TRANSFORMER MANUAL

Bérkel Acrylic Mirror

Fone: (11) 4361-1080 - Home Page **www.berkel.com.br** - Email: comercial@berkel.com.br

TRANSFORMER MANUAL

BÉRKEL ACRYLIC MIRROR

Light and resistant, Bérkel Acrylic Mirrors were developed to a wide rande of application substituting glass mirrors, especially when the risk of breakage is reasonable and safety is a concern is a matter of great importance.

They find use as a reflective surface in furniture and decoration, displays and elements of the points of purchase, design and decoration of showcases and malls, providing creative design possibilities, free from the physical and esthetical limitation of common glass mirrors.

This manual contains information and procedures to help transforming the mirror acrylic sheets in useful and perfect products.

Table of contents

1 – What you can do and not

1.1- As acrylic sheets are relatively a soft and flexible material, come imperfection and image distortions can occur. Acrylic mirror should not be used when an absolute perfect image is mandatory. Thickness should be selected in accordance to the final application of the product.

1.2- Acrylic mirrors cannot be molded, but can be curved cold.

1.3- Some types of glues and adhesives can attack the mirrored surface. Run tests on the gluing material on a sample piece of the mirror for at least 72 hours before using the gluing material.

1.4- Do not use acrylic mirrors on glazing or in external weather application.

1.5- Acrylic absorbs water. High levels of humidity can cause temporary warping of the material. This is a characteristic of the product and to be taken into account on any product design or final application.

1.6- Gluing the edges with solvents can cause crazing.

1.7- Acrylic mirrors are a combustible thermoplastic. Adequate prevention measures may be necessary to protect the material from flame, heat or ignition sources.

1.8- Cut acrylic mirrors with panel saw, router or laser machines. DO not use stylet. Do not stamp acrylic mirrors.

1.9- Store the product on a dry and fresh place. It will warp if exposed to temperature variations. Changes on the relative humidity of the air causes the most important variations. Store the product horizontally over a flat surface and wrapped into a plastic to minimize water absorption.

1.10- If possible, keep the protective film layer until the final product is completely ready to use. Take good care of both sides of the mirror during the handling and transforming of the material. 1.11- Do not use where humidity variation can cause expansion and contraction of the sheet, such as in windows, shower boxes, and similar.

Every information of this publication are reliable and issued on good faith. They were though not intended to be a guarantee and therefore we take no legal responsibilities. The users of acrylic mirrors should run enough experiments as to establish that the material is appropriate of their real particular cases.

2 – Advantages of Bérkel Acrylic Mirrors

Reflectivity: 80% - 90% of visible light spectra from 400 – 700 µm.

Weight: Less than half of one glass mirror for the same thickness and size.

Breakage resistance: Can be up to 10 times more resistant to breakage and 17 times more resistant to impact than a glass mirror.

Heat resistance: Able to withstand a regular temperature of 70^{o}C, with peaks up to 88^{o}C.

Easy to Transform: By cutting, drilling, curving, bending, etc. with conventional equipment such as saws, routers or laser cutting machines it is possible to obtain the most different shapes and sizes. With the product, users can reach the most complex and accurate design.

Cost - benefit: Low cost of transformation and installation.

Quality: Highly reflective surface recommends using in displays and points of purchase, furniture and decoration, and other mirror applications such as automotive and nautical industries.

3- Handling, maintenance, and cleaning

Handling

Bérkel supplies acrylic mirrors sheets with a protective polyethylene film on its surface. Do never slide one sheet over the other during transportation and handling. Keep the protective film during storage and transforming to prevent damage to the sheet surface.

Bérkel supplies ready to use acrylic mirrors, and no previous preparation is needed before using it. Material should be stored in fresh place (not hot) far from organic vapors, paints and other chemical products.

Keep the material inside its packing in a fresh, clean and dry place.

If it is not possible to observe the proper storage situation described above, please take into account the following recommendations:

Vertical storage: To prevent warping the sheets, support them properly the sheets at a maximum angle of 10^{o} from vertical.

Horizontal storage: Keep the sheet on a flat surface, thus preventing warping. Avoid sliding one sheet over the other at any time cause this will result in surface scratches. Pile the sheets from the bigger ones to smaller ones in order to avoid hanging pieces. Beyond inducing warping this will facilitate sliding the sheets when handling.

Dirt and strange material between the sheets can cause scratches to the surface especially if one sheet slides over the other. Do not allow any outside material come between the sheets.

Maintenance

Portective film: Bérkel protects very well each acrylic mirror with a varnish on the mirrored surface, and polyethylene film on its frontal surface. Preserving the polyethylene film intact during all the transformation process, also during installation, is highly recommended.

Removing the protective film: If there are difficulties removing the polyethylene film, use an aliphatic solvent, kerosene or distillated ethyl alcohol to soften the film. Clean well the acrylic mirror surface after this process. Do not use any other chemicals or sharp objects to remove the film.

Cleaning

Washing: Use neutral soap, water and a soft cloth to clean the surface, apply a gentle pressure of it. To remove greases, oil or hard dirt, use solvents like hexane or kerosene.

Do not use chemical products over painted or silk-screened surface. Do not use products usually used to clean kitchens and windows, on the acrylic mirrors.

Polishing: Use a plastic polisher and a soft close to obtain a high glow surface. Follow the polisher manufacturer's instructions.

Removing surface scratches: Removing light scratches is possible by using proper acrylic scratching removing chemicals. Clean very well the material before attempting to remove the scratches. After using the removing chemical, clean again using a soft, dry and clean flannel.

4 - Cutting

Panel saw: With this type of saw, a straight and accurate cut is obtained. As vibration is very low, this process is highly recommend. Use one 10-inch disc and a carbide type eighty teeth blade to cut acrylic mirrors. For better results, the teeth should have an angle of 10 to 15º.

Cut the material adjusting the sheet as to have the polyethylene film on the lower side.

Laser cutting: Cutting with a laser machine makes possible to obtain any needed drawing, with very little loss of material. The CO_2 laser de CO2 focus a great quantity of energy in one small and well-defined area, melting and evaporating the material. This method produces clean and polished edges, without any solid residues. A cutting speed of 500 cm/ min can be obtained by using a laser machine pode ser utilizada pelo uso de um laser with power varying from 200 to 1200 watts. After the laser cutting process, it is important to anneal the sheets, especially when gluing will come as a next processing stage.

Attention: Laser cutting will generate residual tensions along the cut area. We suggest the usage of a proof corps to test and confirm the laser cutting results, before actually making it.

5 - Routing

There are many routing machines adequate for working with acrylic mirrors. The routers should have at least 1 HP power and a velocity of 20,000 rpm. A router circle is the proper to obtain round mirrors. Pin routers are very flexible on cutting pieces with complex shapes.

For large-scale production of mirrored sheets the indication are CNC type routers. Precautions are necessary when running a routing cutting machine to avoid cutting mistakes:

First, routers should be appropriate for working at high speeds. Avoid vibration. Even the smallest vibration can cause crazing and fractures on the pieces during the cutting process.

Second, observe the velocity (rpm) applied: High rpm allow faster moving of the sheets during the cutting, resulting on a better finishing to the cut. Velocity should be between 18,000 and 28,000 rpm;

Third, for best productivity use a feeding velocity right below the chips forming velocity. Do not overload the motor.

Fourth, keep the tool always very sharp to avoid chips and loss of productivity. Finally, use a cutting diameter of half an inch or bigger, whenever possible. The bigger the cutting diameter the best will be the surface finishing and the smaller will be the tendency to form chips.

6 - Drilling

Acrylic mirrors can be drilled by a using a simple hand drill. It is advisable to use a drill tool adequate for plastics. Place the mirrored sheet over a solid material, such as wood, for drilling in such a way the drill will cross the sheet and keep penetrating the material below. This prevents chips

and shavings in the side opposite of the one the drill comes into the material. It is necessary to lower the speed as the drill enters or leaves the mirror acrylic sheet.

To make drills of 2.5 cm or bigger, use a cup saw.

7- Surface and edge finishing

The quality of the finishing depends on the quality of the tools, equipment and processes applied to the material. Using adequate sharp tools, with proper equipment reduces the necessity of additional working the finishing of surfaces and edges.

Polishing: A polished edge is the one usually requested on the acrylic mirrors. Sand first the edge. After sanding, use a stationary polishing machine. The diameter of the tool of such polishing machine should be from 20 to 25 centimeters with inclined tapes.

To polish and remove superficial scratches, use a polishing compound of fine to medium abrasivity, depending on the depth of the scratches. Assure that the acrylic mirror will keep moving during the entire polishing process.

8 – Chemical Resistance

As any other plastic material, some chemicals will attack mirror acrylic sheets. Below there is a partial list of materials that attacks the mirrored sheets. Avoid exposing the sheets to such materials. Residual tension, load caused tension and strong or fast temperature variations will negatively affect the chemical resistance of the acrylic mirrors.

Chemicals that attacks the mirrored acrylic sheets:

Benzene	Thinner	Esters	Carbon Tetrachloride
Toluene	Ethyl Alcohol	Acetone	Methanol
Xylene	Ether		

9 – Resistance to external weather

Bérkel acrylic mirrors are not appropriate for external uses of acrylic. If they ever have to be used externally, use a silicon based sealant to prevent moisture and protect the mirrored side. Salty fog will also attack the acrylic mirrors and degrade them.

10- Gluing

Mirrored acrylic sheets are a reflective film applied on an acrylic substrate. When one material is applied to other, both will conform to each other. Any irregular surface will may cause distortion to the mirrored surface, thus inducing reflected image distortion.

For better results, mount the acrylic mirror on a flat, smooth, rigid and inflexible surface. As an example a wood sheet of 2.0 cm thickness.

Treat the surface of the substrate with a high quality sealant or paint to cover the imperfections and avoid moisture. Treat the whole surface with a proper mastic or any adequate adhesive sensible to pressure.

Other option is to make some fixation wholes on the acrylic mirror and fix it directly to the substrate with screws, avoiding using too much pressure on the screws to prevent undulation and distortion to the material.

Visual distortion is a function of the image distance and thickness of the material. A thicker piece will be less flexible and protect the optical

integrity. The correct installation and the selection of right thickness for the acrylic mirrors can reduce l distortion but not eliminate.

Roof application are not recommended, unless the acrylic mirror is mounted in contours or metallic supports suspended in the roof.

Some adhesives and glues may contain substances like toluene, acetone and hexane that attack the protective varnish of the mirrored side. It is advisable to test the use of glues and adhesives in smaller proof corps, for minimum 72 hours, to check whether such attack will occur.

11- Bending an acrylic mirror

Apply a thin strip of intense heat at approximately 3.0 mm form the sheet to better execute a line or strip bending. Resistance filaments of Ni/Cr (nickel/chrome) of 1.15 mm are the most used heating elements.

a. Place the acrylic face in front of the heating element. Do not attempt to heat the side with the varnish;

b. Adjust the power of the source in order to make the heating filament red;

c. Remove the polyethylene protective film;

d. Keep the acrylic in the range of 143 to 160^{o}C. The acrylic will be flexible at this range. Applying a gentle force should be enough for bending. A 3mm acrylic mirror will be ready to bend after 20 to 25 seconds of heating;

e. Time is a critical factor. Too little heating will cause warping along the bending and residual tension that can crack the piece. Excessive heat may cause a reddish color and bubbles on the piece.

f. After bending, cooling should be done as fast as possible, preferably by air recirculation.

Big care was taken in the compilation of the information herein contained. The recommendations about the use of the products are made without guarantee as the using conditions are not controlled by Bérkel. It is responsibility of the customer provide assurance that the product will be appropriate for each situation and that the conditions of its application be adequate.

Every information of this publication are reliable and issued on good faith. They were though not intended to be a guarantee and therefore we take no legal responsibilities. The users of polycarbonate sheets should run enough experiments as to establish that the material is appropriate of their real particular cases.

Fone: (11) 4361-1080 - Home Page **www.berkel.com.br** - Email: comercial@berkel.com.br