

ImagoPrints™
Fabrication Techniques

June 2006

KnollTextiles

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Note: Conversion of U.S. customary and metric values may have been rounded off and therefore may not be exact.

Introduction

This document pertains only to the collection of ImagoPrints, which includes the patterns— Altered Lines, Pixelated and Ikat Blocks. For all other Imago patterns, refer to the current Imago Fabrication manual.

KnollTextiles introduces the next generation of Imago™, the award-winning hard surface material, made through encapsulating fabric in a high-performance resin. Unlike its progenitor, however, the new ImagoPrints employs overlapping graphic imagery to achieve a unique lenticular effect. ImagoPrints provides a new platform for designers to use depth, texture, color and pattern in sheets of high performance translucent thermoplastic.

Using GE's well-known high-performance LEXAN® polycarbonate sheet as its core, ImagoPrints patterns are fused, through a layering technique, to each side of the LEXAN sheet. The durable exterior coating on both sides resists scratching and damage from most chemicals.

At half the weight of glass, ImagoPrints offers excellent performance attributes combining the outstanding properties of GE's LEXAN and very high strength across a wide range of temperatures. Imago Prints is available in six standard gauges from 1/16" to 1/2" thick.

For more information on LEXAN, please visit the website: www.gestructuredproducts.com or www.gelexan.com. You may also contact your local KnollTextiles representative, or KnollTextiles Customer Service at 866.565.KTKT or knolltextiles@knoll.com.

As with any material, the fabricator should thoroughly test the specified Imago for use in the project's application.

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 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"
 - 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 thickness satisfactorily with band saws.

- 10-18 teeth per inch

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.
- Blade Speeds: 2500-3000 feet per minute

Drilling

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

Hole Diameter	Speed (rpm)	Feed (mill/rev/)	Time (sec.)
1/8"	1750	1-1/2-3	25-30
1/4"	1000-1500	1-1/2-3	30
3/8"	550-1000	1-1/2-3	30
1/2"	325-650	3	45-50

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

Note: In all cases, pre-drill sheet with holes that are 1/16" oversize to allow for expansion.

Note: Do not use drills that have been ground for use on acrylic sheet. They will overheat the material and cause unwanted stress

Punching, Shearing 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 may shatter, ImagoPrints will not crack or craze during shearing, punching, or blanking when sharp tools are used.

Punching

Hollow ground punches can be used 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"

Shearing

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

- Shear blades: 45-degree angle or less
- Maintain 0.0005" clearance between blade and shear blade.
- Scotch 4941-Double-coated pressure sensitive foam tape

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

Bonding and Fastening

ImagoPrints has a durable exterior coating, which resists scratching and most chemical substances. As a result adhesives do not easily bond with the ImagoPrints outer layer. However, pressure sensitive tapes may be used.

The following will adhere to Imago Prints:

- 3M Pressure sensitive adhesive tapes
- 3M Scotch 4950-Double-coated pressure sensitive foam tape
- Scotch 4941-Double-coated pressure sensitive foam tape

As an alternative, urethane adhesives may be used to bond ImagoPrints if the outer films are routed off the sheet to expose the LEXAN underneath. The following urethane adhesive suppliers are recommended by General Electric, the manufacturer of LEXAN (800.451.3147):

Hartel Adhesives
Hartel Enterprises, Inc.
12970 Branford
Pacomia, CA 91331
818-767-0861

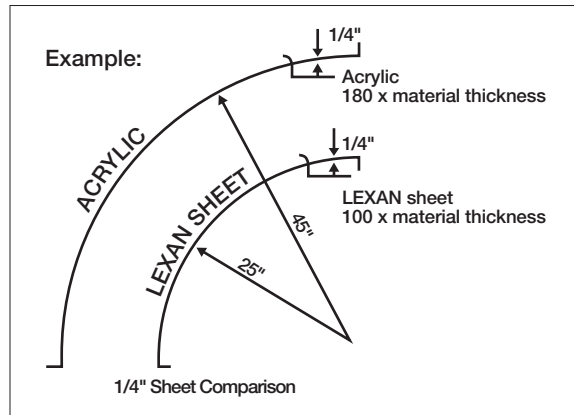
Uralane #5774 and 5776
Ciba-Geigy Corporation
Los Angeles, CA
800-367-8793

ImagoPrints can be mechanically fastened using screws.

Note: In all cases, pre-drill sheet with holes that are 1/16" oversize to allow for expansion.

Cold Forming

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



Cold forming of LEXAN sheet is acceptable for shapes having a radius of 100 times the material thickness or greater.

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

Sheet Thickness:

1/16"	1/8"	3/16"	1/16"
6.25"	12.5"	18.75"	25"

Note: ImagoPrints sheets, which are bent under nonheat molding conditions, should be held in channels or another appropriate system for restraint. The memory in the ImagoPrints sheets will naturally cause it to flatten without such appropriate restraint. Cold bending sheets above 1/4" presents practical fabrication difficulty.

Strip Heating

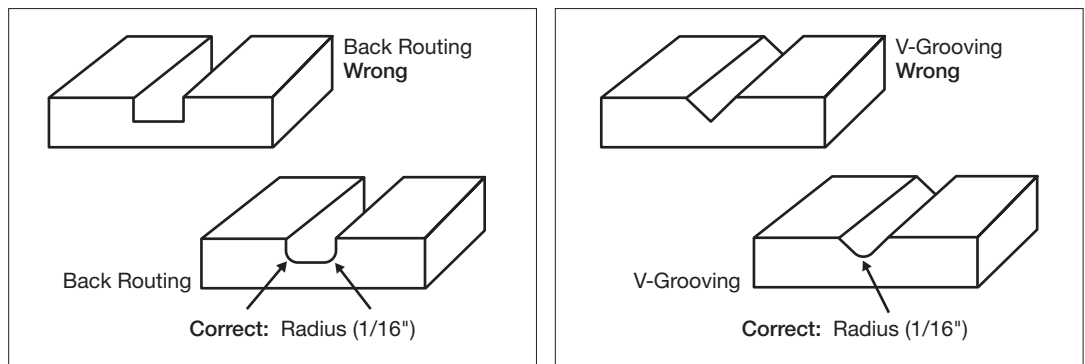
Strip heating is an acceptable method for localized bending of Imago Prints sheet.

Note: Pattern distortion will occur.

While heating the entire sheet is not required, heating both sides at the bend area is recommended 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 thickness 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 a sheet thickness over 1/8", back routing or V-grooving is commonly used.
- Radius cutters for back routing and V-grooving are recommended to minimize localized high stress areas and assure optimum impact strength.



Edge Finishing

Step 1

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

Step 2

- Sand edges, typically starting with a 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.

ImagoPrints™ and Imago™ Terms and Conditions

Orders

Order all Imago and ImagoPrints sheet by name and number where indicated. Fax orders to 866-565-5860.

Order Confirmation

The acknowledgement or seller's invoice is the final expression of the agreement between the customer and KnollTextiles and supersedes all prior oral and written statements regarding the order. The confirmation can be modified only in writing or reconfirmation signed by KnollTextiles. Minimum order quantity for standard product is one sheet (4 foot x 8 foot).

KnollTextiles' Imago and ImagoPrints are sold by the sheet (4 foot x 8 foot). Call 866-565-5858 for availability, minimums and pricing.

Change Orders

KnollTextiles is not required to accept requested change orders. However, as a general rule, KnollTextiles will accept reasonable change orders with the following conditions:

1. The request for change must be submitted in writing and received in time to be implemented.
2. Changes will be subject to additional charges for material, labor and administrative costs.

Cancellations

Orders are non-cancelable and non-returnable. Imago and ImagoPrints are made to order.

Damage Claims

All KnollTextiles products are inspected prior to shipment. Since KnollTextiles is not responsible for damage in shipment or in storage, customers should carefully inspect all items at time of delivery and note any obvious damage on the deliver receipt. For the customer's protection, such obvious or subsequently discovered concealed or damaged must be reported immediately to the carrier. Claims on Imago and ImagoPrints will not be considered if the sheet has been cut, formed, or worked by the customer or others. No claims for labor charges will be allowed in any circumstances.

Prices

Published textile prices are net 30 days, provided customer meets Knoll's standards for open credit terms, F.O.B., KnollTextiles Operations Center, East Greenville, PA, 18041.

Prices do not include:

1. Shipping/Handling charges
2. Storage of insurance charges
3. Sales and other taxes
4. Local delivery, uncrating and installation

Credit

Imago and ImagoPrints always require a minimum 50% deposit. Credit may be established upon KnollTextiles written acceptance of satisfactory data/references. KnollTextiles may cancel or change credit terms at its discretion and may request advance payment at any time. All prepaid orders must include shipping and handling charges and tax where applicable. If local taxes are not applied on prepaid orders, customers must complete a resale certificate, indicating their tax I.D. number.

Availability

All product discussed in this price brochure are subject to changes in availability and/or price at any time, with or without notice.

Shipping

We will ship in accordance with customer instructions. Unless the customer specifically requests in writing partial shipments as completion occurs, KnollTextiles may await completion of entire order and ship on a specified basis or may take partial shipments from time to time. All Imago and ImagoPrints shipments will be made F.O.B., Palisades, Fla.

KnollTextiles is not liable for any delay or failure to deliver or perform due to strikes, lockouts or other labor difficulties, failure or delay sources of supply, transportation difficulties, accidents, fires, acts of God, or any other causes of like or unlike nature beyond KnollTextiles control.

All KnollTextiles' shipments are made on a dock to dock basis, or a sidewalk delivery. Please contact your KnollTextiles regional office if you require additional services, i.e. inside delivery. This will be a separate charge and handled on a regional basis when available. The Knoll Traffic Department will determine from the "ship to" destination the recommended method of shipment. Unless complete instructions as to shipping method and route are stipulated by the customer, we have the option to ship by, what is in our opinion, the best possible way.

Claims

All claims against KnollTextiles such as claims for shortages and errors must be made in writing within 10 days after delivery. The facts on which the claim is based must be directed in writing to the KnollTextiles regional sales office.

Failure to make such a claim against KnollTextiles within a 10-day period shall constitute acceptance of the merchandise and waiver of any shortages, errors or other claims.

Cutting, forming, or working of the product will be deemed acceptance of the shipment and waiver of all defects, shortages, errors and that the correct color/pattern has been received. KnollTextiles gives no warranty, expressed or implied, as to description, quality, merchantability, fitness for any particular program, or any other matter, of any Imago or ImagoPrints product which KnollTextiles shall supply.

Knoll warrants to the original purchaser that all Imago or ImagoPrints products under normal wear and tear shall meet the specifications listed in the current technical literature under each products name, including lightfastness, and flame retardant rating for a period of (1) year with remedies as follows: should any failure to conform with this limited warranty appear on the product during the first year after the date of shipment, upon prompt written notice, Knoll will repair or replace, as its option, the affected Imago or ImagoPrints product only.

This warranty does not apply to:

Acts or omissions of parties other than Knoll.

User modification.

Unusual atmospheric or environmental conditions.

Misuse of product.

Purchasers remedies set forth herein are exclusive and the liability of Knoll with respect to the breach of this agreement or any contract entered into between the parties pursuant hereto shall not exceed the price of the Product or part on which such liability is based. ALL OTHER WARRANTIES INCLUDING ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. KNOLL, ITS CONTRACTOR, AUTHORIZED DEALERS AND SUBCONTRACTORS OR SUPPLIERS OF ANY TIER SHALL NOT BE LIABLE TO PURCHASER FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING FROM BREACH OF THIS AGREEMENT.