

Fabrication

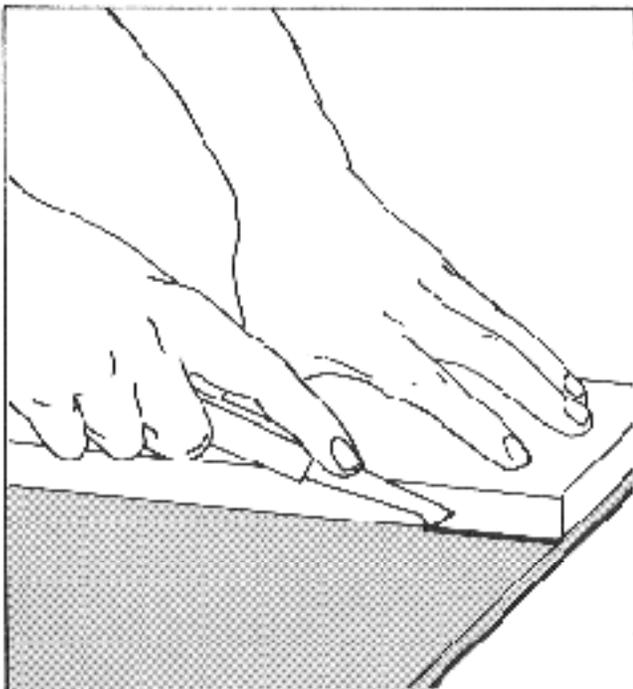
#3 Other Methods of Cutting

This brief gives advice for:

- Equipment
- Procedures
- Trouble Shooting
- Equipment Suppliers
- Additional Technical Information and Assistance

Equipment

ACRYLITE® FF acrylic sheet is most commonly cut using a circular table or panel saw. These saws are recommended because they produce minimal vibration while cutting. However, depending on the shape of the cut and equipment available, it may be necessary to use other types of cutting equipment or techniques. Other methods of cutting sheet include the use of a scriber, Fletcher® Cutter, saber saw, jig saw, hand-held circular saw and laser.



Always draw the scribing knife along a straight edge.

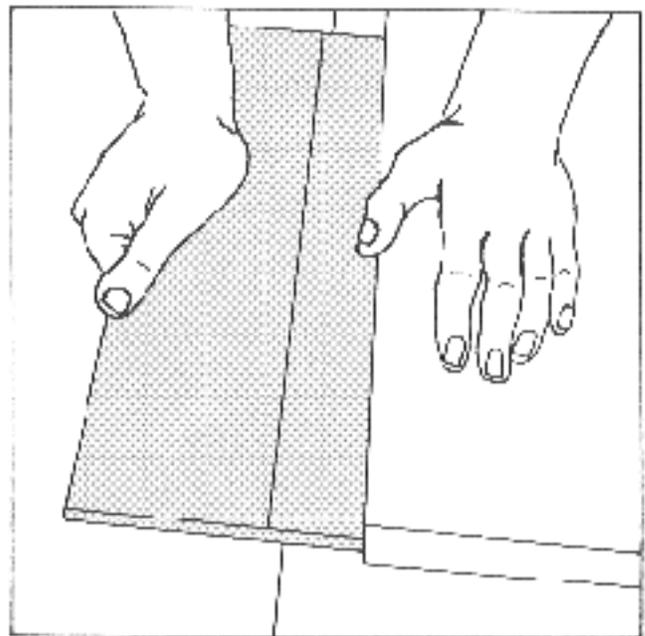
Procedures

Be sure to follow the manufacturers' safety recommendations for equipment and materials used with ACRYLITE FF sheet.

Scribing and Breaking

This method is useful for quick, straight line cutting of short lengths of single sheets less than 0.118 inch (3 mm) thick.

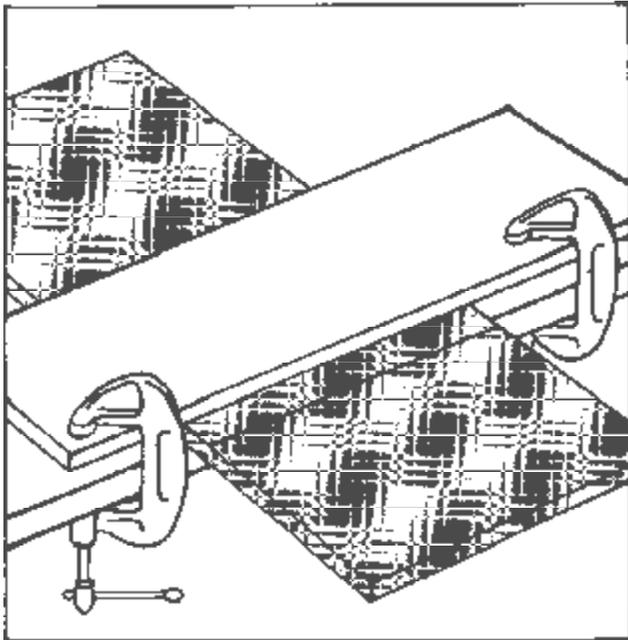
Lay the masked sheet on a flat surface and mark the line to be scribed (scored). Use a straight edge held firmly in place to guide the scriber or knife along the line. Scribe the sheet several times with firm even pressure along the same line.



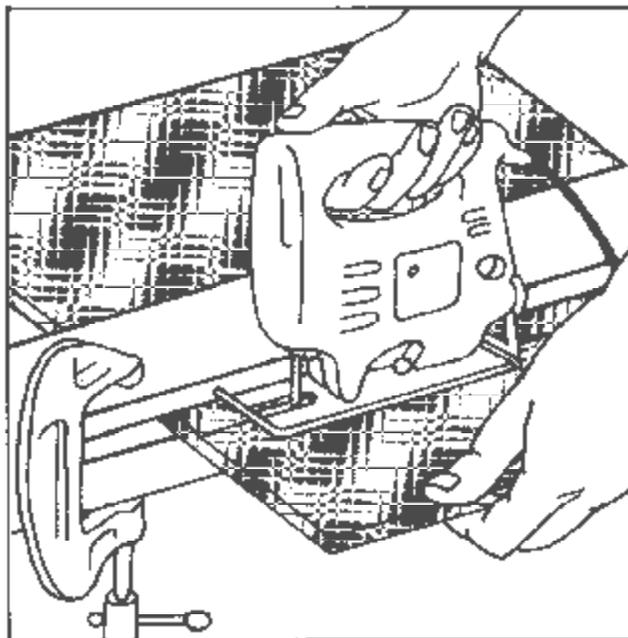
Break sheet over edge of table after scribing.

Next, position the sheet so that the scribed line is just beyond the edge of the working surface. While holding the sheet firmly in place on the working surface near the scribed line, apply a sharp downward pressure to the end of the sheet overhanging the surface edge. This will cause the sheet to break along the scribed line.

The Fletcher-Terry Company makes a number of "scribe and break" cutting systems that can be used on acrylic sheet. Although these systems are designed specifically to meet the needs of picture framing shops, they can be used for straight cutting single sheets of acrylic up to 48" x 96" in size and 1/4" thick.



Clamp sheet firmly to table before cutting with saber saw.



Use clamping strip as a guide for the saw.

Of these systems, the Fletcher 3000® Multi-Material Cutter is the most versatile. This cutter has a unique spring loaded, triple-tool turret cutting assembly that allows the user to quickly alternate between three different scoring knives. Knives for glass, plastic and matboard/foamboard can be easily selected by simply rotating the turret cutting assembly to the proper position.

A straight line is first scribed in the acrylic where the cut is desired. This is done by selecting the scoring knife designed for plastic and drawing it by hand across the sheet using the guide system. After the sheet is scribed, a hand-operated roller is then guided along the scribe line applying even pressure to cleanly break the sheet. If the sheet is covered with a protective film, the film on the back surface will not be broken and may need to be torn or cut to separate the pieces of acrylic sheet. If the protective film is removed in advance, then care must be exercised not to scratch the surface of the acrylic sheet during handling.

Blade Selection

When using a saber, jig or band saw, blades with 7-14 tpi (teeth per inch) are usually acceptable for all purpose cutting. The correct tooth spacing is dictated by the thickness of sheet being cut, as well as the quality of cut desired.

In general, a blade should be selected so that at least two teeth are engaged in the thickness of the sheet while cutting. This means for 1/8" (3 mm) thick sheet a blade with 16 tpi is a good starting point, whereas for 1/4" (6 mm) thick sheet, a blade with 8 tpi may be a better starting point.

If chipping is experienced or a better finish is desired, try a blade with more teeth per inch. If melting is experienced, try a blade with less teeth per inch. Melting will also be caused by dull blades, so be sure the blade is sharp. Never use a blade that has been used for other materials such as wood or aluminum. These materials will dull the blade to the point where it cannot be successfully used with acrylic sheet.

Saber Saw Cutting

This method is useful for cutting involving a frequent change of direction. The blade should have a raker set design. Adequate support is necessary to minimize the vibration of the reciprocating blade which may chip or crack the sheet.

A straight board clamped to the sheet near the cutting line may be used as a saw guide and will assist in reducing vibration. Blow compressed air onto the blade to remove chips and to cool the blade.

Jig Saw Cutting

Jig saws or scroll saws should be used only for inside cuts and for intricate letters. The blade should contain some set for clearance. Use a fast, steady feed rate. Because the stroke is short, the blade heats up quickly, and tends to soften and fuse the plastic.

Most jig saws have a small blower nozzle attached to the blade guide. This stream of air will help to cool the blade and keep the plastic from gumming. You may also use a cooling fluid like oil or water.

Band Saw Cutting

Band saws are frequently used for cutting curved sections or trimming thermoformed parts. A good cutting quality (minimal chipping and melting) can be obtained from a blade which is 1/2" (12.7 mm) wide. This blade type is sufficient for cutting radii of a 3" (76 mm) minimum. If a tighter cutting radius is required, the blade width must be reduced to 1/4" (6 mm). A blade speed of 2500-4000 surface feet per minute (760-1200 m/min.) is recommended. In general the thicker the material, the slower the blade speed should be. The use of a board clamped to the sheet will assist in minimizing vibrations, scratching and breakage.

Electric Circular Hand Saw Cutting

Circular hand saws may be used for making straight cuts if the sheet is clamped securely to the work surface to minimize vibration. Blades recommended for circular table saws (carbide tipped, triple-chip tooth design with a slightly positive rake) will yield the best results. Specifics on blade design may be found in Fabrication Tech Brief #2, "Straight Line Cutting with Circular Saws." A guide such as a board clamped on top of the sheet will help reduce vibration and assure a straight cut.

Laser Cutting

Laser technology is being rapidly accepted by industry for quickly and accurately cutting, welding, drilling, scribing and engraving plastics.

CO₂ lasers focus a large amount of light energy on a very small area which is extremely effective for cutting complex shapes in acrylic sheet. The laser beam produces a narrow kerf in the plastic allowing for close nesting of parts and minimal waste. CO₂ lasers vaporize the acrylic as they advance resulting in a clean polished edge but with high stress levels. Depending on the application, annealing acrylic sheet after laser cutting may be needed to minimize the chance of crazing during the service life of the part. For more detailed information on laser cutting acrylic sheet, see Fabrication Tech Brief #13, "Laser Machining."

Annealing

If sheet stresses caused by cutting are extremely high, crazing (fine, visible cracks that appear in the sheet over time) will occur at joints, bends, cuts, drilled holes and other fabrication areas. To eliminate the possibility of crazing, the fabricated sheet should be annealed.

Annealing is a simple heating procedure which relieves stresses without changing the shape of the fabricated sheet and often increases sheet strength.

To anneal sheet *after fabrication*:

1. Preheat oven to 175°F (80°C).
2. Remove all masking from sheet.
3. Place fabricated sheet in oven and heat it 1 hour for each millimeter of sheet thickness. (Example: Heat 3 mm sheet for 3 hours.)
Minimum heating time = 2 hours for sheet 2 mm and less.
4. Turn off oven and let sheet cool slowly. (For more details, see Fabrication Tech Brief #12, "Annealing.")

Trouble Shooting

Problem	Cause	Solution
Melted edges	Overheating	Increase feed rate Use coolant such as air or water Sharpen blade
Crazing of finished part	Excessive stresses	Increase feed rate Use coolant such as air or water Sharpen blade Anneal parts
Excess chipping	Vibration	Clamp material Use a guide
	Wrong blade	Use a blade with more tpi

Equipment and Materials Suppliers

The suppliers listed below offer materials and equipment suitable for use with ACRYLITE FF sheet. Authorized ACRYLITE Sheet Distributors may also offer some materials and equipment.

Band Saw Blade

Blackstone Industries, Inc.

The Foredom Electric Company
16 Stony Hill Road
Bethel, CT 06801
203-792-8622
Fax 203-796-7861
www.foredom.com

Lasers

Laser Machining, Inc.

500 Laser Drive
Somerset, WI 54025
715-247-3285
Fax 715-247-5650
www.lasermachining.com

TSI Lumonics Corporation

8401 Jefferson Hwy.
Maple Grove, MN 55369
763-315-1780
Fax 763-315-1781
www.tsilumonics.com

Universal Laser Systems, Inc.

16008 N. 81st Street
Scottsdale, AZ 85260
480-483-1214
Fax 480-483-5620
www.ulsinc.com

Additional Technical Information and Assistance

We invite you to visit our TechKnowlogy Center on www.cyro.com.

Visitors have immediate access to frequently asked questions, technical concerns, physical properties, processing conditions, fabrication tips, regulatory compliance information, engineering guidelines, tips for troubleshooting, and hundreds of other facts about acrylics from one of North America's leading manufacturers of acrylic-based polymer and sheet products.



Fire Precautions

ACRYLITE FF sheet is a combustible thermoplastic. Precautions should be taken to protect this material from flames and high heat sources. ACRYLITE FF sheet usually burns rapidly to completion if not extinguished. The products of combustion, if sufficient air is present, are carbon dioxide and water. However, in many fires sufficient air will not be available and toxic carbon monoxide will be formed, as it will when other common combustible materials are burned. We urge good judgement in the use of this versatile material and recommend that building codes be followed carefully to assure it is used properly.

Compatibility

Like other plastic materials, ACRYLITE FF sheet is subject to crazing, cracking or discoloration if brought into contact with incompatible materials. These materials may include cleaners, polishes, adhesives, sealants, gasketing or packaging materials, cutting emulsions, etc. See the Tech Briefs in this series for more information, or contact your ACRYLITE Sheet Distributor or the CYRO Technical Center for information on a specific product.

Important Notice:

The information and statements herein are believed to be reliable but are not to be construed as a warranty or representation for which we assume legal responsibility. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose of any information or products referred to herein. NO WARRANTY OF FITNESS FOR PARTICULAR PURPOSE IS MADE. Nothing herein is to be taken as permission, inducement or recommendation to practice any patented invention without a license.

