

MIRROR ACRYLIC SHEET FABRICATION GUIDE

Mirror Acrylic sheets which are produced with durable, lightweight thermoplastic have gained widespread use, particularly in applications where high stress risks are prevalent and safety is paramount, replacing mirrored glass.

Mirror Acrylic sheets can be used as reflective surfaces in decoration, visual displays and shop design, freeing creative designers from the aesthetic and physical limitations of normal glass. The procedures required to process acrylic (PMMA), polycarbonate (PC) and PET-G mirrored sheets into usable products are summarised under main headings.

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Preliminary Informations

1. Due to acrylic being a soft and easily mouldable material, deformation and defects may occur in some cases. It should not be used in areas where a precise image reflection is expected. The appropriate thickness must be carefully determined before cutting.
2. Mirror acrylic sheets should not be shaped using heat treatment. Sheets should be shaped cold.
3. Some adhesives affect the mirror surface and some solvent bonding may cause hairline cracks at the edges. To determine whether an adhesive is suitable, test it on disposable pieces for at least 72 hours.
4. Mirrored products are not recommended for any outdoor application.
5. Acrylic is a moisture-absorbing material. High moisture levels cause the material to warp and bend. Such warping and bending are caused by acrylic's sensitivity to moisture. This information should be taken into account in product design or use.
6. Mirror acrylic sheet is a flammable thermoplastic. Therefore, it should be kept away from high temperatures and flames.
7. Mirror acrylic sheets cannot be cut using mould cutting, but they can be cut using milling, sawing, and laser cutting.
8. Mirror Acrylic sheets should be stored in a cool, dry place. Acrylic sheets exposed to fluctuating temperatures may warp or bend. Fluctuating humidity levels are the main cause of this material being affected. Sheets should be stored flat and in plastic packaging to minimise the absorption of water vapour.
9. The protective film must not be removed until processing of the relevant material is complete. Both surfaces of the 'mirror acrylic' sheets must be well protected during processing and packaging to prevent damage.

We believe this information-based recommendations and datas to be reliable. As conditions and applications are beyond our control, no guarantee is provided. We offer recommendations to potential users to determine the suitability of our material and adapt it to commercial scale.

About Our Products

1. Mirror Acrylic Sheet

These are the most popular, lightweight and flexible products that can be used as mirrors. They come in a wide range of thicknesses, colours and sizes. They can be cut with a milling machine, laser or saw.

2. Mirror PET-G Sheet

Impact resistance is higher than acrylic. It can be easily cold-formed, cut with a milling machine or drilled. These processes are suitable for high-volume production. Thinner thicknesses than acrylic are available.

3. Mirror PC Solid Sheet

It is recommended for applications requiring high impact resistance, heat and flame resistance. It is comparable to acrylic in terms of optical properties but is 30 times more durable than acrylic.

4. See-Thru (Two Way) Mirror Sheet

Semi-transparent reflective coating for imaging and surveillance. Available in transparent and coloured versions on acrylic and polycarbonate sheets.

5. Paint Protection

Our mirror sheet products feature grey paint on the rear surface. This rear coating is the most durable, robust, and scratch-resistant coating available in the mirror industry.

6. Adhesive Tape Protection

Our mirror sheet products can be manufactured with adhesive tape applied to the back side. Thanks to the adhesive tape on the back surface, it can be quickly and easily applied onto the suitable surface.

7. Protection Paper Masking

A protective paper masking provides additional protection to facilitate easier packaging, processing and handling of Mirror Acrylic sheets.

Advantages Of Mirror Acrylic Sheets

Reflectivity: Mirror Acrylic Sheets provide approximately 85-90% reflection in the wavelength range of 400-700 nanometres in the electromagnetic spectrum, referred to as 'visible light'.

Lightness: Mirror Acrylic Sheets are half the weight of glass of the same size and thickness.

Breakage Resistance: Mirror Acrylic Sheets are 10 times stronger than glass of the same thickness in terms of breakage resistance and 17 times stronger in terms of impact resistance.

Heat: Mirror Acrylic Sheets can tolerate continuous heat treatment up to 70°C. It can also withstand temperatures above 87°C for short periods.

Easy Processability: Many shapes and sizes can be obtained by cutting with conventional saws and routers using appropriate blades and cutters. Mirror Acrylic Sheets can be cold bent to obtain rounded shapes or heated along the strip to achieve sharp bends. More precise and complex designs can be achieved with a laser cutting system.

Wide Product Range: Mirror sheets can be produced in thicknesses ranging from 0.8mm to 6mm. Special colours such as Silver, Gold, Bronze, Blue, and Red are available.

Economic: Low processing and assembly costs.

Quality: Provides the ability to achieve an extremely high-reflective surface for use in display, decoration, and other mirror applications.

Packaging and Storage

All mirror acrylic sheets have protective film applied to their upper surfaces. Do not slide the mirror acrylic sheets during transport. The protective film should remain on the sheet surface to protect it from potential damage during storage and production. Mirror acrylic sheets are shipped ready for storage.

Keep away from excessive heat, paint spray, solvents and other chemical vapours. Mirror acrylic sheets should be stored in their undamaged original packaging in a clean, dry and cool area. However, this may not always be practical. For customer's use, it may be necessary to open all or part of the shipment packages. In such cases, the following instructions must be followed;

- a. **Vertical Storage:** If mirror sheets are to be stored upright, they must be stored carefully to prevent bending problems. The sheets should be positioned so that the angle with the vertical does not exceed 100 degrees. Plywood-backed frames should be used to provide the material with all necessary support.
- b. **Horizontal Storage:** When storing acrylic mirror sheets horizontally, care must be taken to prevent bending, slipping and scratching. If sheets of different sizes are stored together, ensure that the widest pieces are at the bottom and the smallest pieces are at the top. This arrangement will prevent the formation of protrusions that could cause bending and slippage during movement. This reduces

the risk of any material between the sheets scratching the sheet. The pallets are packaged with multi-layered outer packaging that protects the sheet from dirt and moisture. The outer packaging must not be damaged or opened during storage.

Maintenance and Cleaning

- a. **Masking:** Each mirror acrylic sheet is protected by a removable protective film on the front surface and paint or tape on the back surface. This masking is applied to protect the sheet throughout all production and installation stages. 'Acrylic mirror' sheets should be transported with the mirrored surface facing downwards and without removing the protective film. Aware that the sheets do not slide over each other.
- b. **Removing of Masking:** If you encounter difficulties removing the masking, use aliphatic naphtha, kerosene or distilled alcohol to moisten the adhesive. Do not use other chemicals or sharp objects to remove the masking.
- c. **Cleaning:** The surface of the sheet can be wiped with a damp, soft cloth using mild soap, taking care not to press too hard and avoiding the edges. Use hexane or kerosene to remove grease, oil or tar residues from the material. Do not use any chemicals on printed designs. When cleaning mirror acrylic sheets surface, do not use glass cleaning sprays, kitchen cleaning compounds or other chemicals.
- d. **Polishing and Buffing:** Surface shine can be achieved by using a good plastic cleaner or polish such as Pledge or Johnson's Pledge. Follow the instructions on the cleaner's container for polishing.
- e. **Removing Scratches:** Fine scratches can be removed by hand polishing using a plastic scratch remover or compound cleaner. Remove all residue and polish with a flannel cloth. Deep scratches may need to be lightly sanded using 400 grit (coarse-grained sandpaper) 'wet or dry' sandpaper, then polished.

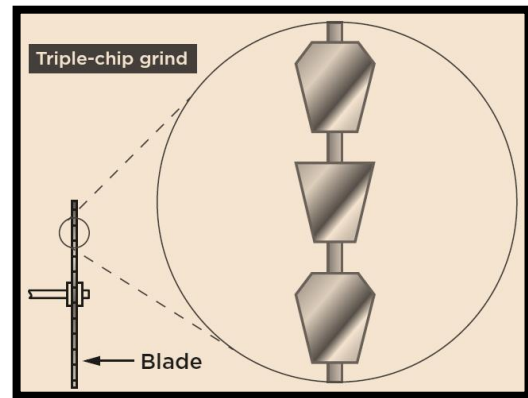
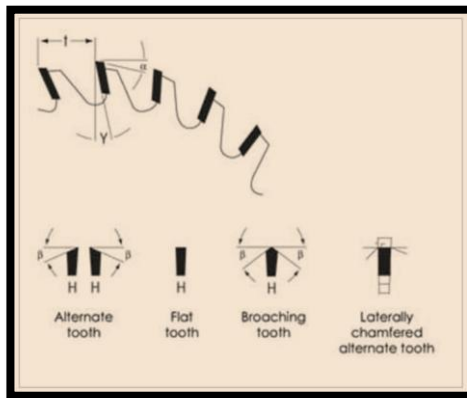
Cutting

a. **Marking and Breaking with a Scribing Tool:**

This method is used for cutting single sheets of mirror acrylic with a thickness of less than 3 mm in a fast and straight line. The line to be drawn on the 'mirror acrylic' sheet is marked using a scribe (e.g., a craft knife). Place a straight edge firmly along the line and use it as a guide for the cutter or knife. Cut the mirror along the straight line with firm, even pressure strokes. Then, lift the mirror off the workbench upside down from the end. Break the mirror with a sharp downward pressure.



b. Cutting with Circular Saws and Table Saws: These saws are used when it is required to cut one or more ‘mirror acrylic’ sheets into a precise and perfectly straight strip. This is the most common method. This cutting method is preferred because vibration is very low during application. The best way to prevent unwanted wear and vibration is to mount a reinforcement piece with a diameter of $1/2 - 2/3$ of the saw blade tip outward from the blade tip. For multi-purpose cutting, saws with 80 or 100 teeth, carbide-tipped triple-chip design should be used. For best results, saws with 100-150 tooth angles should be used.



Type of sawing	Band saw	Circular saw
Tooth distance	sheet thickness below 3 mm, 1 to 2 mm	8 to 12 mm
	sheet thickness 3 to 20 mm, 2 to 3 mm	8 to 12 mm
Clearance angle α	30 to 40 °	15 °
Rake angle ψ	15 °	10 °
Tooth angle β	-	15 °
Cutting speed	1200 - 1700 m/ min	2500 - 4000 m/min
Feed speed	-	20 m/min

The mirror acrylic sheet should be cut with the protective film side facing down. To protect the painted back surface during cutting, place paper between the sheets. Use a saw with sufficient power and at an appropriate feed rate to achieve the required cuts. Variable feed speeds may cause adhesion and chipping on the mirror acrylic sheet.

c. Cutting with a Sabre Saw: Sword-type saws are generally used for cuts that require constant directional changes. It is important to provide sufficient support to prevent vibration that could cause chipping. To achieve this, clamp a straight board or batten to the side of the cutting line on the sheet. This can also be used as a cutting guide. Before cutting acrylic mirror sheets, set the saw to its highest speed. The blade of the sabre saw should have at least 14 teeth per inch.



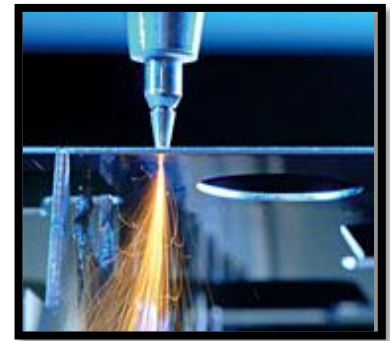
- d. **Cutting with a Jigsaw:** This type of cutting application is most commonly used for internal cuts and mixed letter cuts. As the impact is very short-lived, the blade tip heats up very quickly, causing the mirror acrylic sheet to soften and melt. To prevent this, work at a fast and steady feed rate. The saw blade tip should have 14 teeth per inch.



- e. **Cutting with a Band Saw:** Band saws are used for cutting the edges of curved sections and shaped parts. The band saw blade should have 10 teeth per inch.



- f. **Laser Cutting:** Lasers can be used to cut almost any shape with minimal material waste on 'mirror acrylic' sheets. CO₂ lasers work by focusing a high amount of energy onto a specific small area, melting and vaporising the material. After cutting, it provides a clean, burr-free and polished edge sheet. Using a laser of approximately 200-1200 watts, cutting is successfully completed at an average speed of 5 metres per minute. It is strongly recommended that sheets intended for subsequent gluing be annealed after cutting.



Warning: High stress may occur along the cut line during laser cutting. Therefore, it is advisable to test a piece of sheet metal before processing. During the entire sheet cutting process, the saw blade edges must be cooled with air.

Router

There are many routers suitable for processing. The router should have a minimum power of 1 horsepower and an idle speed of 20,000 rpm. Single or double fluted router bits are normally used in routers. However, some may use between one and four flutes. Cutters can be carbide-tipped, high-speed steel, solid carbide or diamond-tipped. Cutter heads can be guided, unguided, straight cut, multi-fluted, shaping or specialised.

When machining with a router, certain precautions must be taken to prevent errors occurring on acrylic mirror sheets. Firstly, the router diameter must be low and it must operate at high speed. Vibration must be prevented, as even slight vibration can cause hairline cracks. Secondly, rotational speeds must be monitored; high speeds allow for rapid feeding of the sheet. Recommended rotation speeds are between 18,000 and 28,000 rpm. Thirdly, for maximum production, the feed rate should be set just below the chipping rate. Do not overload the motor. Fourthly, the sharpness of the cutting edges is important to prevent chipping and not reduce production. Finally, use cutters with a diameter of ½ or larger. This will result in a better surface finish without chipping.

Warning: The cutting edges must be air-cooled throughout the entire sheet cutting process.

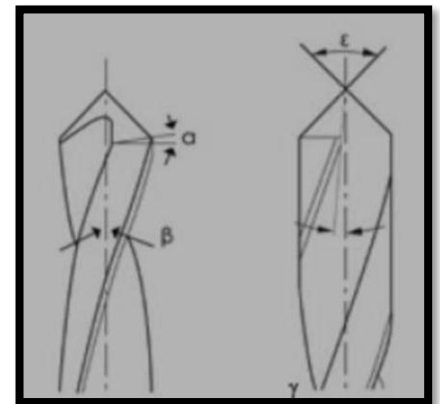
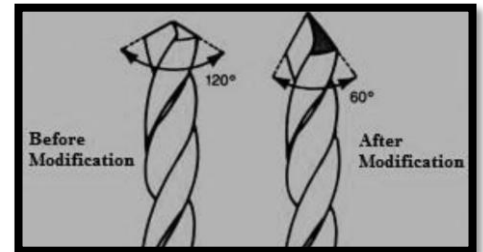
Drilling

Mirror Acrylic Sheets can be drilled using commercially available power driven equipment, such as portable drills, drill presses, lathes, or automatic multiple-spindle drilling units. For drilling operations you should choose the correct tool and equipment because the first step in working with acrylics is to obtain the proper tools.

Some standard or conventional high speed drill bits do not work well with acrylic. Metal working, high-speed twist drill bits can be used with minor bit modification. These drill bits are made to bite into metal when pushed. If used as is, metal working drill bits will chip acrylic sheet as well as cause other damage. Drill bits manufactured specifically for plastics work best when drilling acrylic sheet.

Drill Bits are generally made of HSS (High Speed Steel), HSS with carbide tips, solid carbide or cobalt. You can use these kinds of bits but you should make a modification. Follow the steps below to make the modification.

- Generally metal drilling bits have 120° tip angle. If you use these bits they will chip and cause other damage to the plastic. If you want to have a better drilling on acrylic and some other plastic sheets you should grind the tip angle from 120° to 60-90°
- Second step is about rake angle. You should grind the cutting edge to 0 - 4° rake angle. This aims to scrape acrylic sheet.
- Finally, you should grind away the surface behind the cutting edge to clearance angles of 12 - 15°.



Tip angle ϵ	60-90°
Clearance angle α	3 – 8°
Twist angle β	12 – 15°
Rake angle γ	0 – 4°

You can use the table below for drill speeds guideline on equipment that allows variation of the rotational speeds.

Drill Diameter		Speed (RPM)
1/8"	3 mm	3500
3/16"	4,5 mm	2500
1/4"	6,0 mm	1800
3/8"	9,5 mm	1200
1/2"	12,7 mm	900
5/8"	16,0 mm	700
1"	25,4 mm	450

Warning: The cutting edges must be air-cooled throughout the entire sheet cutting process.

Edge and Surface Finishing

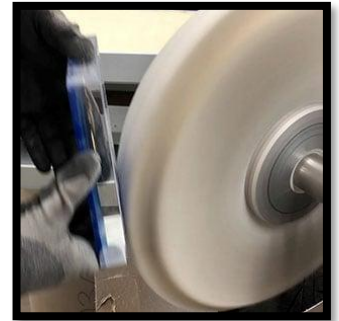
Achieving a smooth and transparent edge depends on the quality and method of the cutting equipment used for edge trimming.

Although a polished edge is the best edge, it requires a lot of preparation. If the edges are cut with a saw, pre-sanding is necessary. Well-milled corners may not require sanding. A fixed polishing head provides the best polished surface.

a. **Hand Polishing:** A polishing agent is applied using suede or short-pile brushes. These types of applications are also used for the maintenance of the material after cleaning.



b. **Machine Polishing:** Some edge milling machines can produce polished surfaces using diamond tools. However, in many cases, edges can also be polished using felt or flannel cloths wrapped around a rotating disc and a polishing agent.



Chemical Resistance

Like all plastic materials, mirror acrylic sheets react when exposed to many chemicals. Below is a list of some of the chemicals known to react with mirror acrylic sheets. Exposure of the material to these chemicals should be avoided. Factors such as stresses generated during production, exposure to load or temperature changes, or the application method may influence the potential reaction. In all these cases, care should be taken regarding the use of dry-phase chemicals or solvents near the mirror acrylic sheet.

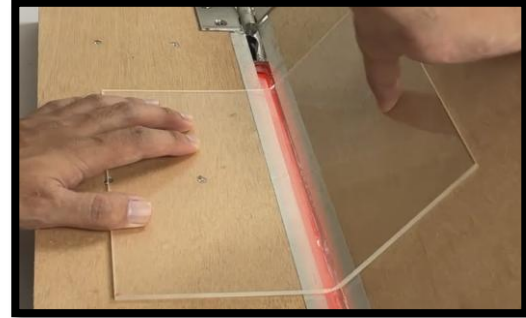
Benzene	Ethyl Alcohol
Varnish Thinners	Ketones
Esters	Methyl Alcohol
Carbon Tetrachloride	Esters
Toluene	

Weather Resistance

The use of mirror acrylic sheet products outdoors is not recommended. If they are to be used outdoors, they should be kept away from moisture and insulated with a neutral silicone material around the edges to prevent moisture from entering the protective paint layer. Salt spray can also cause degradation of the mirror.

Bending

Bending with strip hot wire is the most commonly used and most successful bending method. In this application, mirror acrylic sheets are placed approximately 3 mm away from the strip hot wire to perform the process. 1.15 mm nickel-chromium resistance wire is the most commonly used heating element.



- Place the mirrored side facing the heating element. Do not attempt to heat the painted side. This will prolong the heating time and cause the reflective finish of the mirrors to become dull and discoloured.
- Adjust your power source so that the resistance wire turns a bright red colour.
- Peel the protective film back 3-4 cm from both sides of the bending area. Failure to remove the masking, whether it is polyethylene or paper, will increase the heating time and prevent the bend from being achieved as desired.
- Acrylic can be bent between 143°C and 163°C. The bending process should be carried out at the lowest temperature and time required to achieve the bend. 3 mm thick mirror sheet should become bendable within 20-25 seconds.
- Timing is a critical parameter. Insufficient heating will cause excessive stress along the bending line, leading to warping and cracking. Excessive heating will cause burning.
- Cooling should be carried out as quickly as possible using air circulation.

Bonding

It is a reflective film applied to the surface of an acrylic sheet with a mirror effect. As plastic is a flexible material, when applied to rough and non-planar surfaces, it may cause bending or warping in certain areas (locally) of the mirror sheet. This cause a non-homogeneous reflection when viewed from the mirror surface. For best results, mirror sheets should be applied on smooth, hard, solid and flat surfaces.

Adhesive-taped mirror sheets may be preferred for surface mounting. It is important to choose adhesives that do not damage the painted surface or the mirror coating when mounting mirror sheets with a painted back surface. Some adhesives contain solvents such as toluene, ketone and hexane, which are harmful to the protective paint layer on the back. The use of adhesives containing 5% or more solvent is not recommended.

Neutral type silicones specifically designed for mirror products applications can be used for bonding of mirror acrylic sheet to surfaces. Also, double-sided tapes specifically designed for mirror products can be used.

Warning: As there are many adhesives and mastics on the market, it is recommended that they should be tested on a small sample before use. All tests should be applied to the sample for at least 72 hours before use to determine their suitability for the back paint layer, reflective layer and acrylic itself.

Flammability

Mirror acrylic sheets are flammable thermoplastic. Necessary precautions must be taken to protect the mirror sheets from flames and high temperatures.

IMPORTANT NOTES:

Careless hand carrying or processing of the product may cause injury. Before use, ensure that the necessary protective equipment is used and that the necessary precautions are taken.

The recommendations in this brochure are based on information we believe to be reliable. The most important issue is to use the correct materials and the correct production method.

However, as these products are under the control of the person or company applying them during application, we do not provide any guarantee regarding any accidental situation or effect that may occur during application, and we have no liability in this regard.