

# PLEXIGLAS® SHEET: Cementing and Troubleshooting

ACRYLIC SHEET

## Option 1: SOLVENT CEMENTING RECOMMENDATIONS

### **Use methylene dichloride (MDC) as the basic cement.**

Add up to 10% diacetone alcohol to reduce blushing caused by the evaporation of solvent in humid conditions.

Use the following solvent cement mixture for optimum joint appearance: 70% MDC, 20% MMA (methyl methacrylate inhibited monomer) and 10% GAA (glacial acetic acid). Store solvent cements in vapor-proof/corrosion-proof containers, such as glass or plastic-coated metal. Use only enough solvent to wet the joints, since excessive solvent will increase set times and possibly result in whitening or crazing. Do not flow or drip solvent on any flame polished, strip heated or dry-belt sanded surfaces. When soak cementing, limit soak time to approximately 45 seconds. The optimum edge finish is one which has been cut by a skim router (approximately .030" removal). Do not force fit parts to be cemented.

### **Cementing Technique: Capillary Action Method**

The parts must be closely fitted with no visible gaps. The parts to be cemented should be unclamped or lightly clamped together. The cement is dispensed (from a hypodermic needle or eye dropper) along the joint. Capillary action draws the cement between the parts. Time for the joint to set varies from 2-5 minutes depending on the solvent used and temperature and humidity. Do not flow or drip solvent cement on a flame-polished, strip-heated or dry-belt sanded surface as these conditions show the maximum fabrication stress possible in plastic sheet.

### **Cementing Technique: Soak Dip Method**

The parts must be closely fitted with no visible gaps. One of the parts is placed in a container holding the solvent cement until the edge softens into a cushion. When the parts are assembled, the cushion from the first forms a cushion on the second part by solvent action. Masking may be required near the edges to be cemented, to prevent excessive softening. The parts should be allowed to set for 24 hours before handling.

**Caution:** Whitening in the joint and an increased chance of crazing may occur with the dip-soak method.

## **TROUBLESHOOTING TECHNIQUES FOR SOLVENT CEMENTING**

### **Voids problem**

Provide better fitting joint (shim to .002" gap). Do not use excessive pressure on joint.

### **Bubble problem**

Add up to 25% glacial acetic acid to solvent for better wet out.

### **Long set time problem**

Use less cement. Add methylene chloride to cement mixture.

### **Cloudy joint problem**

Reduce evaporation rate by adding up to 10% diacetone alcohol.

### **Crazing problem**

Keep solvent and solvent vapors away from flame polished surfaces, dry-belt sanded edges and strip heated bends. Don't force fit parts to be cemented. Anneal properly supported parts by oven heating overnight at 175 degrees F. Soak areas to be cemented in water overnight. Remove, dry and cement immediately.

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### Option 2: POLYMERIZABLE CEMENTING RECOMMENDATIONS

Polymerizable cements are those in which a catalyst (component B) is added to an already thick monomer polymer syrup (component A) to promote rapid hardening. Cement PS-30 and Weld-On 40 are polymerizable cements of this type. They are suitable for cementing all types of Plexiglas sheet. At room temperature, the cements harden (polymerize) in the container in about 45 minutes after mixing the components. They will harden more rapidly at higher temperatures. The cement joints are usually strong enough for handling one to two hours after assembly depending upon part configuration. The joints may be machined four hours after assembly, but it is better to wait 24 hours.

PS-30 and Weld-On 40 joints retain excellent appearance and color stability after outdoor exposure. These cements produce clear, transparent joints and should be used when the clarity and appearance of the joints are important. PS-30 and Weld-On 40 should be used at temperatures no lower than 65°F. If cementing is done in a room cooler than 65°F, it will require a longer time to harden and the joint strength will be reduced. The cement should be prepared with the correct proportions of components (preferably fresh) as given in the supplier's instructions and thoroughly mixed, making sure neither the mixing container nor mixing paddle adds color or affects the hardening of the cement. Clean glass or polyethylene mixing containers are preferred. Table 1, below, summarizes these procedures.

TABLE 1: Procedures for Using Polymerizable Cements

To get good performance from polymerizable cement the following directions must be closely:

1. If at all possible, store Component B, the catalyst, under refrigeration not below 40°F. If this is impossible, be certain that Component B is stored in a dark place and that it is definitely kept out of direct sunlight. If Component B turns yellow or amber, discard it and obtain a fresh lot from the supplier.
2. When mixing Components A and B, be sure to use clean containers. Make sure that any disposable containers are not lined with a coating that will affect either component. If the container coating is soluble in either of the cement components it may contaminate the cement and cause improper curing.
3. Both Component A and Component B should be at room temperature at the time of mixing. It may be convenient to remove a one-day supply from refrigeration the day before mixing.
4. When Components A and B are combined, be certain that the two components are continuously under agitation for two minutes to insure their complete mixing. Let the air bubbles rise to the surface before using the cement.
5. Combine Components A and B in the ratio of 95 parts Component A to 5 parts Component B, either by weight or by volume. Do not use a mixture containing less than 93 parts Component A or more than 7 parts Component B.

PS-30 may be thinned by adding up to 25 percent MMA inhibited monomer to Component A to minimize bubbles when laminating. Up to twice the normally recommended amount of Component B may be used to increase the polymerizing rates. Adding about 10 percent (by weight) Plexiglas VS-100 molding resin will reduce shrinkage of the cement during polymerization, but also decreases joint strength slightly. The pellets must be thoroughly dissolved before mixing the components. Because of their short pot life (approximately 45 minutes), Cement PS-30 and Weld-On 40 must be used quickly once the components are mixed. Time consumed in preparation shortens the effective working time, making it necessary to have everything ready to be cemented before the cements are mixed. For better handling, pour cement within 20 minutes of

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mixing. For maximum joint strength, the final cement joint should be free of bubbles. It will usually be sufficient to allow the mixed cement to stand for 10 minutes before cementing to allow bubbles to rise to the surface.

To remove the bubbles quickly, spin the cement with an electric drill. This is done by drilling a hole in the center of a metal jar cap and placing a bolt through it, then placing a nut on the outside. This bolt is gripped by tile chuck of an electric drill. Screw jar into cap and spin cement for one minute. This is for up to 6-ounce jars only. For large sizes, a centrifuge that contains the jar should be used.

The gap joint technique should only be used with colorless Plexiglas sheet, or in cases in which joints will be hidden, or when light leaks are not a problem. Inconspicuous joints in colored sheet are difficult, if not impossible, to achieve. Adding acrylic sign paints to Component A can be effective at times, but may adversely affect the joint strength.

Cement forms or dams may be made with masking tape as long as the adhesive surface does not contact the cement. This is most easily done with a strip of tape placed over the masking tape adhesive. The tape must be chosen carefully. The adhesive on ordinary cellophane tape prevents the cure of PS-30 and Weld-On 40. Before actual fabrication of parts, sample joints should be tried to ensure that the tape system used will not harm the cement. Since it is important for all the cement to remain in the gap, only contact pressure should be used. Figures 1A, 1B, and 1C shows variations of the Open V-Joint technique. Figure 2 combines 4 open "V" angle technique joints to construction a box.

Bubbles will tend to float to the top of the cement bead in a gap joint after the cement is poured. These cause no problem if the bead is machined off. A small wire (not copper), or similar objects may be used to lift some bubbles out of the joint; however, the cement joint should be disturbed as little as possible.

Since polymerizable cements shrink as the cement hardens, the freshly poured cement bead should be left above the surfaces being cemented to compensate for the shrinkage. If it is necessary for appearances, the bead may be machined off after the cement has set, as shown in Figures 3A and 4B) and 5.

Figures 6 and 7 illustrate two cementing techniques that have proven useful with the furnishings industry. The first shows a thick section butt joint using polymerizable cement, with the thick Plexiglas sheet preset into a fixture. The latter Figure shows a system for making inside joints that cannot be routed and finished as described previously.

### POLYMERIZABLE CEMENTS SUPPLIERS

Caseway Industrial Products

Bay City, MI

989-391-9992

[www.casewayindustrialproducts.com](http://www.casewayindustrialproducts.com)

Industrial Polychemical Sciences(IPS)

Gardena, CA

800-421-2677

[www.ipscorp.com](http://www.ipscorp.com)

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If at all possible, store component B, the catalyst, under refrigeration but not below 40°F. If this is impossible, ensure that component B is not stored in direct sunlight and preferably in a dark place. If component B turns yellow or amber, discard it using proper chemical disposal techniques and obtain a fresh lot from the supplier. When mixing component A & B, be sure to use CLEAN containers. Ensure that disposable containers are not lined with a coating that will affect components A or B by cause improper curing. When mixing, both components should be at room temperature. It may be convenient to remove a one-day supply from refrigeration on the previous day. When components A & B are combined, ensure that they are continuously under agitation for two minutes to ensure complete mixing. Let air bubbles rise to the surface before using the cement. Combine components A & B in a ratio of 95 parts component A to 5 parts component B, either by weight or by volume. Do not use a mixture of less than 93 parts component A or more than 7 parts component B.

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