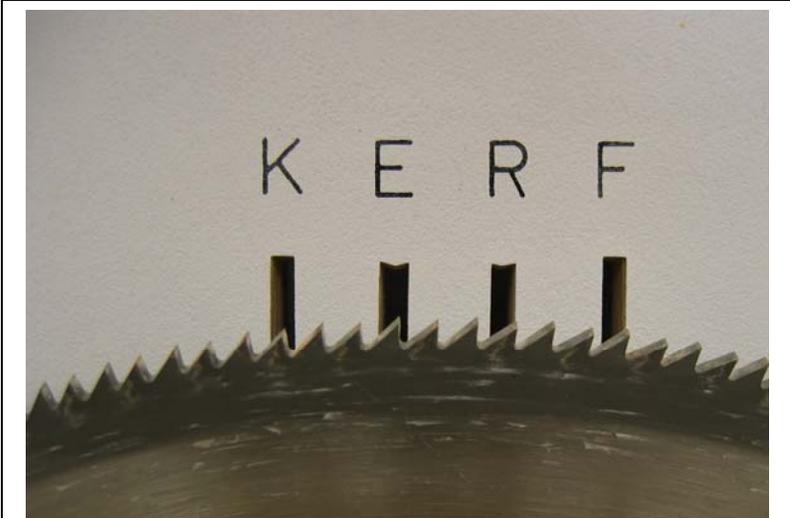


Figure 2. Common kerf shapes.



Figure 4. Zero-tolerance insert for table saw.



Figure 5. Hold-down to keep acrylic flat across the blade.



Figure 6. Finished rabbets with flat kerf and even depth.

Glues

These glues soften the acrylic and allow the surfaces to weld together.

Weld-on #3. In a high humidity environment Weld-on #3 may cause a white “blush” to form on the plastic, in that case use Weld-on #4.

Craftics – Plastick (sic) Acrylic Solvent Cement.

Plastruct - (Bondene – white label) and Ambroid - (Proweld) are products that may work – the labels say they are for acrylics.

Keep the top of the glue container on – the glue solvents evaporate very rapidly. Store the glue in the refrigerator where it will last longer.

Do not use cyanoacrylic glue (e.g. CA, cyano, crazy-glue) – it does not work well and may cause a white blush on the acrylic which is difficult to remove.

Dispensers

Plastic glue bottles –

There are several brands of glue bottles of the type shown in Figure 7. Some leak and are unusable, some don't leak and work very well.

Hypodermic syringes –

Buy several at local drug stores. A 2 ½ cc hypodermic syringe with a 25g [blue hub] needle will work very well. Sand or grind the sharp point of the needle to a smooth round shape otherwise it will tend to climb out of the joint as you slide it down the groove.

Insert the needle into the glue and pull back on the plunger to fill the syringe. Aim the needle away from any acrylic - don't forget the supply of acrylic across the room – and squirt excess air out of syringe.

After a while the black rubber piston in the syringe will swell. Take the syringe apart. After some exposure to the air the plunger will shrink back to normal size.



Figure 7. Glue bottles and hypodermic needle applicators.

Assembly Jig

At this point remove the protective paper/plastic from the acrylic sheet. There are several options at this stage. A strip of the covering can be removed along the edge to allow gluing, but the material may be very difficult to remove from inside the case after it is built. Or, remove all the covering from the inside and a strip on the outside. Or, take it all off. Just be sure all parts of the jig are non-scratchy.

Using an assembly jig as shown in Figures 8a and 8b, assemble the ends and sides of the case. Use 1/16" sticks or thick cardboard strips to elevate the acrylic away from the jig. This also opens the joint so the glue will flow into it better. Large sheets of acrylic may tend to sag away from one another in the middle; use strips or shims to push them up into contact (Figure 9). Sight down the seam to be sure the rabbet joint is properly seated (Figure 10). Slide the glue needle down the joint while slowly squeezing the bottle (Figure 11) or syringe plunger (Figure 12) while watching the glue run into the joint to determine the correct rate of "speed and feed." Elevating one end of the jig facilitates the flow of glue along the seam.

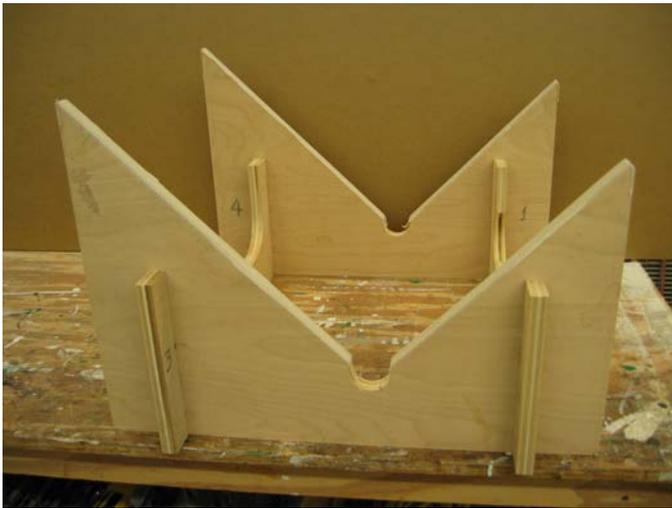


Figure 8a. End view of assembly jig.



Figure 9b. Side view of assembly jig.

Tape a cardboard buttress in place to help support the glued sides when removing them from the jig (Figure 13). The glue sets up rapidly but the joint remains flexible and only gains strength over many hours.

After the sides are assembled, let the case top down into the top rabbet. Carefully turn the unit upside down into the jig, and very carefully run glue into the top joints (Figure 14).

Rough, sharp edges can be smoothed and rounded with sharp flat files, first a bastard cut then a mill cut, tips wrapped with tape so as not to gouge the acrylic (Figure 15). Do not use sandpaper. It leaves a grit residue that will scratch the plastic.

The cover can be fastened to the base. Drill holes, with a sharp bit, about 1/32" larger than the screw diameter and tighten the screws gently. This prevents cracking the acrylic and allows for expansion.



Figure 9. Thin sticks used to elevate the acrylic away from the jig.

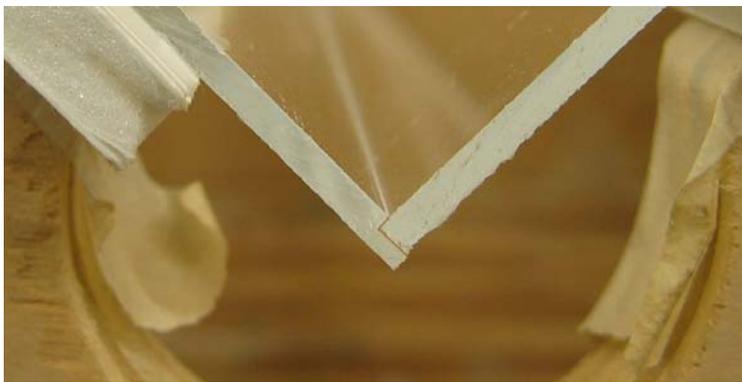


Figure 10. A properly seated rabbet joint.



Figure 11. Applying glue with a hypodermic-tipped bottle.



Figure 12. Applying glue with a hypodermic-tipped syringe.



Figure 13. Cardboard buttress to support glued sides.



Figure 14. Case in jig ready for final gluing.



Figure 15. Bastard-cut and mill-cut files, with taped ends to avoid scratching and gouging of the acrylic.



Figure 16. Novus #1 acrylic cleaner, and lighter fluid for removing grease- or oil-based smears.

Care of Acrylic Model Cases

Clean with a weak solution of mild detergent, Novus #1, Plexus, or similar acrylic cleaner/polish (Figure 16).

Naphtha (lighter fluid) or kerosene may be used to remove grease or oil based smears (Figure 16).

Use only cotton cloths to clean. **Do not** use paper towels – they often contain silica crystals that can scratch plastics.

Do not use abrasive cleaners, ammonia (Windex, 409), alcohol, acetone, gasoline.

Do not place models in cases in direct sunlight. High temperatures can develop in the case and damage the model.

Minor scratches and glue drop defects can be minimized using Novus products #2 and #3, and/or the polishing kits referenced in the list of supplies. Grit 12,000 must be the final one used.

Supplies

Acrylic sheets (0.093 – 0.125) – Lowes, Home Depot, glass/plastic fabrication shops.

Lucite - www.lucite.com

Plaskolite - Optix acrylic sheet - www.plaskolite.com

Plexiglas - www.plexiglas.com

- and many other brands...

Acrylic solvent cement

Glass/plastic fabrication shops.

Weld-on #3 or #4. (www.ipscorp.com)

Craftics – Plastick acrylic solvent cement. (www.craftics.com)

Hobby shops.

Ambroid ‘Proweld’.

Plastruct ‘Bondene’.

Applicators

Micromark - accordion dispenser with 25 gauge needle with dull point.

www.micromark.com.

www.craftics.com – good applicator bottle as well as cement.

www.flex-i-file.com – good plastic bottle with needle.

Hypodermic syringes - 2 ½ cc with 25 gauge needle - at any drugstore.

Repair products –

Novus #1 – Plastic Clean and Shine.

Novus #2 – Fine Scratch Remover.

Novus #3 – Heavy Scratch Remover.

Information and instructions for use at: (<http://www.novuspolish.com/>)
Purchase at glass /plastic fabrication shops, and marine supply stores, e.g. West Marine.

Micro-Mesh Abrasives – grits available from 600 to 12,000.
www.micro-surface.com, www.sisweb.com, www.detailmaster.com,
www.micromark.com.

The above suppliers have a variety of polishing kits available – they all contain the Micro-Mesh Abrasives products.

Bibliography

Harold (Dynamite) Payson, *Boat Modeling the Easy Way*, South Thomaston, ME: H. H. Payson & Co., 1995. (An excellent book overall. The appendix gives the details needed for acrylic case building, several warnings, and a number of helpful hints.)

Lankford, Ben. *Building a Ship Model Glass Case*. *Ships in Scale*, Vol. V, No. 1 (Jan-Feb 1994): 30-31. (Good discussion of frame and glass construction.)

Feldman, Clayton A. *Building Clear Acrylic Cases for Ship Models*. *Ships in Scale*, Vol. VI, No. 5 (Sept-Oct 1995): 58-60. (He tapes the panels together for gluing. He does not explain how to prevent the glue from getting under the tape. Otherwise a helpful article.)

Feldman, Clayton A. *Building Furniture-Type Cases for Ship Models, Part 2*. *Ships in Scale*, Vol. VI, No. 6 (Nov Dec 1995): 29-33. (Excellent instructions for “post and beam” wood frame case.)

Bullitt, George R. *Small Display Case*. *Ships in Scale*, Vol. VII, No. 2 (Mar-Apr 1996): 61-64. (Several techniques for gluing acrylic – brush, tray – and adding thin brass frame.)

Niemann, Al. *Building Your Own Glass Case Inexpensively*. *Ships in Scale*, Vol. VIII, No. 4 (Jul-Aug 1997): 63-65. (Good discussion on cutting glass for a framed case.)

Ship Modelers Association - www.shipmodelersassociation.org/tps0006.htm.
Plexiglass Case. (Demonstrates a technique a bit different than the one I use.)

Wegner, Dana; *Lead Corrosion in Ship Models*.
http://www.dt.navy.mil/cnsm/lead_01.html. (The authoritative essay on the topic of lead corrosion.)

Chemistry

Acrylic sheets - polymethylmethacrylate -PMMA.

Glues

Weld-on #3 solvent glue. Contains Methylene Chloride (75-09-2), Dimethyl Glutarate (1119-40-0) and Methyl Methacrylate Monomer (80-62-6). www.ipscorp.com

Weld-on #4 solvent glue. Contains Methylene Chloride (75-09-2), Methyl Acetate (79-20-9), Methyl Methacrylate Monomer (80-62-6) www.ipscorp.com

Craftics – (Plastick (sic) Acrylic Solvent Cement). Contains Methylene Chloride and Diacetone Ether.

Plastruct - (Bondene – white label) and Ambroid - (Proweld) are products that may work – the labels say they are for acrylics. They are said to contain Methylene Chloride.

Polishes

Novus 1- Isopropyl Alcohol.

Novus 2 - Odorless Mineral Spirits, Silica, Amorphous, Diatomaceous Earth, Crystalline Silicas, Morpholine, Oleic Acid, Water.

Novus 3 - Dipropylene Glycol Monomethyl Ether, Alumina (dust), Water.

Plexus Polish – Aliphatic petroleum distillates, i.e. Naphtha.