Technical information

ACRYLITE® cell cast sheet (GP)

Physical Properties

ACRYLITE® cast acrylic sheet is meticulously produced to meet stringent standards, providing outstanding optical qualities, precise thickness tolerances, superior light stability, and minimal internal stress for consistent performance.

The colorless ACRYLITE® cast acrylic sheet comes with an exclusive 30-year limited warranty on light transmission, ensuring the quality of the product.

ACRYLITE® sheet is a lightweight, robust thermoplastic material that boasts many times the breakage resistance of standard glass and is highly resistant to weathering. ACRYLITE® cell cast can be effortlessly sawed, machined, thermoformed, and cemented. It also absorbs ultraviolet light up to approximately 360 nanometers.

Due to its unique properties, ACRYLITE® cell cast is ideal for numerous applications, including:

- Retail store displays
- Security glazing
- Industrial and residential glazing
- Luminaries
- Aquariums
- Decorative paneling
- Spectator shielding
- Skylights
- Signs

Availability
ACRYLITE® cell cast is available in clear, various colors, and a broad range of standard sizes and thicknesses, from 0.118” (3mm) to 1.0” (24mm). It is also available as ACRYLITE® Satinice, featuring a velvet frost surface on one or both sides. The product is offered in numerous colors with varying degrees of transmitted and reflected light. ACRYLITE® Satinice maintains the same physical properties as standard cell cast acrylic.

Safety
ACRYLITE® sheet is more impact-resistant than glass. In case of impact beyond its resistance limit, it does not shatter into small slivers but instead breaks into larger pieces. ACRYLITE® sheet meets the requirements of ANSI Z 97.1 for use as a Safety Glazing material in Buildings for thicknesses ranging from 0.080” (2.0 mm) to 0.500” (12.7mm).

Weather Resistance
ACRYLITE® cast acrylic sheet offers superior weather resistance compared to other transparent plastics. It withstands harsh conditions like intense sunlight, extreme cold, rapid temperature changes, saltwater spray, and more. Its inherent stability ensures it does not degrade over time, making it a preferred choice for skylights, school buildings, industrial plants, aircraft glazing, and outdoor signage.

ACRYLITE® cell cast acrylic sheet exhibits excellent dimensional stability, expanding and contracting with temperature and humidity changes, but it does not shrink with age. Some shrinkage occurs when heated to forming temperature.

Weighing half as much as glass and 43% as much as aluminum, ACRYLITE® sheet is lightweight, with one square foot of 1/8" (3.0 mm) thick sheet weighing less than 3/4 pound (1/3 kilogram).

Although less rigid than glass or metals, ACRYLITE® sheet is more rigid than many other plastics. Its rigidity increases when formed into corrugated or domed shapes, reducing deflection under wind load.

Large, flat ACRYLITE® sheets may deform under continuous loads like snow or their own weight if not properly supported. Forming can increase rigidity and minimize deformation.

Despite a tensile strength of 10,000 psi (69 MPa) at room temperature, stress crazing can occur at lower, continuous loads. Design loads should not exceed 1,500 psi (10.4 MPa) for most applications, and localized stresses should be avoided.

Cold Flow

Large, flat ACRYLITE® sheet may deform due to continuous loads such as snow, or even from its own weight if not sufficiently supported. Increased rigidity obtained by forming will minimize cold flow.

Strength and Stresses

Although the tensile strength of ACRYLITE® cell cast is 10,000 psi (69 M Pa) at room temperature (ASTM D638), stress crazing can be caused by continuous loads below this value. For most applications, continuously imposed design loads should not exceed 1,500 psi (10.4 M Pa). Localized, concentrated stresses must be avoided. For this reason, and because of thermal expansion and contraction, large sheets should never be fastened with bolts, but should always be installed in frames.

All thermoplastic materials–including ACRYLITE® cell cast–will gradually lose tensile strength as the temperature approaches the maximum recommended for continuous service. For ACRYLITE® cell cast, the maximum is 180°F (82°C).

Expansion and Contraction

ACRYLITE® sheet expands three times as much as metals and eight times as much as glass when subjected to temperature changes. For instance, a 48" panel can expand and contract about 0.002" for each degree Fahrenheit change. In outdoor settings where temperature variations can be as much as 100° F, the panel may expand and contract approximately 3/16". Glazing channels should be sufficiently deep to accommodate this movement.

ACRYLITE® sheet also absorbs water in high humidity environments, leading to expansion. At 100%, 80%, and 60% relative humidities, dimensional changes are 0.6%, 0.4%, and 0.2%, respectively.

Heat Resistance

ACRYLITE® cell cast acrylic can be used in temperatures ranging from -40°F (-40°C) to +200°F (93°C), depending on the application. Continuous use should not exceed 180°F, while short, intermittent use can go up to 200°F. Components made from ACRYLITE® cell cast should not be exposed to high heat sources such as high-wattage incandescent lamps unless ventilated to dissipate heat.

Light Transmission

Colorless ACRYLITE® cell cast has a light transmittance of 92%. It is warranted not to lose more than 3% of its light-transmitting ability in a 30-year period. Contact Plastic Craft for the complete warranty.

Chemical Resistance

AACRYLITE® cell cast acrylic demonstrates excellent resistance to various chemicals, including:

Solutions of inorganic alkalis like ammonia
Dilute acids such as sulfuric acid up to a concentration of 30%
Aliphatic hydrocarbons such as hexane
ACRYLITE® sheet is generally not affected by most foods, and the foods themselves are not affected by it. However, it can be attacked by:

Aromatic solvents like benzene and toluene
Chlorinated hydrocarbons like methylene chloride and carbon tetrachloride
Ethyl and methyl alcohols
Some organic acids such as acetic acid
Lacquer thinners, esters, ketones, and ethers
For a more comprehensive list of chemicals and their effects on ACRYLITE® sheet, refer to the detailed table in the original document.
For a listing of the resistance of ACRYLITE® sheet to more than 70 chemicals, refer to the table on page 6.

Formability

ACRYLITE® sheet softens gradually when heated above 210°F (99°C). At temperatures between 340°F and 380°F (171°C to 193°C), it becomes soft and pliable, allowing it to be formed into almost any shape using inexpensive molds. The optimum forming temperature depends on the thickness and desired depth of draw. ACRYLITE® sheet typically shrinks by 1.5% when heated without a frame and retains the formed shape once cooled.

As a thermoplastic material, heating a formed ACRYLITE® part above 210°F (99°C) may cause it to revert to its original flat state.

Cutting and Machining

ACRYLITE® sheet can be cut using circular or band saws. It can also be drilled, routed, filed, and machined similarly to wood or brass, with slight tool modifications. Cooling the cutting tool is recommended to prevent heat buildup and stress in the sheet, which could lead to stress crazing. Tool sharpness is crucial to prevent gumming and other issues during machining.

Laser Cutting

Laser technology is highly effective for cutting, welding, drilling, scribing, and engraving plastics. CO2 lasers can cut complex shapes in ACRYLITE® sheet with precision. The laser beam creates a narrow kerf, allowing for close nesting of parts and minimal waste. Although laser cutting produces a clean, polished edge, it also introduces high stress levels; therefore, annealing the acrylic sheet after laser cutting is recommended to reduce the risk of crazing.

Cementing

ACRYLITE® sheet can be cemented using common solvent or polymerizable cements, such as ACRIFIX®. The most critical factor is the edge of the part to be cemented. The edge must have been properly machined so as to have a square flat surface and no stresses. Annealing of the part prior to cementing is recommended. Cement and cement fumes should not contact formed or polished surfaces.

Annealing

To eliminate stresses caused by machining and/or polishing, annealing is recommended. ACRYLITE® cell cast may be annealed at 180°F (82°C) with the heating and cooling times determined by the sheet thickness. An approximate guideline is: annealing time in hours equals the sheet thickness in millimeters and the cool-down period is a minimum of 2 hours ending when sheet temperature falls below 140°F. For example, 1/8" (3 mm) ACRYLITE® cell cast would be heated for 3 hours at 180°F (82°C) and slowly cooled for at least 2 hours.

Flammability

ACRYLITE® cell cast is a combustible thermoplastic. Precautions should be taken to protect the material from flames and high heat sources. ACRYLITE® 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 is from other combustible materials. We urge good judgment in the use of this versatile material and recommend that building codes be followed carefully to ensure it is used properly.

Other properties related to flammability:

- Burning rate is 1.2 inches per minute (for 3 mm thickness) according to ASTM D 635.
- Smoke density: Measured by ASTM D 2843 is 11.4%.
- Self-ignition temperature is 910°F (488°C) when measured in accordance with ASTM D 1929.

While these test data are based on small scale laboratory tests frequently referenced in various building codes, they do not duplicate actual fire conditions.

ACRYLITE® cell cast meets the requirements of the following building codes for use as a Light Transmitting Plastic:

- NES (See National Evaluation Services, Inc., Report # NER-582)
- ICBO (See ICBO Evaluation Services, Inc., Evaluation Report #3715-CC2 Classification)
- BOCA and SBCCI (Accept National Evaluation Services, Inc., Report # NER-582)

Thermal Conductivity

The thermal conductivity of a material-its ability to conduct heat-is called the k-Factor. The k-Factor is an inherent property of the material and is independent of its thickness and of the surroundings to which it is exposed.

The k-Factor of ACRYLITE® sheet is:

1.3 B.T.U. / (hour) (sq. ft.) (°F /inch) or 0.19 W/m.K

Whereas the k-Factor is a physical property of the material, the U-Factor—or overall coefficient of heat transfer—is the value used to calculate the total heat loss or gain through a window.

The U-Factor is the amount of heat, per unit time and area, which will pass through a specific thickness and configuration of material per degree of temperature difference between each of the two sides.

This value takes into account the thickness of the sheet, whether the sheet is in a horizontal or vertical position, as well as the wind velocity.

U-Factors are based on specific conditions (e.g., single-glazed or double-glazed installations) and are different for summer and winter. Listed below are U-Factors for several thicknesses of ACRYLITE® sheet for single-glazed, vertical installations, based on the standard ASHRAE* summer and winter design conditions.

U-Factors—BTU/hour sq. ft. F° (w/m² x K)			
ACRYLITE® Sheet Thickness		Summer Conditions	Winter Conditions
Mm	inches		
3.0	.118	0.98 (5.56)	1.06 (6.02)
4.5	.177	0.94 (5.34)	1.02 (5.79)
6.0	.236	0.90 (5.11)	0.97 (5.51)
9.0	.354	0.83 (4.71)	0.89 (5.05)
31.5	1.25	0.56 (3.18)	0.58 (3.29)

*American Society of Heating, Refrigerating and Air-Conditioning Engineers

The total heat loss or gain through a window (due to temperature difference only) can be calculated by multiplying the area of the window, times the difference between indoor and outdoor temperatures, times the appropriate U-Factor (from Table above). Heat intake through solar radiation must be added to arrive at the total heat gain.

ACRYLITE® sheet is a better insulator than glass. Its U-Factor or heat transfer value is approximately 10% lower than that of glass of the same thickness. Conversely, its RT-Factor is about 10% greater.

Thermal Shock and Stresses
ACRYLITE® sheet is more resistant than glass to thermal shock and to stresses caused by substantial temperature differences between a sunlit and a shaded area of a window, or by temperature differences between opposite surfaces of a window.

Chemical Resistance
The table on the next page gives an indication of the chemical resistance of clear ACRYLITE® sheet. The code used to describe chemical resistance is as follows:

R = Resistant
ACRYLITE® cell cast withstands this substance for long periods and at temperatures up to 120°F (49°C).

LR = Limited Resistance Fabrication
ACRYLITE® cell cast only resists the action of this substance for short periods at room temperatures. The resistance for a particular application must be determined.

N= Not Resistant Application of Chemicals
ACRYLITE® cell cast is not resistant to this substance. It is swelled, attacked, dissolved or damaged in some manner.

Plastic materials can be attacked by chemicals in several ways. The methods of fabrication and/or conditions of exposure of ACRYLITE® sheet, as well as the manner, in which the chemicals are applied, can influence the final results even for "R" coded chemicals. Some of these factors are listed below.

Fabrication–Stress generated by sawing, sanding, machining, drilling, polishing, and/or forming.
Exposure–Length of exposure, stresses induced during the life of the product due to various loads, changes in temperatures, etc.
Application of Chemicals– by contacts, rubbing wiping, spraying, etc.

The table therefore should be used only as a general guide and, in case of doubt, supplemented by tests make under actual working conditions.

Chemical Resistance of Clear ACRYLITE®

Chemical	Code	Chemical	Code	Chemical	Code
Acetic-Acid (5%)	R	Ethyl Acetate	N	Mineral Oil	R
Acetic Acid (Glacial)	N	Ethyl Alcohol (30%)	LR	Naphtha (VM&P)	R
Acetone	N	Ethyl Alcohol (95%)	N	Nitric Acid (up to 20%)	R
Ammonium Chloride (Saturated)	R	Ethylene Dichloride	N	Nitric Acid (20%-70%)	LR
Ammonium Hydroxide (10%)	R	Ethylene Glycol	R	Nitric Acid (over 70%)	N
Ammonium Hydroxide (Conc.)	R	Formaldehyde	R	Oleic Acid	R
Aniline	N	Gasoline (Regular, Leaded)	LR	Olive Oil	R
Battery Acid	R	Glycerine	R	Phenols	N
Benzene	N	Heptane	R	Soap Solution (Ivory)	R
Butyl Acetate	N	Hexane (Commercial Grade)	R	Sodium Carbonate	R
Calcium Chloride (Sat.)	R	Hydrochloric Acid	R	Sodium Chloride	R
Calcium Hypochlorite	R	Hydrofluoric Acid (40%)	N	Sodium Hydroxide	R
Carbon Tetrachloride	N	Hydrogen Peroxide (up to 40%)	R	Sodium Hypochlorite	R
Chloroform	N	Hydrogen Peroxide (over 40%)	N	Sulfuric Acid (up to 30%)	R
Chromic Acid	LR	Isopropyl Alcohol (up to 50%)	LR	Sulfuric Acid (Conc.)	LR
Citric Acid (20%)	R	Kerosene	R	Toulene	N
Detergent Solution (Heavy Duty)	R	Lacquer Thinner	N	Trichloroethylene	N
Diesel Oil	R	Methyl Alcohol (up to 15%)	LR	Turpentine	LR
Dimethyl Formamide	N	Methyl Alcohol (100%)	N	Water (Distilled)	R
Dioctyl Phthalate	N	Methyl Ethyl Ketone (MEK)	N	Xylene	N
Ether	N	Methylene Chloride	N		

Physical Properties of ACRYLITE®

		ASTM Method	Typical Value (.236" Thickness)[b]
Property[a] Mechanical	Specific Gravity	D 792	1.19
	Tensile Strength Elongation, Rupture Modulus of Elasticity	D 638	10,000 psi (69 M Pa) 4.2% 400,000 psi (2800 M Pa)
	Flexural Strength (Rupture) Modulus of Elasticity	D 790	16,500 psi (114 M Pa) 475,000 psi (3300 M Pa)
	Compressive Strength (Yield) Modulus of Elasticity	D 695	18,000 psi (124 M Pa) 430,000 psi (2960 M Pa)
	Shear Strength	D 732	9,000 psi (62 M Pa)
	Impact Strength Izod Milled Notch	D 256	0.4 ft. lbs/in. of notch (21.6 J/m of notch)
	Rockwell Hardness	D 785	M-94
	Barcol Hardness	D 2583	49
	Residual Shrinkage[c] (Internal Strain)	D 702	2%
Optical (Clear Material)	Refractive Index	D 542	1.49
	Light Transmission, Total UV Transmission Haze	D 1003	92%, 0 at 320 nanometers, less than 1%
Thermal	Forming Temperature	–	340-380 °F (170-190°C)
	Deflection Temperature under load, 264 psi	D 648	210 °F (99°C)
	Vicat Softening Point	D 1525	239 °F (115°C)
	Maximum Recommended Continuous Service Temperature	–	180 °F [d] (82°C)
	Coefficient of Linear Thermal Expansion	D 696	0.000040 in/in-°F (0.000072 m/m-°C)
	Coefficient of Thermal Conductivity (k-Factor)	Ceno-Fitch	1.3 BTU/(Hr) (Sq. Ft.) (°F/in.) (0.19 w/m.K)
	Flammability (Burning Rate 3 mm thickness)	D 635	1.2 in/min. (30.5 mm/min.)
	Self-Ignition Temperature	D 1929	910 °F (490 °C)
	Specific heat @ 77 F	–	0.35 BTU/(lb.) (°F) (1470 J/Kg.k)
	Smoke Density Rating (3 mm thickness)	D 2843	11.4%
Electrical	Dielectric Strength Short Time (0.125"-thickness)	D 149	430 volts/mil (17 KV/mm)
	Dielectric Constant 60 Hertz 1,000 Hertz, 1,000,000 Hertz	D 150	3.5, 3.2, 2.7
	Dissipation Factor 60 Hertz 1,000 Hertz, 1,000,000 Hertz	D 150	0.06, 0.04, 0.02
	Volume Resistivity	D 257	1.6 x 10^{16}ohm-cm
	Surface Resistivity	D 257	1.9 X 10^{15}ohms
Water Absorption	24 hrs @ 73 F Weight Gain during Immersion Soulable Matter Lost Water Absorbed Dimensional Change during Immersion	D 570	0.2% 0.2% 0.0% 0.2% 0.2%
Long Term Water Absorption	Weight Gain during Immersion 7 Days 14 Days 21 Days 35 Days 48 Days	D 570	 .05% .06% .08% 1.0% 1.1%
Odor		–	None
Taste		–	None

Notes:
(a) Typical values: should not be used for specification purposes.
(b) Values shown are for 6mm thickness unless noted otherwise. Some values will change with thickness.
(c) Difference in length and width, as measured at room temperature, before and after heating above 300°F.
(d) It is recommended that temperatures not exceed 180°F for continuous service, or 200°F for short, intermittent use.

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