



GE Structured Products

***How to Form,
Fabricate,
and Finish
LEXAN[®] Sheet***

**Structured
Products**

Introduction

LEXAN sheet is recognized for its high durability and versatility as a fabrication material. Compared with other plastics, it offers superior impact and flame resistance plus excellent clarity, color stability and a variety of tints. These advantages

add up to display units with long lasting sales-promoting appeal.

The following information is provided to you for the proper forming, fabrication, and finishing techniques for LEXAN sheet, to ensure the most durable, highest quality displays.

Cutting and Sawing

LEXAN polycarbonate sheet can be cut with a variety of common hand-held and table mounted sawing equipment. Remember, take care to protect yourself from injury. Use appropriate eye and ear protection and exercise caution when operating cutting equipment.

Special attention to blade design and cutting speed is important to obtain good quality finishes.

Circular Saws

Blade should be designed to minimize blade body rubbing during sawing. Fine tooth hollow ground blades and triple chip carbides are excellent choices and will produce a good quality surface finish.

- Thin gauge sheet: 1/16"–3/32"
 - Hollow ground panel blades.
 - 10-12 teeth per inch.
- Heavy gauge sheet: 1/8"–1/2"
 - Triple chip cut carbide blades with alternating bevel and straight teeth.
 - 3 teeth per inch.

Band Saws

LEXAN sheet can be cut in all thicknesses satisfactorily with band saws.

- 10–18 teeth per inch.
- Blade speeds: 2500–3000 feet per minute.

Milling and Routing

High rotating speeds or low feed rates are advisable for end milling. Higher feed rates are permissible, but only with increased milling speeds.

The use of right or left handed spiral cutting bits with hand-held or table mounted routers will minimize material chatter and help hold the LEXAN sheet against the router surface.

Bit Recommendations

- Spiral router bits are preferred.
- Two- or three-fluted carbide tipped bits, 3/8"–1/2" diameter, can also be used.

Router Speeds

- No-load speeds: 25,000–30,000 rpm.

Shearing, Punching, and Blanking

Punching and shearing are effective methods for cutting LEXAN sheet into workable sizes. However, the sheared edge should be removed by a secondary routing operation to minimize high stress areas.

Compared to acrylic, which will shatter, LEXAN sheet will not crack or craze during shearing, punching or blanking when sharp tools are used.

Shearing

Smooth cuts can be obtained by shearing with the following guidelines:

- Shear blades: 45° angle or less
- Maintain 0.0005"–0.001" clearance between blade and shear bed.

Punching

Hollow ground punches can be successfully, but it may be necessary to make provision for hole shrinkage if hole diameter tolerance is critical.

Example:

Hole Diameter	Sheet Thickness	Typical Shrinkage
1/2"	1/8"	.007"
1/4"	1/8"	.004"

Blanking

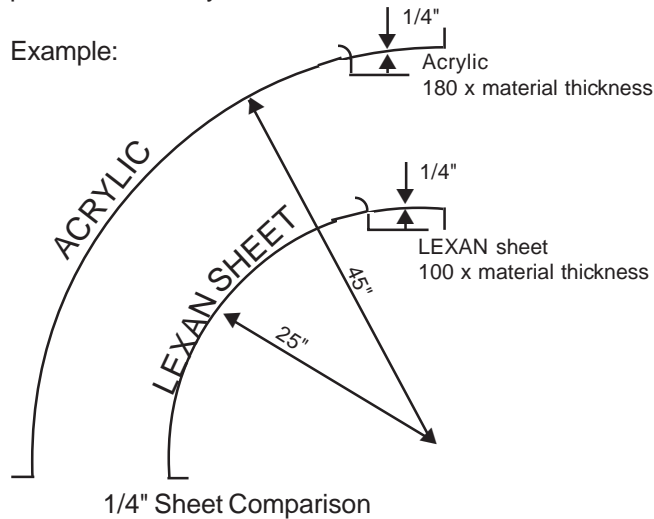
The ductility of LEXAN sheet allows for blanking with clean edges, unlike acrylic which is far more brittle.

- Conventional steel rules and clicker dies provide excellent results.
- Sharp tools yield best edges.

Cold Forming

LEXAN sheet can be cold bent to tighter curves than are possible with acrylic.

Example:



Cold forming of LEXAN sheet is acceptable for shapes having a radius of 100 times the material thickness or greater. Bends with radii less than 100 times the material thickness will require heat forming.

See table below for typical radii of curvature for various thicknesses of LEXAN sheet.

Recommended Radii

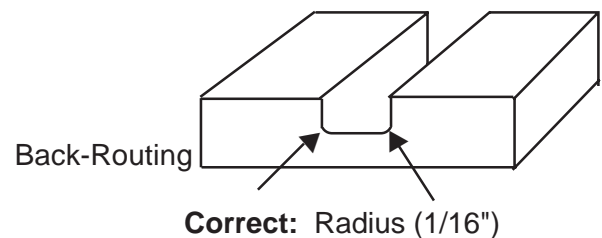
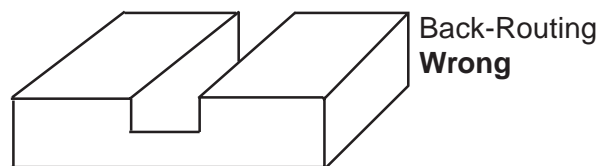
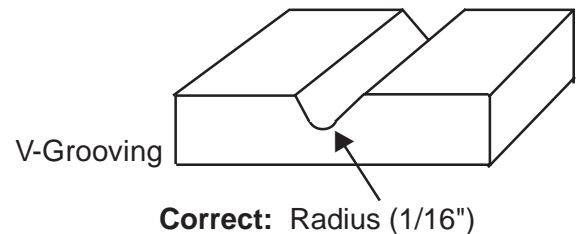
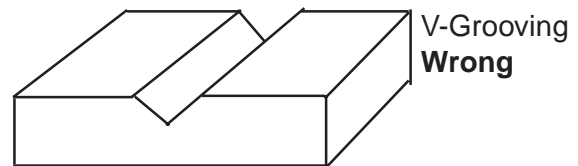
Sheet Thickness	Recommended Minimum Radius in Inches
1/8"	12.5
3/16"	18.5
1/4"	25.0
3/8"	37.5
1/2"	50.0

Strip Heating

Strip heating is an acceptable method for localized bending of LEXAN sheet for indoor displays. While heating the entire sheet is not required, heating both sides at the bend area is required for best results. Using nichrome wire or a straight calrod heater allows localized heating to form simple and complex angles.

Strip Heating Techniques

- Temperature for strip heating: approximately 315°F.
- Sheet thicknesses up to 1/8" may be strip heated without pre-drying the sheet.
- Top and bottom strip heaters or bending machines equipped with temperature controlled radiation heaters on both sides of the sheet are recommended.
- To eliminate the need for pre-drying when using sheet thicknesses over 1/8", back routing or V-grooving is commonly used. This removes material in the area of the bend where the heat is applied. This also allows sharper corners and minimizes warpage.
- Radius cutters for back routing and V-grooving are recommended to minimize localized high stress areas and assure optimum impact strength.



Edge Finishing and Polishing

Edge Preparation

Step 1

- Remove any cutting tool mark produced by a saw or router by manually scraping the edge of the part or sheet with a 90° standard paint scraper.
- Tool should be sharp and free of any burrs or indentations.

Step 2

- Sand the edges, typically starting with 220 grit "wet and dry" abrasive.
- Keep the pad wet to avoid buildup.
- An orbital or reciprocating sander can be used.
- Proceed to a finer grit abrasive (320 grit "wet or dry", as an example).
- Finish sanding with 600 grit abrasive.

Edge Polishing

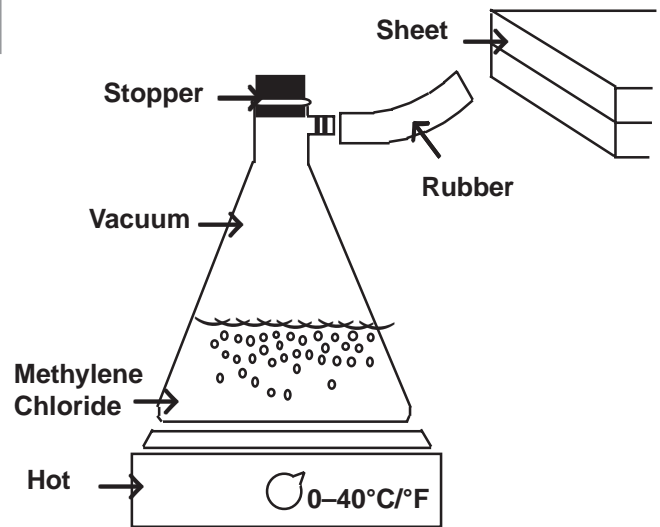
METHOD 1 – Preferred

Step 1

- Set up a small electric heater and a vacuum flask (or other modified vessel) as shown below.
- A 3-foot length of hose is most convenient. If the hose is too short, maneuverability is restricted; if too long, the vapors will condense before exiting.

Step 2

- Boil a suitable amount of methylene chloride.
- Keep the hose approximately 2 inches from the part's edge.
- Slowly and steadily direct the vapor along the edge.
- The surface will very quickly become glossy.



- It is always better to return to an area for touch-up than to apply too much vapor at one time.
- After air drying for about 1 minute, reapply vapor if necessary to achieve a uniform surface.

METHOD 2

- A cloth dampened with methylene chloride and wiped carefully along the edges can produce satisfactory results, although not as good as the above technique.

NOTE: Mask the part or sheet where possible before to restrict solvent contact to the edges. Any liquid that inadvertently contacts the surface should be removed immediately.

CAUTION! Methylene chloride is a suspect carcinogen. Avoid contact with eyes, skin and clothing. Avoid breathing vapor. Use only with adequate ventilation.

Painting and Silkscreening/Drilling

Painting and Silkscreening

LEXAN sheet can be painted by silk screening or standard spray techniques. No primer coat or special surface treatment is required prior to painting. Paint systems for LEXAN sheet have been developed and are available as standard items from the paint manufacturers listed. GE also offers assistance in working with other paint suppliers as necessary.

- Use only compatible paint systems.
- Standard strip masking may be used.
- Standard cutting tools can be used for cutting out copy.
- When cut and spray techniques are employed, use care in cutting through masking layer to avoid deep cuts in sheet surface.

NOTE: Proper ventilation procedures as recommended by the specific paint supplier, should be followed at all times.

Drilling

LEXAN sheet can be drilled easily using a standard twist drill design. High speed steel or carbide tipped twist drills will give the best results with the following conditions.

Hole Diameter	Speed (rpm)	Feed (mtls./rev.)	Time (sec.)
1/8	1750	1-1/2-3	25-30
1/4	1000-1500	1-1/2-3	30
3/8	500-1000	1-1/2-3	30
1/2	325-650	3	45-50
3/4	350	3	50-60

- To minimize the drill's tendency to pull into the material, modify the standard steel twist design by grinding a small flat on the cutting edge.

NOTE: Do not use drills that have been ground for use on acrylic sheet. They will overheat the material, and induce unwanted stresses.

Bonding/Cementing

Solvent Bonds

Solvent bonds are recommended with LEXAN sheet for indoor display applications because of their mechanical strength, fast cure rate, and ease of application.

Solvent Formulation

- Use methylene chloride (MDC) as basic solvent cement.
- For optimum joint appearance, use 90% MDC, 10% glacial acetic acid (GAA).
- To reduce any blush due to humid conditions, add up to 10% diacetone alcohol.

Application

- Use only enough solvent to wet the joints. Excess solvent increases set time and can cause whitening or stress crazing.
- Use smoothest possible edges to eliminate gaps and ensure full bond.
- Hold parts together in fixture under pressure until solvent has fully cured for best results.

Solvent bonding will reduce impact performance of the bonded edge of most materials. However, because of its extremely high impact strength, LEXAN sheet will retain impact strength superior to other plastics when proper solvent bonding techniques are used. When the highest possible impact performance is essential, use flexible adhesive bonding.

Adhesive Bonds

- Flexible adhesive bonds are recommended for applications requiring optimum impact properties. Use adhesives that are chemically compatible with LEXAN sheet and are capable of absorbing impact vibrational and thermal stresses.

To Ensure Maximum Impact Strength

Avoid adhesives which attack the material or induce stress cracking.

- Avoid brittle adhesives.
- In all cases, follow manufacturer's instructions exactly.

Cleaning and Assembly

- Mating surfaces must be clean.
- Clean with cleanser or detergent and water, rinse and thoroughly dry to develop maximum bond strength on all surfaces.
- LEXAN sheet surfaces may also be cleaned with methyl alcohol, isopropanol alcohol or freon TF alcohol.
- Mechanically abrade the mating surface with emery cloth where possible in addition to cleaning to assure maximum bond.
- Mating surfaces must be covered completely with adhesive.
- Complete contact must be maintained during the adhesive cure.
- Improperly cleaned mating surfaces with improperly applied adhesives will result in poor adhesion and bond failure.

Recommended Urethane Adhesives

Hartel Adhesives

Hartel Enterprises, Inc.
12970 Branford
Pacoima, CA 91331
(818) 767-0861

Uralane #5774 and 5776

Ciba-Geigy Corporation
Los Angeles, CA
(800) 367-8793

Suppliers and Compatible Paints

Supplier

Spraylat Corporation
730 S. Columbus Avenue
Mt. Vernon, NY 10550
(914) 699-3030

Compatible Paints

Spray

Lacryl PC 400 Series
Lacryl LP Series (Special Color)
Lacryl No. 204-T Thinner

Screen

Lacryl PC700 Series
Lacryl LPN Series (Special Color)
Lacryl No. 230-T Thinner

Supplier

Wyandotte Paint Products Co.
P.O. Box 255
Norcross, GA 30071
(404) 448-4511

Compatible Paints

GRIPFLEX PAINTS (Current Production)
Batch Numbers 06000 and ABOVE

FR-2 Series or GF-2 Series
No. T-2003 PC Spray Thinner

FR-1 Series or GF-1 Series
No. T-1003 PC Retarder & Screen Thinner
No. T-1004 PC Super Retarder

Notes

For further information and technical literature, please call 1-800-451-3147.

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