POLYCARBONATE-TECHNICAL INFORMATION

TYPICAL UNICLEAR© POLYCARBONATE SHEET PROPERTIES

Property	UNICLEAR©	Units	Test Method
General			
Specific gravity	1.2	-	ASTM D-792
Water Absorption 24 hrs.	0.15	%	ASTM D-570
Refractive Index	1.586	-	ASTM D-542
Mechanical			
Tensile Strength, Yield, .125"	9,000	psi	ASTM D-638
Tensile Strength, Ultimate	9,500	psi	ASTM D-638
Tensile Modulus	345,000	psi	ASTM D-638
Shear Strength	6,000	psi	ASTM D-732
Compressive Strength	12,500	psi	ASTM D-695
Flexural Strength at 5% Strain	13,500	psi	ASTM D-790
Flexural Modulus .125"	345,000	psi	ASTM D-790
Izod Impact Notched .125"	12-16	ft.lb/in of notch	ASTM D-256
Rockwell Hardness	118	R Scale	ASTM D-785
Gardner Impact 1/2" Diameter Dart .125"	>320	in.lbs	ASTM D-5420
Instrumented Impact .125"	>45	ft.lbs	ASTM D-3763
Thermal			
Heat Deflection Temperature 264 psi	270	°F	ASTM D-648
Heat Deflection Temperature 68 psi	280	°F	ASTM D-648
Coefficient of Thermal Expansion	3.75×10^{-5}	in/in/°F	ASTM D-696
Coefficient of Thermal Conductivity	1.35	BTU/hr/ft²/°F	ASTM D-177
Smoke Density	68	-	ASTM D-2843
Shading Coefficient Clear .125"	1.02	-	ASHRAE
Shading Coefficient Gray/Bronze .125"	.70	-	ASHRAE
Shading Coefficient Dark Gray .125"	.58	-	ASHRAE
Brittle Temperature	-200	°F	ASTM D-746
Flammability			
Horizontal Burn, AEB .125"	<1	in	ASTM D-635
Horizontal Burn, ATB .125"	<1	min	ASTM D-635
Self Ignition Temperature	1070	°F	ASTM D-1929
Flash Ignition Temperature	800	°F	ASTM D-1929
UL 94 Clear ≥ .060"	V-2	-	UL 94
UL 94 Clear ≥ .250"	V-0	-	UL 94
Optical			
Transmittance Clear .125"	>88	%	ASTM D-1003
Haze Clear .125"	<1	%	ASTM D-1003
Electrical			
Dielectric Constant 10 Hz	2.96	-	ASTM D-150
Dielectric Constant 60 Hz	3.17	-	ASTM D-150
Volume Resistivity	8.2×10^{16}	ohm-cm	ASTM D-257
Dissipation Factor 60 Hz	0.0009	-	ASTM D-150
Dissipation Factor 1 MHz	0.010	-	ASTM D-150
Arc Resistance			
Stainless Steel Strip Electrodes	10-11	sec	ASTM D-495
Tungsten Electrodes	120	sec	ASTM D-495

POLYCARBONATE SHEET COMBUSTIBILITY

Although the least combustible glazing material, Polycarbonate Sheet will ignite when exposed to an ignition source over 800°F.

UNIGUARD MATERIALS OF CONSTRUCTION

CHEMICAL RESISTANCE & COMPATIBILITY CHART

Uniguard-Polycarbonate (Clear Material)

CHEMICAL RESISTANCE OF POLYCARBONATE MATERIAL
(UNICLEAR & INSPECTION WINDOWS)

UniClear© POLYCARBONATE SHEET IS RESISTANT AT 70°F AND 0% STRAIN TO:

CHEMICALS:

Amyl Alcohol	Chromic Acid (20%)	Lactic Acid (20%)	Potassium Bromate	Sodium Chloride
Aluminum Chloride	Citric Acid (40%)	Magnesium Chloride	Potassium Bromide	Sodium Hypochlorite
Aluminum Sulfate	Copper Chloride	Magnesium Sulfate	Potassium Nitrate	Sodium Sulfate
Ammonium Chloride	Copper Sulfate	Manganese Sulfate	Potassium Perchlorate	Stannous Chloride
Ammonium Nitrate	Formic Acid (10%)	Mercuric Chloride	Potassium Permanganate	Sulfur
Ammonium Sulfate	Formalin (30%)	Nickel Sulfate	Potassium Persulfate	Sulfuric Acid (10%)*
Antimony Trichloride	Glycerine	Nitric Acid (10%)	Potassium Sulfate	Sulfuric Acid (50%)
Arsenic Acid	Heptane	Nitric Acid (20%)	Silicone Oil	Tartaric Acid (30%)
Butyl Alcohol	Hydrochloric Acid (10%)	Oleic Acid	Silver Nitrate	Zinc Chloride
Calcium Nitrate	Hydrogen Peroxide (30%)	Oxalic acid	Sodium Bicarbonate	Zinc Sulfate
Chlorinated Lime Paste	Hydrofluoric Acid (10%)	Pentane	Sodium Bisulfate	
Chrome Alum	Isopropanol	Phosphoric Acid (10%)	Sodium Carbonate	

*Sulfuric Acid at 1% attacks polycarbonate sheet

COMMON HOUSEHOLD MATERIALS UniClear© POLYCARBONATE IS RESISTANT TO:

CHEMICALS:

Borax	Joy Liquid Detergent	Rum
Cocoa	Insulating Tape	Salad Oil
Cement	Linseed Oil	Salt Solution (10%)
Chocolate	Liquor	Soap (Soft/Hard)
Cod Liver Oil	Milk	Table Vinegar
Cognac	Mineral Water	Tincture of Iodine (5%)
Coffee	Mustard	Tomato Juice
Detergents	Olive Oil	Vodka
Fish Oil	Onions	Washing Soap
Fruit Syrup	Orange Juice	Water
Grapefruit Juice	Paraffin Oil	Wine
Gypsum	Rapeseed Oil	

PETROLEUM PRODUCTS UniClear© POLYCARBONATE SHEET IS RESISTANT TO:

Compressor Oil	Spindle Oil
Diesel Oil	Transformer Oil
Kerosene	Vacuum Pump Oil
Refined Oil	

Note: Elevated temperature and/or strain significantly alters resistance to industrial petroleum products.

LIMITED RESISTANCE AT 70°F AND 0% STRAIN TO:

Antifreeze	Hydrochloric Acid (conc.)
Calcium Chloride	Milk or Lime (CaOH)
Cyclohexanol	Nitric Acid (conc.)
Ethylene Glycol	Sulfuric Acid (conc.)

UniClear© POLYCARBONATE SHEET IS NOT RESISTANT TO:

CHEMICALS:

Acetaldehyde	Benzyl Alcohol	Chlorobenzene	Formic Acid (conc.)	Phosphorus Trichloride
Acetic Acid (conc.)	Brake Fluid	Chlorothene	Freon (refrigerant/propellant)	Proplonic Acid
Acetone	Bromobenzene	Cutting Oils	Gasoline	Sodium Sulfide
Acrylonitrile	Butylic Acid	Cyclo Hexanone	Lacquer Thinner	Sodium Hydroxide
Ammonia	Carbon Tetrachloride	Cyclohexene	Methyl Alcohol	Sodium Nitrate
Ammonium Fluoride	Carbon Disulfide	Dimethyl Formamide	Nitrobenzene	Tetrahydronaphthalene
Ammonium Hydroxide	Carbolic Acid	Ethane Tetrachloride	Nitrocellulose Lacquer	Thiophene
Ammonium Sulfide	Caustic Potash Sol. (5%)	Ethylamine	Ozone	Toluene
Benzene	Caustic Soda Sol. (5%)	Ethyl Ether	Phenol	Turpentine
Benzoic Acid	Chloride	Ethylene Chlorohydrin	Phosphorus Hydroxy	Xylene

UniClear© POLYCARBONATE SHEET IS DISSOLVED BY:

Chloroform, Cresol, Dioxane, Ethylene Dichloride,Methylene Chloride, Pyridine

EFFECTS OF MOISTURE ON UniClear© POLYCARBONATE SHEET:

UniClear© Polycarbonate Sheet has good resistance to water up to approximately 150°F. Above this temperature, the effect of moisture is time-temperature related. Exposing UniClear© Polycarbonate Sheet to repeated steam cleaning or dishwashing can create hydraulic crazing. The result can be a clouding of the surface and ultimately a loss of physical strength properties.

UNIGUARD
MATERIALS OF CONSTRUCTION
CHEMICAL RESISTANCE & COMPATIBILITY CHART
Uniguard-Polycarbonate (Clear Material)

POLYCARBONATE CHEMICAL RESISTANCE CHART LEGEND

General chemical behavior:

The chemical resistance of **UniClear**© depends on the concentration of the substance, the temperature, the contact time, and the internal tension level of the polycarbonate sheet due to fabrication, etc.

Several types of damage can arise, some more than one at a time.

Dissolving/Swelling
Low-molecular, aromatic, halogenated, and polar components migrate into the plastic. The damage can range from a sticky surface to complete dissolving.

Stress Cracking
Some chemicals migrate to a minor extend and in very low quantity into the surface, and lead to relaxation of tensions in the material. This results in stress cracking, which can be optically disturbing. Because of increased notch occurrence, some mechanical properties are negatively influenced. Stress cracking is usually easy to see in transparent sheets.

Molecular reduction
Some properties of materials are determined by the molecular weight. If a substance initiates a molecular reduction through a chemical reaction, the impact resistance and elastic properties of the material will be influenced. Electrical properties are almost not influenced; thermal properties are only slightly influenced by molecular weight.

Examples
Solvents not resistant to – Methylene chloride/Toluene/Chloroform/Xylene
Swelling agents – Benzene/Chlorine Benzene/Acetone
Not influenced by or resistant to - diluted mineral acids, many organic acids, oxidizing or reducing agents, neutral and acid salt solutions, and waxes.

In the following table you can find the resistance of **UniClear**©

The test results have been obtained at samples with low internal tensions, which have been stored during 6 months in the substance at a temperature of 20 degrees C (68°F), without any mechanical load.

Apart from the nature of the substances, the chemical resistance is also depending on the concentration of the substance, the temperature during the contact, the contact time and the internal tension of the tested specimen.

This means that our products can be resistant to a number of chemical for short contracts, but are not resistant in case of long exposure, such as performed in these tests.

Therefore, it is always recommendable to execute a test under application conditions, if these differ from the test environment described above.

The tested substances have been chosen as a function of their importance in several areas. In a lot of cases it is possible to deduct results to other, chemically comparable, substances, even if these have not been tested.

Scratch resistance materials **UniClear**© show improved chemical resistance, as long as the sheet surface remains intact.

Legend

Explanation of the symbols:
+ Resistant
O Partially resistant
- Not Resistant

The results shown in the sections 2 up to 10, and especially the commercial products marked with ®, are based on a one-time test. Change in the composition by the producers of these substances can influence the product properties.

POLYCARBONATE CHEMICAL RESISTANCE CHART

1. CHEMICALS

Acetaldehyde	-	Citric acid	+
Acetic acid, up to 10% solution	+	Copper sulphate, saturated aqueous solution	+
Acetone	-	Cresol	-
Acetylene	+	Cupric chloride, saturated aqueous solution	+
Acrylonitrile	-	Cuprous chloride, saturated aqueous solution	+
Allylalcohol	O	Cyclo hexane	-
Alum	+	Cyclo hexanol	O
Aluminum chloride, saturated aqueous solution	+	Cyclo hexanone	-
Aluminum oxalate	+	Dekaline	+
Aluminum sulphate, saturated aqueous solution	+	Diamyl phthalate	-
Ammonia	-	Dibutyl phthalate (plasticizer)	-
Ammoniacal liquor	-	Diethylene glykol	+
Ammonium chloride, saturated aqueous solution	+	Diethylether	-
Ammonium nitrate, saturated aqueous solution	+	Diglycolic acid, saturated aqueous solution	+
Ammonium sulphate, saturated aqueous solution	+	Dimethyl formamide	-
Ammonium sulphide, saturated aqueous solution	-	Dinonyl phthalate (plasticizer)	O
Amylo acetate	-	Dioctyl phthalate (plasticizer)	O
Aniline	-	Dioxane	-
Antimony chloride, saturated aqueous solution	+	Diphyl 5, 3	O
Arsenic acid, 20% solution	+	Ether	-
Benzaldehyde	-	Ethyl alcohol, 96% pure	+
Benzene	-	Ethyl amine	-
Benzoic acid	-	Ethyl bromide	-
Benzyl alcohol	-	Ethylene chloride	-
Borax, saturated aqueous solution	+	Ethylene chlorohydrine	-
Boric acid	+	Ethylene glykol	+
Bromic benzene	-	Ferritrichloride, saturated aqueous solution	+
Bromine	-	Ferro bisulphate	+
Butane (liquid or gaseous)	+	Formaline, 10%ig	+
Butanol	+	Formic acid, 30%	O
Butyl acetate	-	Gasoline	+
Butylene glycol	+	Glycerine	O
Butyric acid	-	Glycol	+
Calcium chloride, saturated aqueous solution	+	Heptane	+
Calcium hypochloride	+	Hexane	+
Calcium nitrate, saturated aqueous solution	+	Hydrochloric acid, 20%	+
Calcium-soap, fat/pure	+	Hydrochloric acid, conc.	-
Carbon acid, wet	+	Hydrofluoric acid, 5%	+
Carbon disulphide	-	Hydrofluoric acid, conc.	-
Carbon monoxide	+	Hydrofluorosilicic acid, 30%	+
Chlorine benzene	-	Hydrogen peroxide, 30%	+
Chlorine gas, dry	O	Hydrogen sulphide	+
Chlorine gas, wet	-	Iodine	-
Chlorine lime slurry	+	Isoamyl alcohol	O
Chlorine lime, 2% in water	+	Isopropyl alcohol	+
Chloroform	-	Lactic acid, 10% in water	+
Chrom alum, saturated aqueous solution	+	Lead tetraethylene, 10% in gasoline	O
Chromic acid, 20% in water	+	Lighting gas	+

POLYCARBONATE CHEMICAL RESISTANCE CHART

Ligroin (hydrocarbon compound)	+	Potassium sulphate, saturated aqueous solution	+
Lime milk, 30% in water	O	Propane gas	+
Magnesium chloride, saturated aqueous solution	+	Propargyl alcohol	+
Magnesium sulphate, saturated aqueous solution	+	Propionic acid, 20%	+
Manganous sulphate, saturated aqueous solution	+	Propionic acid, conc.	-
Mercuro chloride, saturated aqueous solution	+	Propyl alcohol	+
Mercury	+	Pyridine	-
Methacrylic acid	-	Resorcin oil solution, 1%	+
Methane	+	Soda	+
Methanol	-	Sodium bicarbonate, saturated aqueous solution	+
methyester (MMA)	-	Sodium bisulphate, saturated aqueous solution	+
Methyl amine	-	Sodium bisulphide, saturated aqueous solution	+
Methyl ethyl ketone (MEK)	-	Sodium carbonate, saturated aqueous solution	+
Methylene chloride	-	Sodium chlorate, saturated aqueous solution	+
Nitric acid, 10%	+	Sodium chloride, saturated aqueous solution	+
Nitric acid, 10-20%	O	Sodium hydroxide	-
Nitric acid, 20%	-	Sodium hypochloride, 5% in water	+
Nitric Gas, dry	-	Sodium sulphate, saturated aqueous solution	+
Nitrobenzene	-	Sodium sulphide, saturated aqueous solution	O
Oxalic acid, 10% in water	+	Styrene	-
Oxygen	+	Sublimate, saturated aqueous solution	+
Ozone	+	Sulphur	+
Pentane	+	Sulphur dioxide	O
Perchloric acid, 10% in water	+	Sulphuric acid, 50%	+
Perchloric acid, concentrated	O	Sulphuric acid, 70%	O
Perchloro ethylene	-	Sulphuric acid, conc.	-
Perhydrol, 30%	+	Sulphurous acid, 10%	-
Petroleum	O	Sulphuryl chloride	-
Petroleum ether	O	Tartaric acid, 10%	+
Petroleum spirit	+	Tetrachlorocarbon	-
Phenol	-	Tetrachloroethane	-
Phenyl ethyl alcohol	-	Tetrahydrofurane	-
Phosphor trichloride	-	Tetraline	-
Phosphoric acid, conc.	+	Thiophene	-
Phosphoric oxichloride	-	Toluene	-
Potassium aluminum sulpate, saturated aqueous solution	+	Trichloro acetic acid, 10%	O
		Trichloroethyl amine	-
Potassium bichromate, saturated aqueous solution	+	Trichloroethyl phosphate (plasticizer)	O
Potassium bromide, saturated aqueous solution	+	Trichloroethylene	-
Potassium carbonate, saturated aqueous solution	+	Tricresyl phosphate (plasticizer)	-
Potassium chloride, saturated aqueous solution	+	Urea, saturated aqueous solution	+
Potassium cyanide	-	Water	+
Potassium hydroxide	-	Xylene	-
Potassium metabisulphide, 4% in water	+	Zinc chloride, saturated aqueous solution	+
Potassium nitrate, saturated aqueous solution	+	Zinc oxide	+
Potassium perchlorate, 10% in water	+	Zinc sulphate, saturated aqueous solution	+
Potassium permanganate, 10% in water	+		
Potassium persulphate, 10% in water	+		
Potassium rhodanide, saturated aqueous solution	+		

POLYCARBONATE CHEMICAL RESISTANCE CHART

2. DISINFECTANTS

Baktol®, 5%	+
Carbolic acid	-
Chloroamine	+
DDT	-
Delegol ®, 5%	+
Dimamin T, 5%	O
Hydrogen peroxide	+
Iodine tincture	O
Lysoform, 2%	+
Maktol ®	+
Merfen ®, 2%	+
Oktozon ®, 1%	+
Perhydrol	+
Resorcinol solutions, 1%	+
Sagrotan ®, 5%	O
Spirit, pure	+
Sublimate	+
TB-Lysoform	-
Trosilin G extra ®, 1, 5%	+
Zephirol ®	O

3. PHARMACEUTICS, COSMETICS

Blood plasma	+
Delial-Sunmilk ®	+
Hydroplex	+
Iodine tincture	O
Klosterbalsam	+
Lanoline	+
Menthol, 90% in Alcohol	O
Nail polish	-
Nail polish remover	-
Odol-mouthwater ®	+
Periston blood substitute ®	+
Vaseline	+
Vick-Vaporub ®	+

4. NUTRITION

All-spice	-
Apple juice	+
Beef sebum	+
Beer	+
Beets syrup	+
Brandy, 38%	+
Butter	+
Chocolate	+
Cinnamon	+
Clove	-
Cod-liver oil	+
Coffee	+
Common salt	+
Fish	+
Fruit juice	+
Fruit syrup (Raspberry)	+
Gherkins	+
Grape sugar	+
Grapefruit juice	+
Juniper berry	+
Lard	O
Linseed oil	+
Liquor	+
Margarine	+
Meat	+
Milk	+
Mineral water	+
Mustard	+
Nutmeg	-
Onion	+
Orange juice	+
Paprika	+
Pepper	+
Rum	+
Salad oil	+
Syrup	+
Sugar solution, saturated aqueous solution	+
Tea	+
Tobacco	+
Tomato juice	+
Tomato puree	+
Vanilla	+
Vegetable juice	+
Vegetable oils	+
Vinegar	+
Vodka	+
Water	+
Wine	+
Worcester-Sauce	+

POLYCARBONATE CHEMICAL RESISTANCE CHART

5. WASHING / CLEANING AGENTS

Household soap	+
Top Job, Joy®	+
Palmolive Liquid®	+

6. TECHNICAL OILS AND FATS

Camphor oil	-
Castor oil	+
Cod-liver oil	+
Drilling oil	-
Fish oil	+
Fuel oil	O
Lubricant based on paraffin	+
Paraffin oil	+
Sodium soap fat	+

7. MISCELLANEOUS

Battery acid	+
Blood	+
Castor oil	+
Cement	+
Freon ® 113	+
Gasoline	O
Natural rubber	+
Oleic acid, conc.	+
Polishing wax	+
Polyethylene	+
Polyvinylchloride, (containing plasticizer)	O
Sea water	+
Starch	+
Weak acid >4.7 pH	+
Weak base <9.5 pH	O
Tannic acid	-