

TECHNICAL BULLETIN



ARCHITECTURAL GLAZING WITH LUCITELUX™ ACRYLIC SHEET

Manufacturer

LuciteLux™ acrylic sheet is manufactured by Lucite International, Inc.

Purpose of Document

This document presents information regarding product characteristics, uses, design and installation details on LuciteLux™ acrylic sheet. Additional information is available from Lucite International, Inc.

Product Description

Lucite® Acrylic Sheet

Produced from methyl methacrylate monomer, LuciteLux™ acrylic sheet has outstanding optical properties, excellent weather resistance, uniform caliper control and high impact resistance. It has exceptional freedom from warpage, cracks, scratches, blisters, voids, foreign matter and other defects which may affect appearance or serviceability. Also, LuciteLux™ acrylic sheet is light weight and easily fabricated. LuciteLux™ is a continuous cast acrylic sheet with high molecular weight and uniform thickness. LuciteLux™ acrylic sheet products can be ordered in cut-to-size sheets up to 108" x 156", depending upon product type. The LuciteLux™ continuous cast acrylic sheet product offering ranges from .118" to 0.236" thickness. LuciteLux™ acrylic sheets are available in clear, solar tints, translucent whites and many additional colors.

Applications

LuciteLux™ acrylic sheet is used where safety, light weight, optical clarity, and long-term retention of properties are important. Applications include glazing for institutional, industrial and commercial buildings, skylights and domes, shields and guards,

lighting fixtures, solar panels and signage of all types.

Installation Details

Rabbit Dimensions

For outdoor use where large temperature variations may occur, LuciteLux™ acrylic sheet should be installed with a channel engaging the edges. Through-bolting or other inflexible mechanical fastenings are not recommended. The channel frame dimensions depend on sheet thickness, size of panes and design load.

Small panes (major dimensions less than 24 inches) use minimum rabbit depth of 0.375 inches.

For intermediate and large size panes, see Table I

Sealing Details

Sealants and tapes should have sufficient extensibility to accommodate thermal expansion and contraction. The sealants should adhere to both the LuciteLux™ acrylic sheet and the frame.

For small panes (less than 24 in. major dimensions) use non-hardening glazing compound or use butyl tapes.

For intermediate and large size panes, use butyl tapes (intermediate size only) or use suggested sealants. Table II and table III indicate recommended sealant and tape size.

Thermal Expansion

Table IV shows the recommended thermal expansion clearances for LuciteLux™ acrylic sheet. The height and width should be cut shorter than the overall sash dimensions by the amount shown in Table IV. Care should be taken to ensure smooth cut edges, thereby avoiding stress-producing notches.

TABLE I Rabbet Dimensions

Thickness (in.)	Rabbet Dimensions Depth Width		Maximum Sash Opening (in.) Per Design Load		
			20psf	30psf	40psf
0.118	3/8	x 3/8	24 x 33	24 x 31	24 x 29
	1/2	x 1/2	24 x 45	24 x 42	24 x 39
0.177	1/2	x 7/16	42 x 42	40 x 40	39 x 39
			30 x 45	30 x 43	30 x 41
	3/4	x 7/16	36 x 77	36 x 71	36 x 65
0.236	1/2	x 1/2	48 x 71	48 x 63	48 x 57
			44 x 44	42 x 42	41 x 41
			30 x 46	30 x 45	30 x 43
	3/4	x 1/2	60 x 72	60 x 65	60 x 60
			36 x 84	36 x 78	36 x 72
			48 x 114	48 x 106	48 x 98
1	x 5/8	60 x 108	60 x 96	60 x 90	

TABLE II Sealant Size

Thickness (in.)	Long Dimension (in.)	Sealant Dimensions (in.)		Filler Tape Dimensions (in.)	
		Depth	Width	Depth	Width
3/16	up to 72	1/4	1/4	1/2	1/4
1/4	72 to 108	1/4	3/8	3/4	3/8
1/4	108 to 120	1/4	1/2	7/8	1/2

TABLE III Recommended Sealants

Sealant Trade Name	Types	Manufacturer
Adhesive Sealant No. 732	Silicone Rubber	Dow Corning Midland, MI
'Silglaze' II	Silicone Rubber	General Electric Co. Waterford, N.Y.
'UltraGlaze'	Silicone Rubber	General Electric Co. Waterford, N.Y.
'RTV 5818'	Silicone Rubber	General Electric Co. Waterford, N.Y.
'Weatherban' 202	Synthetic Elastomer	3M Company-St. Paul, Minnesota
'Weatherban' 404	Synthetic Elastomer	3M Company-St. Paul, Minnesota
'Mono'	Acrylic Terpolymer	Tremco Mfg. Company-Cleveland, Ohio

The manufacturers' recommendations should be followed when using these sealants.

Installation Details

Sheet Preparation:

1. Use a saw with a sharp blade to cut sheet to desired size.
2. Unmask sheet immediately before installation.
3. The cut edges should be thoroughly cleaned before setting in sash.
4. Excessive sealant smears should be avoided. Paper-backed adhesive tape can be used around the edges adjacent to the rabbets to avoid smears.

Sash Preparation:

1. Sash surfaces should be cleaned to remove dirt or oil.
2. The sash rabbet should be free of burrs.
3. If the sealant manufacturer recommends a specific primer, it should be used to ensure proper adhesion.

Face Glazing:

1. See Figure 1 for installation detail.
2. Use elastic glazing compound only.
3. Apply back sealant to the rabbet, and bed the LuciteLux™ acrylic sheet in the sash so that it is centered.
4. Fasten with glazing points or clips, apply face sealant, and trim the caulking bead.

3. Install butyl tape and/or sealant according to manufacturer's recommendations.

FIGURE 2 Sash Glazing-Intermediate Panes

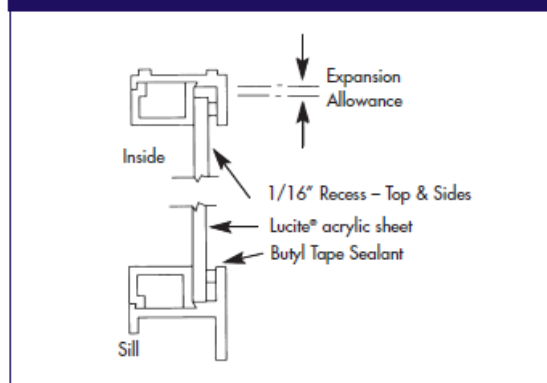


FIGURE 3 Sash Glazing-Large Panes

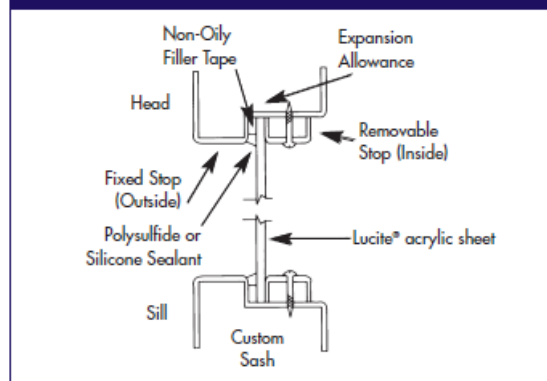
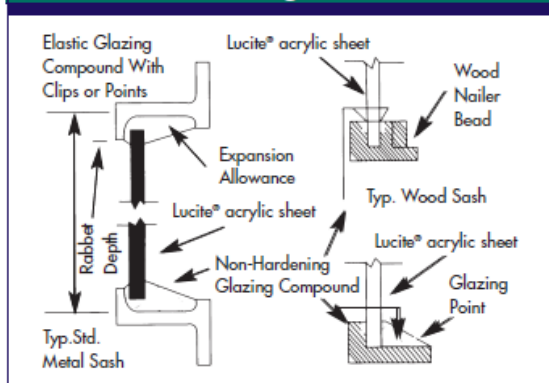


FIGURE 1 Face Glazing-Small Panes



Design Considerations

Properties necessary for calculating design parameters are summarized in Table V and VI. LuciteLux™ acrylic sheet does undergo greater dimensional change due to thermal expansion and contraction than other materials with which it is used in construction (see Table X).

Through-bolting or use of other inflexible mechanical fasteners which do not provide for expansion or contraction may cause failure of the installation.

Standard and Custom Sash Glazing:

1. See Figures 2 and 3 for installation details.
2. LuciteLux™ acrylic sheet can be set directly on sill; it is not necessary to use setting blocks.

**TABLE IV Expansion Clearance
Lucite® Acrylic Sheet**

Length (in.)	Exp. (in.)
up to 36	1/8
36 to 60	1/4
60 to 96	3/8
96 to 120	7/16

LuciteLux™ Continuous Cast Acrylic Sheet/Physical Properties

Property	ASTM	Units
Thickness, Nominal, Inch		0.236
Specific Gravity	D792	1.19
Optical		
Refractive Index	D542	1.49
Light Transmittance	D1003	
<input type="checkbox"/> Parallel		91%*
<input type="checkbox"/> Total		92%*
<input type="checkbox"/> Haze		1%*
Spectral Transmission	DU-792	
<input type="checkbox"/> 290 to 330 nm, 0.25" sheet, max. percent	Beckman	5%
Mechanical		
Tensile Strength	D638	
<input type="checkbox"/> Rupture		11M psi (770 kg/cm ²)
<input type="checkbox"/> Modulus of Elasticity		564M psi (3.9 x 10 ⁹ kg/cm ²)
<input type="checkbox"/> Elongation at Rupture		4.1%
Flexural Strength	D790	
<input type="checkbox"/> Rupture		14.8M psi (1,040 kg/cm ²)
<input type="checkbox"/> Modulus of Elasticity		450M psi (3.1 x 10 ⁹ kg/cm ²)
Compressive Strength	D695	
<input type="checkbox"/> Yield		14.8M psi (1,040 kg/cm ²)
<input type="checkbox"/> Modulus of Elasticity		279M psi (1.95 x 10 ⁹ kg/cm ²)
Shear Strength	D732	8.4M psi (590 kg/cm ²)
Impact Strength	D256	
<input type="checkbox"/> Charpy Unnotched		5.0 ft. lb./in. ² (0.35 kg/cm ²)
Rockwell Hardness	D785	M-100
Thermal		
Hot Forming Temperature		275-350°F (135-177°C)
Heat Distortion Temperature		
3.6°F(2°C)/Min-264 psi	D648	200°F (93°C)*
Coefficient of Thermal Expansion (ave. value) ²	D696	3.9 x 10 ⁻⁵ in./in./°F (7 x 10 ⁻⁵ cm/cm/°C)
Maximum Recommended Continuous Service Temperature		175°F (79°C)
Coefficient of Thermal Conductivity		1.45 Btu in./ft ² hr. °F (0.209 w/m•k)
Shrinkage, max. percent		2.5%
Specific Heat		0.35 Btu/lb. °F (0.35 Cal/gr °C)

LuciteLux™ cast acrylic sheet is combustible like many other synthetic and natural building materials. Small scale test are not intended to reflect hazards under actual fire conditions. *This value changes with thickness. Value given is for 0.236" thickness or where otherwise indicated.

All values are for the clear product.

1. These are typical or average values and should not be used for specification purposes.

2. Change in dimensions = coefficient x (dimension of sheet) x (change in temperature.)

LuciteLux™ Continuous Cast Acrylic Sheet/Physical Properties (cont'd)

Property	ASTM	Units
Electrical		
Surface resistivity, 82°F (28°C), 75% RH	D257	>10 ¹⁴ ohm
Volume Resistivity	D257	4 x 10 ¹¹ ohm/mil (10 ¹⁵ ohm/cm)
Dielectric Strength, Short Time Test	D149	0.42 kv/mil (20 kv/mm)
Dielectric Constant	D150	
<input type="checkbox"/> 60 cycles		4
<input type="checkbox"/> 10 ³ cycles		3
<input type="checkbox"/> 10 ⁶ cycles		3
Power Factor	D150	
<input type="checkbox"/> 60 cycles		0.06
<input type="checkbox"/> 10 ³ cycles		0.04
<input type="checkbox"/> 10 ⁶ cycles		0.02
Arc Resistance	D495	No Tracking
Miscellaneous		
Water Absorption (Wt. Gain on Immersion for 24 hrs.)	D570	0.3%*
Soluble Matter Lost after Immersion	D570	0.0%
Odor		None
Taste		None
Dimensional tolerances, inches:		
<input type="checkbox"/> length, width		+ 1/4" - 0"
<input type="checkbox"/> squareness, difference in length of diagonal		≤ 1/4"
Combustibility*		
Smoke Density Rating	D2843	13.5%
Tunnel Test (Smoke Developed)	E84	
<input type="checkbox"/> 0.118"		385
<input type="checkbox"/> 0.236"		530
Fuel Contribution Factor		11,300 Btu/lb. (26.3 x 10 ⁶ J/kg)
Auto Ignition Temperature	D1929	750°F
Rate of Flame Spread	E84	
<input type="checkbox"/> 0.118"		140
<input type="checkbox"/> 0.236"		110
Radiant Panel, Flame Spread Index	E162	
<input type="checkbox"/> 0.118"		219
<input type="checkbox"/> 0.236"		249
Horizontal Burn	D635	
<input type="checkbox"/> 0.118"		1.18 in./min.
<input type="checkbox"/> 0.236"		0.71 in./min.
UL Horizontal Burning Rating	UL94	94 HB

TABLE VII Chemical Resistance of Lucite® Acrylic Sheet

Compound Class	Common Name	Type	Concentration	Chemical Resistance at 72°F *
Acids	Acetic Acid	Glacial	100%	NR
	Acetic Acid		5	E
	Chromic Acid		40	F
	Citric Acid		10	E
	Hydrochloric Acid	Concentrated	38	E
	Hydrochloric Acid		10	E
	Nitric Acid	Concentrated	70	F
	Nitric Acid		40	G
	Nitric Acid		10	E
	Oleic Acid			E
	Sulfuric Acid	Concentrated	98	NR
	Sulfuric Acid		30	E
	Sulfuric Acid		3	E
	Bases	Ammonia	Solution	.88 SG
Ammonia			28 %	E
Ammonia			10	E
Sodium Carbonate			20	G
Sodium Carbonate			2	G
Sodium Hydroxide			60	E
Sodium Hydroxide			10	E
Sodium Hydroxide			1	E
Hydrogen Peroxide			10	E
Commercial Products	Cottonseed Oil	Edible Grade		E
	Detergent Solution	Heavy Grade	.025 %	E
	Kerosene	No.2 Fuel Oil ASTM D-396		G
	Gasoline		100 octane	F
	Lacquer Thinner			NR
	Mineral Oil	White, USP		F
	Olive Oil	Edible Grade	1	E
	Soap Solution	White Flakes		G
	Transformer Oil	ASTM D-1040		G
	Turpentine	Distilled Spirit ASTM D-13		NR
	Isopropyl Alcohol		10	F
Ethyl Alcohol		10	F	

LEGEND: NR - Not Recommended E - Excellent G - Good F - Fair

* This information is based on tests performed on small unstressed samples. The actual performance of the article will depend on the presence of internal and external stresses and orientation in the manufactured article.

Chemical Resistance

LuciteLux™ acrylic sheet is unaffected by a wide variety of chemicals and cleaning agents, including diluted solutions of acids and alkalis, petroleum oils, aliphatic hydrocarbons and dilute alcohols.

However, gasoline, chlorinated solvents, acetone, or denatured alcohol should never be used to clean panes of LuciteLux™ acrylic sheet, as these solvents tend to soften the uncoated surface of acrylic and may cause crazing.

Combustibility

LuciteLux™ acrylic sheet is combustible, like many other synthetic and natural building materials. LuciteLux™ acrylic sheet should not be used in applications where codes or common sense would deem it unsafe. Data on small scale tests are available (Table V and Table VI); however, these tests are not intended to reflect hazards presented by this or any other material under actual fire conditions.

Thickness Selection

See Table VIII for recommended minimum sheet thicknesses which are based on deflection, wind load, design and normal rabbet and channel depths.

TABLE VIII Major Pane Dimensions VS. Minimum Thickness	
Pane Size Major Dimensions (in.)	Minimum Thickness
40	0.118
63	0.177
96	0.236

Weatherability

LuciteLux™ acrylic sheet is outstanding in its ability to withstand continuous exposure to sun and ultraviolet radiation. No other type of plastic sheet offers such outstanding clarity, strength, and light transmittance in combination with long-term outdoor performance.

Optics

LuciteLux™ acrylic sheet has exceptionally low caliper variation. This

property (see Table XI) ensures consistent quality and very low optical distortion. In addition, clear LuciteLux™ acrylic sheet has shown to provide 92-93% light transmittance, compared to the 89% transmittance of plate glass.

TABLE XI Lucite® L Cast Acrylic Sheet Sheet Thickness VS. Caliper Variation		
Thickness (in.)	Variation	
	Max.	Min.
0.118	.130	.106
0.177	.195	.159
0.220	.242	.198
0.236	.260	.212

Thermal Properties

LuciteLux™ acrylic sheet is a much better thermal insulator than glass. The rate of heat transfer through glass ("K" factor) is four times greater than that through LuciteLux™ acrylic sheet. This being the case, the overall transmission coefficient or "U" factor for LuciteLux™ acrylic sheet will be better than that for glass (see Table IX).

TABLE IX U-Factor for Vertical Windows (BTU/Hr. Sq. Ft/°F)			
Lucite® Acrylic Sheet Thickness	Winter Heat Loss¹		
	1/8"	3/16"	1/4"
Single Glazed	1.06	1.03	0.96
Double Glazed 1/4" air space	0.55	0.52	0.49
Double Glazed 1/2" air space	0.47	0.45	0.43
Lucite® Acrylic Sheet Thickness	Summer Heat Gain		
	1/8"	3/16"	1/4"
Single Glazed	0.98	0.93	0.89
Double Glazed 1/4" air space	0.56	0.53	0.50
Double Glazed 1/2" air space	0.50	0.48	0.45

Data apply to square and rectangular panes of Lucite® acrylic sheet when the length is no more than three times the width. All edges continuously held. Sheet thickness selection is based on total deflection under uniform load limited to five percent of the short side, or three inches, whichever is smaller.

¹Ref: ANSI A134, 1-1972

TABLE X Comparison of Coefficients of Thermal Expansion

Lucite® Acrylic Sheet versus Other Building Materials
Inches /Inch/°F

Lucite® L Acrylic Sheet	0.0000390
Aluminum	0.0000129
Steel	0.0000063
Float Glass	0.0000050

TABLE XII Weight of Lucite® Acrylic Sheet

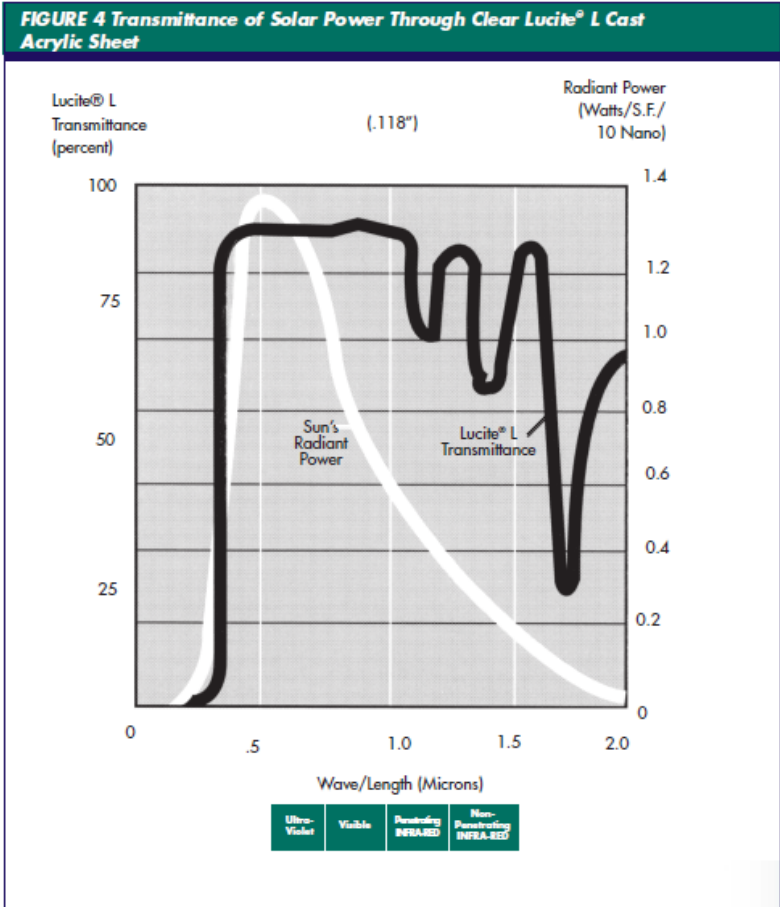
Thickness (In.)	Calculated Weight/Sq. Ft/
0.118	.75 lb.
0.177	1.10
0.236	1.45

Weight

LuciteLux™ acrylic sheet is considerably lighter than glass (50%) and aluminum (43%). See Table XII.

Light Transmittance

As seen in the graph in Figure 4, clear LuciteLux™ acrylic sheet has a high percentage of energy transmittance over the wavelengths where radiant power of the sun's energy is greatest.



Breakage Resistance

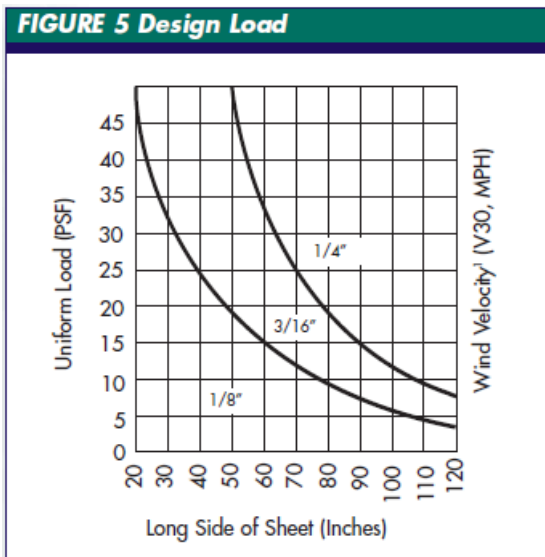
LuciteLux™ acrylic sheet has significantly higher breakage resistance compared to traditional glazing materials. Table XIII shows the impact performance of LuciteLux™ acrylic sheet as a function of thickness.

TABLE XIII Breakage Resistance as a Function of Sheet Thickness
5.0 lb. pointed dart of 12" x 12" Lucite® acrylic sheet

Nominal Thickness (in.)	Max. Drop Height (in.)	Relative Break Resistance
0.118	7.5	1
0.236	42.4	6

Thermoformability

LuciteLux™ acrylic sheet can be readily thermoformed into an almost unlimited variety of forms and contours. Skylights, domes, and other decorative shapes can be easily obtained when sheet is heated to its forming temperature. Moderate contours are often desirable and can be easily obtained without heating the acrylic sheet. LuciteLux™ continuous cast acrylic sheet can be snapped into curved channel supports provided the radius of curvature is in excess of 250 times the thickness of the sheet.



Code and Specification Compliance
Federal Specifications

Clear LuciteLux™ continuous cast acrylic sheet meets or exceeds the properties and quality control provisions of Federal Specification L-P-391D; LuciteLux™ continuous cast acrylic sheet meets Type I (general purpose material having ultraviolet light-absorbing properties.)

American National Standards Institute

LuciteLux™ acrylic sheet complies with ANSI Z 97.1 architectural glazing standard. Because of variations in local building codes, it is difficult to generalize on compliance of LuciteLux™ acrylic sheet for all applications. However, specific building code information will be supplied on request.

Other

- LuciteLux™ acrylic sheet complies with Consumer Product Safety Commission safety standard CPSC 16 CFR 1201 for architectural glazing, and can be used in Category I and Category II products.
- Clear LuciteLux™ continuous cast acrylic sheet meets the requirements of ASTM D 4802 - A-2, Finish 1, Type UVA.

Care and Cleaning

LuciteLux™ acrylic sheet

LuciteLux™ acrylic sheet has a highly polished lustrous surface and will retain its fine appearance for many years if given proper care. Cleansing materials containing abrasives such as scouring powders or strong solvents as found in some window cleaning preparations should never be used to clean panes of acrylic. Gasoline, acetone, chlorinated solvents, or denatured alcohol tend to soften the surface of the plastic and often cause crazing.

When first installed, glazing compound and masking paper adhesive can be easily removed with hexane, dry cleaning naphtha, kerosene or isopropanol. These solvents are flammable. While using them, avoid sparks, open flame or other ignition sources, and do not smoke. They may be applied with a soft absorbent cloth, followed by rinsing with clean water. Remaining drops of water should be wiped away with a soft chamois or moist cellulose sponge.

Thereafter, an occasional washing with mild soap or detergent and water solution is

Sufficient to keep panes of LuciteLux™ acrylic sheet looking like new. Household ammonia in water in the concentrations recommended for general cleaning is also excellent.

Fine hair scratches may be removed or minimized by the use of a mild automobile cleaner polish. Cleaner polish has a very mild abrasive action and its wax content tends to fill small scratches and make them invisible.

Distribution

LuciteLux™ acrylic sheet is available nationwide through plastics distributors. For information on sizes and availability, please contact your local authorized LuciteLux™ acrylic sheet distributor or Lucite International, Inc.

***Technical Literature for
Additional Information***

- LuciteLux™ Fabrication Guide
- LuciteLux™ Acrylic Sheet/Thermoforming Technical Bulletin